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Articles

SPATIAL ANALYSIS OF THE IMPACT OF MIGRATION ON REGIONAL GROWTH IN IRAN (2006-16)

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Abstract

One of the most important applications of economic growth models is for regional economic growth. In regional growth studies, it is necessary to consider spatial effects because of spatial dependence among the growth rates of regions. This research investigates the impact between net migration and its spatial lag on regional growth, based on the neoclassical (Solow) growth model. The used model in the study is the Dynamic Panel Data (DPD) which has been specified as a Spatial Durbin Model (SDM) and estimated by the spatial generalized method of moments (SGMM). The specified model has been tested for the 30 provinces of Iran in the period of 2006-16. The estimated results show that the time-lagged dependent variable had a positive and highly significant effect on income per capita. The impact of initial income per capita on growth is negative, and the convergence hypothesis is thus accepted. That is, poor provinces grow faster than the rich. The income per capita and growth are positively related to net migration rate. Expectedly, the new coming people to a province would increase income per capita and growth. The estimated coefficient of the spatial lag of the dependent variable is statistically significant and demonstrates spatial dependence in income as well as economic growth among the provinces of Iran. Every province's growth rate was positively impacted by the economic growth of its neighbors. However, net migration has no spatial effect on income per capita and growth. In other words, the regional economic growth has not been influenced by migration to neighboring provinces.

Keywords: Neoclassical growth model, convergence, migration, spatial Durbin model, spatial generalized method of moments.

JEL classification: O47, C23, R23

1. Introduction

The economic convergence hypothesis is an important result of the neoclassical economic growth model. According to neoclassical growth models, such as Solow (1956), Cass (1965), and Koopmans (1965), an economy's growth is inversely related to its initial level of income per capita. Therefore, small economies grow faster, termed β-convergence (Barro, 1991). Economists have acknowledged this important hypothesis since the 1990s, after the widespread studies of Barro and Sala-I-Martin (1992). The reason is that poor economies have high marginal products of capital, since their ratios of capital to labor are low. As a result, they tend to grow faster. In fact, the convergence hypothesis returns to the diminishing returns to capital in neoclassical growth models (Barro, 1991).

The convergence hypothesis has been tested in many studies for cross-country cases of and regions in a country as well. Usually, this hypothesis is more compatible with the cases of regions. It seems that in such cases, the growth rates have higher correlation with their initial level of income per capita than cross-country cases of. This study uses the neoclassical growth model for the case of the regions of Iran, with the emphasis of migration. Like other developing countries, there is a dichotomy between developing and less-developed regions of Iran. Some regions have a higher level of development with higher income per capita and people tend to immigrate to such regions (Rahmani, 2011).

Migration within a country has both positive and negative impacts. On one hand, migration and redistribution of population within a country is one of the most fundamental instruments that policymakers rely on to control population density, and to direct population

displacements to economic poles (Mirza-Mostafa and Ghasemi, 2013). On the other hand, displacements — especially from rural to urban areas—have created a wide variety of socio-economic problems for less-developed and developing countries. Regional imbalances accelerate and reinforce regional migration and cause reduction in the national growth rate. As a result of regional migration, origin regions will be faced with the reduction of labor (especially experts) and loss of various types of capital which will eventually lead to production decline. On the other hand, although (physical and human) capital would rise in destination regions, population density will increase and many social and economic problems would emerge.

The neoclassical economic growth models are of the most widely used in investigating the impact of migration on economic growth rates at regional levels. There are two opposing points of view about the results. From the negative view, migration will lead to a reduction in human capital in the origin regions and the accumulation of human capital in destinations, and therefore the growth of origin regions will decrease. In contrast, some economists emphasize the positive effect of migration in destination regions (Anjomani, 2012).

The objective of this study is to estimate the impact of regional migration on economic growth in the provinces of Iran for 2006-16. Accordingly, the paper is structured as follows: Section 2 reviews the literature, section 3 specifies the econometric model, and section 4 analyzes the obtained results. The paper ends with a conclusion and suggestions.

2. Literature review

2.1. The impact of regional migration on growth

Studies for diversified cases including Anjomani (2012) for the USA, Rahmani and Hassanzadeh (2011) for Iran, Di Maria and Stryszowski (2009) for some other countries in a panel data model, Groizard and Llull (2007) for a panel of 92 developing and developed countries, Moody (2006) for Australia, Shoiji (2001) for Japan, Persson (1994) for Sweden, and so on, demonstrate that regional migration plays a crucial role in regional growth and development. Therefore, countries try to control the displacement of people among regions. Regional migration is a process through which population growth rate and the growth rate of labor supply change. Thus, regional migration would affect regional economic growth. Regional migrations are generally characterized by a flow of human resources from villages or towns with fewer facilities (the origin regions) to big cities and metropolitan areas with more facilities and higher educational attainment (Sabagh Kermani, 2001: 124). Migration flows are from villages to cities, from towns and small cities to capital cities of provinces, and from capital cities of provinces to nearby metropolitans in other provinces. People prefer to immigrate to rich provinces in which there are more facilities for life and more job opportunities.

The impact of migration on regional growth and development is one of the most important problems of developing and less-developed countries (LDCs). In fact, it is a truly uncontrollable and ungovernable phenomenon in many cases. Consequently, it negatively influences macroeconomic variables including economic growth and development. Indeed, regional imbalances strengthen and accelerate regional migration, and this is one of the most disturbing obstacles to the growth of such economies at the national level. In addition, this phenomenon can impact other macroeconomic variables in a disorderly manner.

These consequences can be considered from the perspective of both the origin and destination regions. With the emergence of displacement flows from an origin region, that area will be faced with the reduction and even loss of various types of capital—especially human and physical capital stock—which will eventually lead to a reduction in production. In contrast, this phenomenon in destination regions leads to congestion, pollution, administrative complications, etc. The final consequence is higher living costs and higher production costs as well. Eventually, the economic growth will decrease in both origin and destination regions (Zangeneh, 2007). On the other hand, migration would increase production and economic growth in destination regions through enhancing physical and human capital stocks. In other words, the impact of migration on regional economic growth is ambiguous.

Regional migration is one of the most important factors that socioeconomic policy makers pay attention to when planning for regional development using population control tools and directing population displacement according to regional facilities. The objective is to reduce the costs of displacement for both regions. Local governors try to turn threats into opportunities and weaknesses into strengths through local development planning. A rise in human capital is an inevitable result for destination regions. Since, theoretically and empirically, human capital is one of the main determinants of economic growth and development, destination regions reap this benefit. In addition to the growth of human capital and economic growth, other positive impacts include increasing positive externalities and higher productivity. These factors lead to higher economic growth in turn.

In recent decades, along with the expansion of endogenous growth theories, various views have been raised on how regional migration influences economic growth through human capital. In endogenous economic growth models, including Romer (1990) human capital have a fundamental role, since it generates the new products and ideas that underlies technological progress (Barro, 1991). A region with more human capital would absorb new ideas and products and catch to the newer technology up, and would thus grow faster (Nelson and Phelps, 1966).

2.2. The theoretical framework

Economists classify regional growth theories in different ways. According to one source, there are four groups (Sabagh-Kermani, 2001) The theory of cumulative causation was proposed by Myrdal (1956) and expanded by Kaldor (1957). According to this theory, the regional growth of production per labor is determined by the extended use of economies of scale as well as localized agglomeration (specialization) in production (Sabagh-Kermani, 2001: 238). 2) The growth poles theory is a regional and industrial planning model proposed by Perroux (1955). This theory is similar to the theory of cumulative causality but provides more details on the mechanism of unbalanced regional growth. Hirschman (1958) proposed polarization and trickle down effects as factors to add to this theory. 3) Wave growth models believe that regional growth has a wave pattern instead of a smooth and continuous trend. This model is similar to the growth poles theory. 4) Neoclassical growth model, known as the Solow model, is one the most applied models in empirical studies. In fact, this model has attracted a considerable attention in empirical regional studies. The Solow model is one of the most widely used models in investigating the impact of migration on economic growth at the regional levels. Since the specified model in our study is based on the neoclassical growth model, we will discuss this model in more detail.

The Solow growth model focuses on four main variables: output, capital, labor, and knowledge (effectiveness labor). This model is based on two central assumptions. First, in the considered production function, the returns to scale in capital and effective labor is constant. Second, other inputs than capital, labor and knowledge are unimportant (Romer, 2001). One of the most important obtained results, according to the model, is the conditional convergence hypothesis for regions. This model attempts to explain long-term economic growth using the relationship of capital accumulation, population or labor growth, and increasing productivity, which is generally known as technological progress. The core of this model is the neoclassical Cobb-Douglas production function which provides a link to microeconomic foundations. The production function is shown as follows:

$$Y_t = F(K(t), A(t).L(t)) \quad (1)$$

in which Y is output, K is capital stock, L is labor, and A is knowledge stock and multiplied by L. t shows time. Time does not enter the production function directly, but only through variables (inputs). In other words, output changes over time only if inputs change (Romer, 2001). For understanding equilibrium properties, it is divided by A.L:

$$F\left(\frac{K}{A.L}, 1\right) = \frac{1}{A.L}F(K, A.L) \quad (2)$$

(K / A.L) is the level of capital per unit of effective labor (worker) and is shown by *k*. Thus, $\left(\frac{F(K,AL)}{AL}\right) = \frac{Y}{AL}$ is output per unit of effective worker (demonstrated by y).

Finally, we will have:

$$y = f(k) \tag{3}$$

That is, output per unit of effective labor as a function of capital per unit of effective labor. Considering the production function in the Cobb-Douglas form, we have:

$$f(k) = f\left(\frac{K}{A.L}, 1\right) = \left(\frac{K}{A.L}\right)^{\alpha} = k^{\alpha} \tag{4}$$

$$f'(k) = \propto k^{\propto -1} > 0$$
$$f''(k) = -(1-\propto) \propto k^{\propto -2} < 0$$

In addition:

$$\Longrightarrow \quad \dot{L}(t) = nL(t)$$

$$\begin{cases} \frac{\dot{L}(t)}{L(t)} = n \; or \; \dot{L}(t) = n.L(t) \\ \frac{\dot{A}(t)}{A(t)} = g \; or \; \dot{A}(t) = g.A(t) \end{cases} \tag{5}$$

in which n and g are exogenous parameters and show the growth rate of the labor force (population) and the rate of technological growth, respectively. However, since we assume that saving is equal to investment and changes in capital stock are equal to investment minus depreciation, changes in capital stock are determined through the following equation:

$$\dot{K}(t) = sY(t) - \sigma K(t) \tag{6}$$

where s is the saving rate and σ is the depreciation rate of capital stock.

It is assumed that n and σ, g are relatively small and their sum is positive (Romer, 2001). The model is set in continuous time. It implies that the model variables are defined at every point in time. According to the equation (6), the growth of capital stock per unit of effective labor is:

$$\dot{k}(t) = \frac{\dot{K}(t)}{A(t).L(t)} - \frac{K(t)}{[A(t).L(t)}\left[A(t)\dot{L}(t) + L(t)\dot{A}(t)\right] \tag{7}$$

$$= \frac{\dot{K}(t)}{A(t).L(t)} - \frac{K(t)}{[A(t).L(t)}\frac{\dot{L}(t)}{L(t)} - \frac{K(t)}{[A(t).L(t)}\frac{\dot{A}(t)}{L(t)}$$

$$= \frac{sY(t) - \sigma K(t)}{A(t).L(t)} - k(t).n - k(t).g$$

$$= s\frac{Y_t - \sigma K(t)}{A(t).L(t)} - \sigma.k(t) - n.k(t) - g.k(t), \quad f(k) = \frac{Y}{AL}$$

Therefore,

$$\dot{k}_t = s.f(k(t)) - (n + g + \sigma)k(t) \tag{8}$$

Equation (8) is the key equation of Solow model (Romer, 2001). The term of $s.f(k(t))$ is the actual investment per unit of effective worker and $(n + g + \sigma)$ is the amount of investment required to keep k at its existing level, termed break-even investment. k grows at a rate of n + g:

$$\frac{\dot{k}}{k} = n + g \tag{9}$$

Since the quantity of effective labor is growing at rate $n+g$, the capital stock must grow at rate $n+g$ to keep k steady. Assuming constant returns to scale, Y grows at the same rate $(n + g)$. In equilibrium, the growth rate output per capita depends on technological progress (Taghavi, 2004). According to equation (8), the growth path of output per unit of effective worker is extracted.

In the Solow model, long-run growth of output per worker depends on technological progress, while short-run growth can result from either technological progress or capital accumulation (Romer, 2001). One of the most important results of the endogenous neoclassical growth model is the convergence hypothesis which has attracted a considerable attention in regional empirical studies. According to the hypothesis, areas with lower initial capital per worker grow faster and thus tend to converge towards regions with higher capital to worker ratios.

There are two concepts for convergence. First, the absolute convergence hypothesis says that poor economies tend to grow faster than rich economies, regardless of their characteristics. Second, the conditional convergence hypothesis proposes that economies tend to converge to their balanced growth paths, and hence their growth rates depend on their current position relative to balanced growth paths. The larger the distance, the faster the economy grows. In other words, poor regions do not grow quickly if they do not have the necessary infrastructure.

3. Methodology

In this study, two different approaches are used for assessing the impact of independent variables on economic growth. First, the model will be estimated through the generalized method of moments (GMM) or a dynamic panel data (DPD) model (Arellano–Bond estimator). Unlike static panel data models, dynamic panel data models include lagged levels of the dependent variable as regressors. The second approach will use the GMM estimator in a spatial Durbin model. Here, the variables of regional migration and income per capita will be used as spatial Durbin variables.

The GMM estimator is a powerful tool that, unlike the Maximum likelihood (ML) method, does not require precise data on the distribution of error terms (Meshki, 2011). A dynamic panel data model includes the lagged levels of the dependent variable. Hence, the assumption of the lack of autocorrelation between the independent (explanatory) variables and the error terms are violated. In other words, including a lagged dependent variable as a regressor violates strict exogeneity assumption because the lagged dependent variable is necessarily correlated with the idiosyncratic error term. As a result, using ordinary least squares (OLS) estimators (for fixed and random effects panel data models) provides biased and inconsistent results (Baltaji, 2008; and Arellano & Bond, 1991). The generalized method of moments (GMM) estimator resolves the problem through utilizing the instrumental variables (IV) estimation. Regression variables, even lagged variables, are used as instrumental variables to eliminate the bias caused by the endogeneity of explanatory variables (Green, 2012).

The first-order differential generalized method of moments (GMM) was first proposed by Arellano and Bond (1991). In the Arellano–Bond method, the first differences of the regression equation are taken to eliminate the fixed effects. In other words, the intercepts are eliminated in this method (Yavari & Ashrafzadeh, 2005). Arellano and Bover (1995), and Blundell and Bond (1998) proposed some changes to the first order equation of GMM and suggested the orthogonal deviations estimator. The difference between these two methods is the manner in which individual effects are included in the model. The advantages of the second method are to increase the accuracy and reduce the bias of limitations of sample size (Baltaji, 2008).

This study utilizes the Arellano-Bover /Blundell-Bond Dynamic Panel data two step estimator. The model is shown as follow (Arellano, 2003):

$$y_{it} = \sum_{j=1}^{p} \alpha_j y_{i,t-j} + x_{it}\beta_1 + w_{it}\beta_2 + v_i + \varepsilon_{it} \quad (10)$$

where α_js are p parameters that should be estimated. x_{it} is a k_1-dimentional vector of completely exogenous variables. w_{it} is a k_2-dimentional vector of predetermined or exogenous variables. β_1 and $\beta 2$ are respectively k_1-dimentional and a k_2-dimentional vectors of parameters to be estimated. vi is the panel level effect (which may be correlated with the explanatory variables). εit is the independent and identically distributed (i.i.d) variable with the variance of σ_ε^2. The model assumes that vi and ε_{it} are independent for each cross-section i

during the whole time period t. w_{it} and x_{it} include the lagged independent variables and dummy variables. However, these two variables are equivalent in dynamic panel data models.

In the study, the dynamic panel data model is specified through spatial econometric techniques. In order to specify the spatial GMM model, it is considered a Spatial Dynamic Panel Model (SDPD), shown as follows:

$$y_{it} = \alpha + \tau y_{it-1} + \rho \sum_{j=1}^{n} W_{ij} y_{it} + \sum_{k=1}^{K} \beta_k X_{itk} + \sum_{k=1}^{K} \sum_{j=1}^{n} D_{ij} Z_{itk} \theta_k + a_i + \gamma_t + v_{it} \quad (11)$$

The error term has three components: the panel model error term v_{it}, the within-group error term γ_t, and the between-group error term a_i. W is the row-standardized spatial weight matrix. a_i shows the individual (cross-sectional) fixed or random effects. γ_t also shows the fixed and random effects of time. If $\tau = 0$, the model will be static, and if $\tau \neq 0$, then the model will be dynamic. In other words, the lagged dependent variable will also enter into the model, and the model will be the spatial dynamic panel data (SDPD) model or spatial generalized method of moments (SGMM) model (Yu, Jang & Lee, 2008).

4. The model and variables

In empirical specification of the slow growth model, the growth rate of income per capita is dependent variable and the time-lagged of income per capita is one of the independent variables. Since the growth rate is calculated through $ln(y_t)$ minus $ln(y_{t-1})$, we can bring $ln(y_{t-1})$ to the left-hand side of the equation and write the relation in terms of $ln(y_t)$. According the theoretical base, the Dynamic Panel data (DPD) Model is specified as follows:

$$\ln(GDP_{it}) = \alpha + \beta_1 \ln(GDP_{it-1}) + \beta_2 IM_{it} + \beta_3 I_{it} + \beta_4 FR_{it} + \beta_5 BU_{it} + \beta_6 HC_t + \beta_7 HC_{it}^2 + \mu_{it}$$
$$\mu_{it} = \alpha_i + \gamma_t + v_{it} \quad (12)$$

The specified model (12) is estimated for provinces of Iran for 2006-16. Since the data are regional, there would be spatial dependence between them. In other words, each region would be influenced by its neighbors' conditions and its conditions as well. Therefore, the spatial specification of the model is considered in the form of the spatial Durbin model:

$$\ln(GDP_{it}) = \alpha + \beta_1 \ln(GDP_{it-1}) + \beta_2 IM_{it} + \beta_3 I_{it} + \beta_4 FR_{it} + \beta_5 BU_{it} + \beta_6 HC_t + \beta_7 HC_{it}^2 + \rho W \ln(GDP_{it-1}) + \gamma W IM_{it} + \mu_{it}$$
$$\mu_{it} = \alpha_i + \gamma_t + v_{it} \quad (13)$$

The spatial lag of income per capita (dependent variable) has entered the model. In addition, the spatial Durbin variable is the spatial lag of regional migration. The definition of variables in the models are stated in Table (1).

Table (1). Variables and parameters of the specified models

Variable	Definition
y	income per capita
IM	Net migration rate (net entrance to each province from others)
I	The ratio of Investment to *GDP*
FR	Fertility rate
BU	The ratio of the government consumption expenditures to *GDP*
HC	Human capital
HC^2	The square of human capital
W.y	The multiplication of the spatial weight matrix and *y* per capita (for considering spatial autocorrelation)
W.IM	The multiplication of the spatial weight matrix and *IM* (Durbin variable)
α	Intercept
β	Coefficients of explanatory variables
ρ	The coefficient of spatial autocorrelation
γ	The coefficient of spatial Durbin

$\ln(y_{t-1})$ plays a crucial role in the Solow growth model and its coefficient is used for testing the convergence hypothesis. If the estimated coefficient is negative and significant, the convergence hypothesis would be accepted. It implies that poor economies growth faster than rich toward their balanced growth paths. As mentioned in the previous sections, the impact of migration on growth rate is ambiguous.

In endogenous growth models, such as Robelo (1990) and Barro (1990), per capita growth and the investment ratio tend to move together. For example, an exogenous improvement in productivity tends to raise both the growth and investment ratio (Barro, 1991, p.422). On the other hand, some studies like Barro and Becker (1989), Becker, Murphy and Tamura (1990), and Barro (1991), in which fertility is exogenous, per capita growth and fertility rate tend to move inversely. In fact, a higher human capital leads to higher growth and lower fertility.

The effect on fertility involves an increase in the value of parent's time and therefore a rising in the cost of raising children (Barro, 1991). In other words, more educated people are more productive in producing goods rather than more children (Barro, 1991, p.409). Barro (1989, 1990, and 1991) found that government consumption expenditures (as a relative variable to GDP) had negative effects of growth and investment. He argues that government consumption had no direct effect on private productivity, but lowered saving and growth through the distorting effects from taxation or government-expenditure programs (Barro, 1991, p. 430). Human capital is a key factor affecting economic growth and is highlighted in endogenous growth theories. Actually, human capital influence technological progress through generating new ideas and new products. Barro (1991, p.409) believes that countries with greater initial stock of human capital experience a more rapid rate of introduction of new goods and ideas and thereby tend to grow faster.

In this paper, we considered two proxies for human capital: the percentage of population with secondary education and the mean years of schooling. Since the second proxy, mean years of schooling does not show significant effects of growth, the results of the first proxy have just presented in the next section.

As mentioned before, the model was estimated for 30 provinces of the country for the period 2006-2016. In this study, Alborz province is considered as a part of Tehran province due to limited access to data. The data were extracted from the Statistical Yearbooks of Iran and the Central Bank Statistics of Iran.

5. Empirical results

The model specifies in two forms in relations (12) and (13). In fact, relation (13) is the spatial Durbin specification of the relation (12) with two spatial variables: spatial lag of the income per capita (the dependent variable) and the spatial lag of migration. As explained before, in the empirical specification of the Solow growth model, the growth rate of income

(GDP) per capita, which is measured as the difference of natural logarithm of income per capita and its first order lag (ln y – ln y¬¬-1), is a function of the starting income per capita variable (the first order lag of natural logarithm of income per capita (ln y¬-1)), and other variables which reflex the structure of each economy. Therefore, we can consider the natural logarithm of income per capita as the dependent variable. However, we have to reduce 1 from the estimated coefficient of for investigating the convergence hypothesis.

Table (3) shows the estimated results. Model I is the traditional model which is presented in the equation (12). The model has been estimated through GMM. The estimated $\chi 2$ of the Sargan test is 13.579 with the probability of 0.404, therefore it is higher than Chi-squared of the table. Thus, the null hypothesis is not rejected. As a result, instrumental variables are correctly selected and there is no meaningful correlation between the instrumental variables and error terms. The results of the Arellano-Bond test has been demonstrated in the table.

Table 2. Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob. > z
1	-2.061	0.039
2	-1.578	0.115

Source: Authors' calculations. * H0: no autocorrelation.

Results indicate that the z-value of the first-order autocorrelation test is -2.061 with the probability of the 0.039, which shows that the null hypothesis of the absence of first-order serial autocorrelation cannot be accepted. Therefore, the model is dynamic and the first-order time lagged of the dependent variable enters in the model as an independent variable. However, in order to confirm that there is no higher serial autocorrelation—which leads to overestimating the coefficients of the two-step Arellano-Bover /Blundell-Bond model—higher order autocorrelation tests were used. The Arellano-Bond test for second-order serial autocorrelation shows the probability of z-value is 0.115 and confirms that the model does not have higher order serial autocorrelation.

Table 3. Estimating the coefficients of specified models for 30 provinces of Iran, 2006-16.

Variables	Model I	Model II
$\ln y_{-1}$	0.752***	0.866***
	(94.05)	(55.61)
IM	0.223***	0.047**
	(8.52)	(2.14)
I	0.0023	0.0002
	(0.55)	(0.02)
FR	1. 349**	0. 010
	(2.13)	(0.03)
BU	-0.024***	-0.011***
	(-16.13)	(-5.97)
HC	-0.134***	0.236***
	(-0.98)	(2.80)
HC^2	-0.157***	-0.137***
	(-11.68)	(-3.93)
α	3.113***	1.392***
	(25.80)	(8.00)
ρ	-	0.021*
		(1.68)
γ	-	0.032
		(1.02)
Sargan test	χ^2 (13.579) (prob.=0.404)	-
R^2		0.972
Moran's I statistic		2.628** (prob.=0.009)

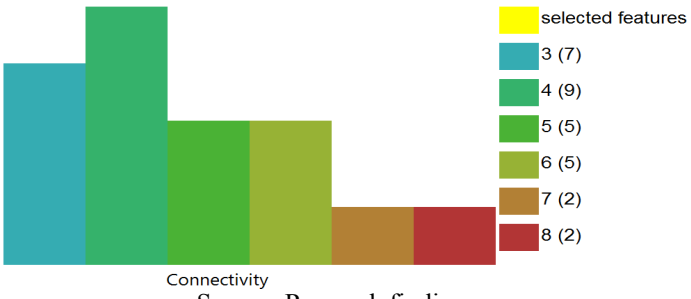
Source: Authors' calculations. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. z-statistics are in parentheses.

Estimating model I coefficients through Arellano-Bover/ Brundell-Bond by traditional econometric techniques demonstrates that the estimated coefficient of the lag of the dependent variable (ln y_{-1}) is 0.725 and highly significant. As mentioned before, for considering the impact of ln y_{-1} (the starting level of income per capita) on growth, we must compute 0.725-1 which is equal to -0.275. That is, the starting level of income per capita have a negative significant impact (with a coefficient of -0.275) on per capita growth which reflects the convergence hypothesis. It means that growth rates tend to be inversely related to the initial incomes per capita. In other words, poorer provinces with lower income per capita grow faster toward their balanced growth path. This result is consistent with the results of other studies on Iran's provinces such as Rahmani and Hassanzadeh (2011).

However, the estimated coefficients would be biased if there would be spatial dependence among observations, and the spatial specification of the model must be considered. The Moran's I test verifies the spatial dependence in incomes per capita. The estimated statistics is 2.627 and significant. Hence, there are positive spatial effects for the income per capita and growth of provinces in Iran. In other words, the income per capita and the growth rate of each province is related to the incomes per capita and growth rates of others. It is clear that more distance between provinces reduces the spatial effects. We enter spatial effects in the model through spatial weight matrix which is defined according to the first-order queen contiguity.

Figure (1) plots the neighbors histogram for provinces of Iran. The colors of columns are related to the numbers of neighbors in a spectrum of blue color with 3 neighbors to red color with 8 neighbors. For example, 7 provinces of Iran have 3 neighbors and 9 provinces have common borders with 4 other provinces, and so on. As the figure show, there is a strong spatial connectivity between provinces of Iran.

Figure 1. Neighbors histogram of the provinces of Iran.



Source: Research findings.

The last column of Table 2 shows estimated results for the spatial Durbin model in which two spatial variables were added: the spatial lag of the dependent variable, so that its estimated coefficient demonstrates spatial autocorrelation; and the spatial lag of regional migration which displays spatial effects of migration among provinces. As expected, the estimated coefficient of spatial lag of income per capita ($\hat{\rho}$) is positive and statistically significant which reflects positive spatial dependence among Iran's provinces. That is, having borders with higher income provinces influences incomes per capita positively. In other words, having poor neighbors can be a negative factor for income per capita and economic growth. The estimated coefficient of the Durbin variable ($\hat{\gamma}$) is also positive but not significant. Hence, there is not significant spatial effects from regional migration.

The Moran's I test and significantly estimated coefficient of the spatial lag of the dependent variable demonstrate that the model has spatial form and the spatial effects must be considered in the model.

Results show that income per capita is strongly related to its time-lagged. The estimated coefficient in the spatial Durbin model is 0.866 and strongly significant. According the previous explanations, the initial level of income per capita would influence growth negatively with a coefficient of -0.134. Accordingly, higher initial income per capita decrease the growth rate of provinces. Thus, the convergence hypothesis is accepted for provinces of Iran. In other words, poor provinces tend to grow faster than the rich.

The estimated coefficient of the regional migration variable is 0.047 which is positive and statistically significant. Therefore, net migration has a positive effect on income and growth,

and the entry of people from other provinces increases the incomes of destination provinces, and their growth rates rise. As expected, immigration to provinces increases the growth rate, since the physical and human capital would be increase as new people enter a region, and new opportunities would be created.

Although the estimated coefficient of investment is positive, it is not significant, which demonstrates that investment has had no significant effect on the income per capita and growth of the provinces of Iran. Also, the impact of fertility on income per capita and growth is positive and significant which is at odds with the predictions of Barro (1991). On the other hand, the share of government consumption expenditures in GDP has significantly negative effect on growth. This result is consistent with the Barro (1991) arguments. This means that provinces with higher government consumption expenditures are expected to have lower growth rates, which could be due to distorting effects from taxation or government-expenditure programs.

In the specified model, the square of human capital has been added. That is, instead of a linear form, the relationship between income per capita and human capital has been considered as a quadratic form. Thus, human capital and its square has been entered the model as explanatory variables. Both variables have statistically significant effects on income per capita and on growth as well. The estimated coefficient of human capital is significantly positive. As expected, income per capita is positively related to human capital and rising human capital increases growth. However, there is an inverse U-shape relationship between human capital and income per capita and growth. Accordingly, there is an optimal amount for human capital. After the optimum point, the income per capita would decline as human capital rises.

6. Conclusion

This research has considered the impact of regional migration on economic growth for the provinces of Iran in 2006-2011. The specified model is based on the Solow growth model. The specified model is a spatial dynamic panel data (SDPD) model. The obtained results show that both time lag and spatial lag of income per capita have statistically significant impacts on the income and growth of Iran's provinces. The starting income per capita has expectedly negative impact on per capita growth, which confirms the convergence hypothesis. That is, poor provinces grow faster toward their balanced growth paths. The positive estimated coefficient of the spatial lag of income shows positive regional effects. Accordingly, having rich neighbors increases income and economic growth. Also, being a destination province for migrants from other provinces positively influences income and economic growth, while there is no significant spatial effect from migration on income per capita and growth.

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THE EFFECTIVENESS OF HEALTH BUDGET IN REDUCING POVERTY: EVIDENCE IN INDONESIA

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Abstract

The purpose of this study is to analyze the effectiveness of health expenditures in reducing poverty in Indonesia. The data used was panel data from three specific autonomous regions: Aceh, Papua, and West Papua, data from 2006-2017. The method of analysis used in the study was the ARDL Panel model. The results of the study show that in the short term, health expenditures o not affect poverty in the autonomous regions. The results from each region showed no short-term effect. Long-term estimates show that health spending can reduce poverty by up to 6 percent assuming cateris paribus. Adjustments of these impacts will occur every 9.6 months. This study recommends that the government increases the health budget so that the poor can get protection and avoid health problems. The study also recommends increased regulation of health expenditures to make it more effective and have an impact in the short term.

Keywords: Health Budget, Poverty, ARDL Panel, Special Autonomy
JEL classification: C23, H51, I38

1. Introduction

Throughout Indonesian history, poverty has prevented millions of children from to getting quality education and exacerbated difficulties in financing healthcare. A widespread lack of savings investment, access to public services, employment opportunities, social security and a social safety net for families, along with increasing urbanization to the city, has caused millions of people to have limited resources to meet the needs of food, clothing, and shelter. Poverty causes rural communities to sacrifice anything for the security of their lives by risking physical labor to receive wages that are not commensurate with the labor costs incurred (Nano, 2009).

Strategic development efforts have long been implemented in Indonesia in hopes of achieving high economic growth. However, as development has progressed, new problems have appeared, including an uneven distribution both on a regional and national level. This leads to a *trade-off* between growth and equity. High economic growth is expected to produce a *trickle-down effect* from the upper economic classes to the economic layers below it. The fact is that such an effect does not occur, and poverty and inequality actually increase.

If we use the poverty line value used by the World Bank, which classifies the percentage of Indonesians living on less than USD 1.25 per day as those living below the poverty line (in other words, *poor*), the percentages in the table above will look inaccurate because the value is increased by a few percentage points. Furthermore, if we calculate the number of Indonesians living on less than USD 2 per day, according to the World Bank, the image for the percentage of the population living in poverty will increase even more sharply. This shows that most of the Indonesian population lives almost below the poverty line. About

a quarter of Indonesia's population (around 65 million people) live just a little above the national poverty line.

The government has implemented poverty reduction efforts in the form of poverty reduction policies, programs, and spending. These efforts have been able to reduce the number of poor people in a real way, but the targets of policies and programs have not been fully achieved. This is because the programs have s not been implemented in an integrated manner, so that some programs overlap, hampering efficiency (Mulyani, 2007).

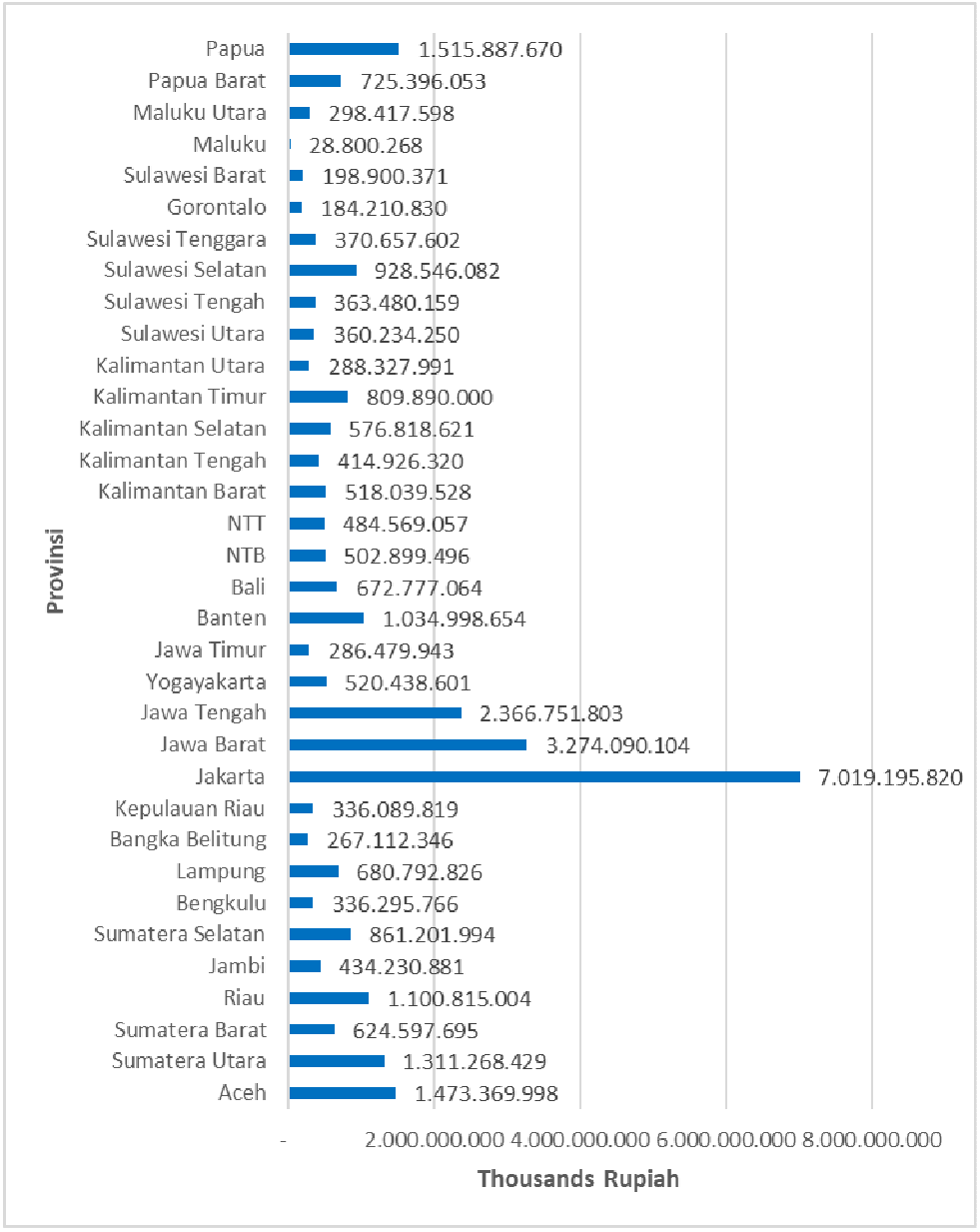
Today, the Indonesian government's policy to reduce poverty is to increase health budget allocations for the entire community. One of these efforts, the Health Insurance program, is a strategy to reform the health service financing system in Indonesia. All poor people are exempt from financial burdens when accessing health service facilities at the Puskesmas, district/city general hospitals (RSUD), provincial hospitals, and referral center hospitals in and outside the region, all of which are adequate medical facilities and health services (National Team Acceleration of Poverty Reduction: 2012)

Although economic growth at the desired target has still not been achieved, the government continues to strive to reduce the poverty rate to 1 digit The Finance Ministry continues to increase the budget allocations for poverty reduction and to fight inequality in low-income communities, through various programs such as Family Hope Program (PKH), Program Indonesia Pintar (Smart Indonesia Program), National Health Insurance (JKN), food aid, Bidik Misi Scholarships [a scholarship program for low-income families], and village funds. The government has budgeted IDR 25.5 trillion for the health budget for 2018 (Sicca, 2018).

The government has also allocated a certain amount of its budget for health funds allocated for APBD funds in each province Provincial contributions to health funds can be seen in Image 1. Health problems are a critical concern for all people, as health is the number one key to life. Most Indonesians are vulnerable to poverty. They live only slightly above the national poverty line and have revenue of less than the US $2 per day. That income is only enough to meet the necessities of life (eating, drinking, shelter). An income of this level will be insufficient cover health needs. In the health sector, the government has sought to increase the level of public health more evenly by increasing the reach and quality of health services. The government has implemented various initiatives with this goal,, such as Askeskin [a health insurance program for the poor], Jamkesmas [National Healthcare Scheme] and free medical treatment. However, the question now is whether increasing the healthcare budget can reduce poverty in Indonesia.

The level of public health can be seen in home sanitation systems. The government has so far paid little attention to this factor. Currently, there is a crisis in the supply of sanitation facilities. The government budget is insufficient for *the* development of proper sanitation facilities. The effects of this crisis are experienced by poor people who tend to use water from polluted rivers. Even in the capital city or in big cities, poor people tend to be those residents who live near a waste disposal site. There are several options for addressing this crisis, including holding a national consensus to discuss financing sanitation facilities and encouraging local governments to build facilities through special allocation funds (DAK). To find a comprehensive solution, there must be a review of budgets and policies that focus on health issues and sanitation.A proportion of the APBN budget must be allocated in order to solve this to problem. The development of good infrastructure must be carried out in tandem with increasing community social awareness on the importance of health (Zaenuddin, 2007).

Image 1: All Provincial Health Budgets in Indonesia, 2017



Source: BPS 2018

2. Literature Review

Poor can be interpreted as *having little money and few possessions; not having enough money for the basic things that people need to live properly,* which means not having enough money for the basic things that people need to live right (Stevenson, 2010). The above statement contains two causal forms in interpreting the word poor, that is: (i) poor as in having a minimal amount of something; and (ii) poor as not good in terms of quality or condition (Griffith, 2011).

Chambers (1997) argues that the notion of poverty is very dependent on who asks, how it is understood, and who responds. This perspective groups the meanings of poverty into several groups. One of the groups interprets poverty as a broad concept, including multidimensional deficiencies. Further, it is explained that poverty describes twelve dimensions, with each one interrelated. These twelve dimensions consist of: (1) education/ ability, (2) institutional access, (3) time, (4) season, (5) residence/location, (6) security, (7) physical disability, (8) material, (9) social relations, (10) legal, (11) political power, and (12) information. Various studies reduce these dimensions so that the concept of poverty is defined more narrowly as individuals who live in poor conditions, are vulnerable, marginalized, and who lack or have minimal access to institutions such as education, law, and other resources.

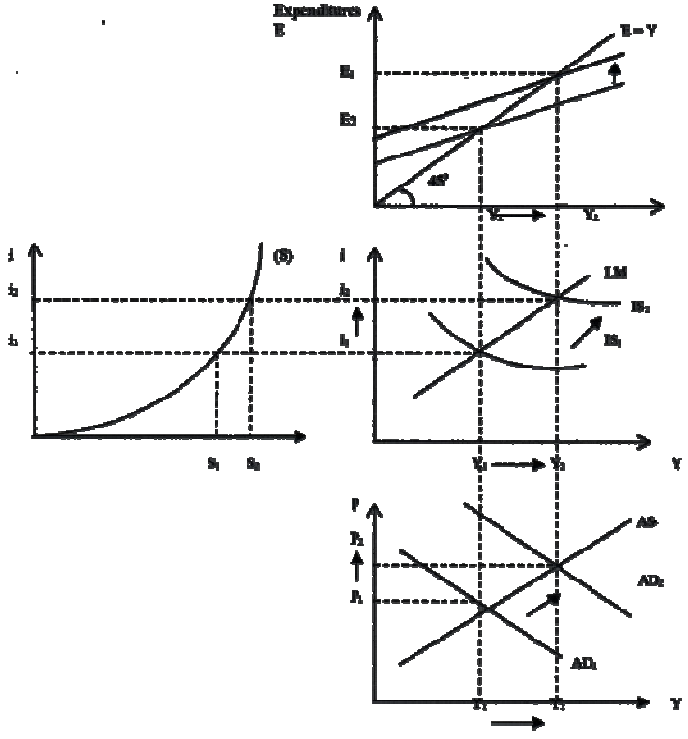
The term "government expenditure" can be used as an indicator of the amount of government activity financed by government funds. The more prominent and numerous the government's activities, the higher the government expenditure concerned (Suparmoko, 2004). Boediono (2001) reveals that in macroeconomic theory, government expenditure consists of three main categories, which can be classified as follows:

1) Government expenditures on the purchase of goods and services.
2) Government expenditures on employee salaries. Changes in employee salaries influence macroeconomic processes, as changes in employee salaries will indirectly affect the level of demands.
3) Government expenditures on transfer payments.

The influence of health expenditures on poverty can be examined using two approaches. First, an increase in the health budget will shift government expenditure (E) from E1 to E2 with the difference ΔG, affecting income through the formula ΔG (1 - MPC). Increasing the health budget, as a fiscal expansion policy, will increase state expenditures, so the IS curve will shift to the right as seen in Image 2. As a result, national output will increase from Y_1 to Y_2.

As national production increases, there is an increase in income, followed by an increase in interest rates from i_1 to i_2. The savings function (S) has a positive correlation with interest rates, so if the interest rate rises, this will encourage people to consume less and save more. Increasing savings will increase people's income, which will lead some residents to cross the poverty line, which means the number of poor people will decrease. So it can be concluded that increasing health subsidies can reduce the number of poor people.

Image 2: Impact of Health Expenditures on Poverty



Source: (Mankiw, 2007) (modification)

Oriavwote (2018) investigates the relevance of government spending on poverty reduction in Nigeria. The results show that government spending on buildings and construction has a significant and positive impact on per capita income, but the elasticity is very low. The results of the Granger causality test show there is no causal relationship between government spending on health and education. However, there is a causal relationship between government spending on education and per capita income.

Keane (2018) explains that India has a high level of expenditures on out-of-pocket health care (OOP), and a lack of development in the health insurance market. As a result, measures to alleviate poverty and inequality that treat medical spending symmetrically with consumer

goods outside the boundary. Poverty level to show how OOP health costs affect all forms of consumption distribution.

Furthermore, Bahtera (2018) explains that government spending in the education and health sectors have an influence on poverty in Aceh Province, , but that there are differences between districts and cities. The estimation results show that education expenditures in a city area have a significant influence on reducing poverty, while the development of new areas does not affect reducing poverty.

Musyoka (2018) explains that one of the world's goals is to increase health so that productivity will also increase. In Kenya, the government attempts to reduce poverty by improving the health of its citizens. The estimation results show that poverty reduction can be seen from the use of perfect health, it can be seen that the increase in household expenditure from health reporting is one-factor measuring poverty.

Wherry (2017) explains that over the past thirty years, there had been a significant expansion in public health insurance for low-income children in the US through Medicaid. The results of the study show that public health insurance provides essential financial benefits for low-income families. Expansions in public health insurance for low-income children and adults is associated with reduced medical expenses, increased financial stability, and increased material well-being for families.

Umeh (2017) describes unfairness in access to health insurance by examining a poor community-based health insurance program. The results of this study show that rich people are generally more willing to pay for insurance than poor people, and thus socioeconomic status will affect access to healthcare services. The most frequent reason why people opted out of this insurance program was the lack of money to pay premiums.

Rapiuddin (2017) conducted research on the technical efficiency of the education sector and the health sector in 24 districts/cities in South Sulawesi Province. The results of this study indicate that in general, most districts/cities in South Sulawesi Province are still not efficient in terms of technical costs and technical systems.This indicates that there is still a large amount of waste in education spending and much health spending, but it is not followed by education and health services and facilities, and there have been no efforts to improve the system to improve the level of education and public health.

Omari (2016) showed the effect of sectoral government spending on poverty levels in Kenya. The regression results show that expenditures on the agricultural sector and the health sector have a positive and significant effect on poverty levels, while infrastructure sector spending has a negative and significant effect on the poverty level. The effect of education sector expenditures on poverty levels was not significant. It was recommended that the government in Kenya increase the allocation of expenditures for the agriculture and health sector.

In terms of the effects of health insurance on poverty, Korenman (2016) examined the impact of Massachusetts's health reform. . The results of the study indicate that the benefits of public health insurance and premium subsidies provide a significant and substantial reduction of one third in the poverty level. Among low-income families who bought individual insurance, premium subsidies reduced poverty by 9.4 percentage points.

Vilcu (2016) studied trends in subsidized health insurance in Asian countries. According to this research, there are currently 8 countries with a total of 14 subsidy schemes. The groups most often given health subsidies are the poor, elderly, and children. The membership systems are in different tiers, where many participants get insurance fully subsidized by the government and some get half of the full subsidy. Even so, in most cases, the subsidy is higher compared to those who do not have health insurance, but still lower than insured formal sector employees.

Ganguly (2016) conducted a study examining the effects of a reduction in fuel subsidies on poverty and equality in India. This study showed a positive relationship between crude oil prices and the level of poverty and inequality in India. It further showed that the elimination of subsidies for fuel such as gasoline, diesel, and Liquified Petroleum Gas (LPG), even when carried out during a period of decline in crude oil prices, had detrimental effects on the poor. It is crucial that the abolition of subsidies be combined with targeted pro-poor policies.

Lubotsky (2016) conducted research on health insurance and income inequality in the US. This research analyzed economic inequality by focusing on wage rates, income, or income.

Health insurance and other forms of compensation and government benefits are usually not included in income measures and inequality analysis. Health spending in 2014 accounted for more than 17 percent of GDP, and almost 70 percent of this expenditure was for public or private health insurance plans. Given the large and ever-increasing health care costs in the United States and the presence of large government health insurance programs such as Medicaid and Medicare, it is imperative to understand how health insurance and related public policies contribute to economic well-being and inequality.

The Special Administrative Region of Yogyakarta (DIY) poverty reduction policy is an effort to eradicate poverty with policies and funds from both central and regional governments. The results of the study found that the DIY government continues to improve the economic welfare of poor people in the regions, but because of the limitations and powerlessness of poor people, in addition to regional fiscal limitations, it is challenging to improve the welfare for the population in poverty in the DIY. Policy recommendations that can be made include empowering existing local economic potential, creating jobs, and building productive businesses such as small businesses for community members to increase their income. In addition, coordinating pro-poor programs with the central government is a step that must be taken (Saragih, 2015).

Ahmed Shoukry Rashad (2015) analyzes who benefits from public health subsidies in Egypt. The results of the study show several levels of inequality in the benefits of public health services, which vary according to the type of health care provided. In particular, subsidies associated with university hospitals are generally beneficial to the rich and have the effect of increasing inequality, while subsidies related to outpatient and inpatient care provided by the Ministry of Health and Population have not been pro-poor but have the effect of reducing inequality. Measures for poverty reduction and health service reform in Egypt were recommended to not only focus on expanding the coverage of health benefits, but also on increasing distribution.

Çevik (2013) analyzes the effects of government spending on health care on health outcomes using cross-national comparisons. This study uses cross-sectional regression to estimate the strength of the relationship between child and infant mortality rates and public health expenditures in countries throughout the world. This study demonstrates statistically significant and strong results with various specifications. Government health expenditure as a fraction of GDP was negatively correlated with under-five mortality rates, with an elasticity of -0.17 to -0.22. The elasticity was -0.20 for infant mortality. The income level is slightly less significant, and public health expenditure becomes a little more empirically significant.

Misdawita (2013) conducted an analysis of the impact of subsidies and government spending in the fields of education and health on poverty in Indonesia. Poverty, in addition to unemployment and social inequality, is a significant and fundamental problem in Indonesia. This study found that government spending in education was effective in reducing poverty, but subsidies and government spending in the health sector were not, due to inappropriate targeting of subsidized users in the field .

Bynoe (2012) claimed that public spending on education and health care is necessary for human development and to achieve other benefits such as economic growth. The most important public goal is to use public expenditure to reduce poverty and to help create an enabling environment where the private sector can become a growth engine (Swaroop, 1996). Most of the variables used by this model were selected according to the previous literature. However, unlike most literature that assesses the Caribbean, this model tried to explain the quality of interpreting educational attainments.

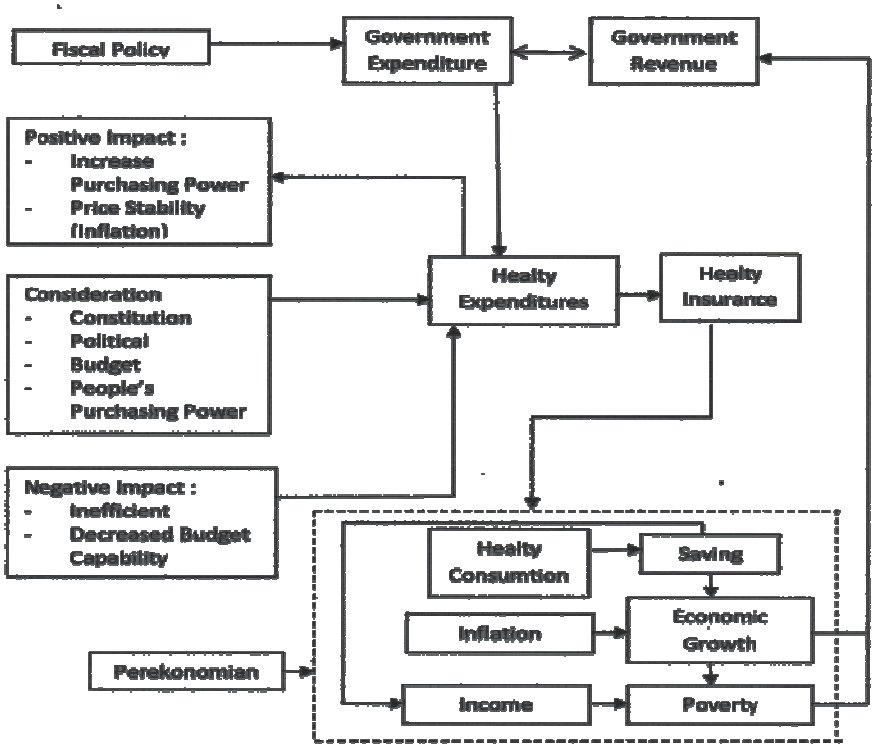
Andrés Ramírez Hassan (2013) studied the impact of health insurance on the poor in Medellín, Colombia. This study used binary data models and numbers with endogenous dummy variables to evaluate the effects of subsidized health care programs in Medellín. . Subsidized programs, which mainly target the poor, were found to have a significant impact on the use of medical care and hospitalization, which might have a negative impact on the program's financial resources. In particular, econometric estimates from the utilization of health services indicate that there is a selection. These facts imply that the program can increase its scope if a mechanism is made to reduce the effects of individual moral hazards.

Maipita (2010) conducted a study of the impact of fiscal policy on economic performance and poverty rates in Indonesia, as the government has continuously designed policies to

accelerate economic growth and reduce poverty. However, the government faces several obstacles, such as increasing deficits, that have the potential to affect the priority scale as well as the pros and cons that occur in it. Based on these considerations, economic policies must be revised and redesigned to be pro-growth, pro-job vacancies, and pro-poor. In general, this study aims to examine the impact of the expansion and contraction of fiscal policy on economic performance in Indonesia.

To evaluate the gap in income distribution, Decaluwe et al. (1999) used the beta distribution function. The results of this study indicate that increasing subsidies had a better impact than the two previous fiscal policies. Although the income transfer policy had a positive impact on increasing household income in rural areas and reducing poverty, this policy had the negative effect of reducing GDP.

Image 3: Conceptual Framework for the effect of Health Expenditures on Poverty



Using nationally representative data from India, Flores (2008) revealed that if the government allocates some expenditures to finance the cost of hospital care, one of them is about three-quarters of the cost of inpatient care issued by the community. Because poverty is highest in India to pay for hospital care, 24% of individuals admitted to hospitals have inadequate funds to pay for care. If the government covers 30% of medical costs of poor people who are hospitalized, this will reduce their household expenses so that they can save their money for other needs. The government pays 10% of the costs of fr inpatient care, which reduces household expenditures on health costs. This can reduce the burden on the household and can increase household income.

More broadly, health expenditures will also lead to increased incomes in the community because people's spending on healthcare is funded by government expenditures, which means that people can save the money that they would have spent.. Another thing that arises due to health budget policies is the problem of opportunity costs. Increasing budget allocations for health will reduce budget allocations for other activities, which can increase economic output and also reduce inflation.

3. Method of Analysis

3.1. The scope of the Study

This study analyzes the effectiveness of health expenditures for poverty reduction in Indonesia's Autonomous Regions, namely Aceh, Papua, and West Papua, from 2006-2017.

3.2. Source and Type of Data

The data used are data from 3 provinces in Indonesia, Aceh, Papua, and West Papua, that receive special autonomy funds. The type of data used in this research is panel data for the years 2006 to 2017 on government expenditures on health and poverty.

3.3. Analysis Model

In the ARDL regression analysis, the data used is time series data, but in this study, researchers used the ARDL model with panel data. This ARDL model is used to see the role of time, the justification of the theory, and the relationships between variables (Gujarati, 2003).

The ARDL model uses panel data as follows:

$$Y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \theta_i Y_{t-i} + \beta' X_t + \sum_{i=0}^{q-1} \beta^{*\prime} \Delta X_{t-i} + u_t \quad (3.1)$$

$$\Delta X_t = P_1 \Delta X_{t-1} + P_2 \Delta X_{t-2} + \cdots + P_i \Delta X_{t-i} + \varepsilon_t \quad (3.2)$$

$$Y_{j,t} = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \theta_i Y_{j,t-i} + \beta' X_{i,t} + \sum_{i=0}^{q-1} \beta^{*\prime} \Delta X_{j,t-i} + u_{j,t} \quad (3.3)$$

To facilitate the calculations, the researcher then substituted equation (3) for the research variable and transformed it into the form of a natural logarithm for each variable, so:

$$\Delta lnAK_{j,t} = \alpha_{0i} + \sum_{i=1}^{n} \alpha_{1i} \Delta lnAK_{j,t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta lnBK_{i,t-i} + \beta_{11} lnAK_{j,t-1} + \beta_{21} lnSK_{j,t-1} + u_{j,t} \quad (3.4)$$

Where AK is poverty, BK is health expenditures, α1 to α3 are short-term coefficients, β1 to β3 are long-term coefficients, t is years (i.e. 2006-2017), j is region, the options for which are three autonomous regions, i is the order of lag, and u is an error term.

3.4. Data Stationarity Test

The data stationarity test is conducted to determine whether the time series data used has a stable (stationary) or non-stable (nonstationary) pattern on each variable. The test methods for the presence or absence of root units in the data were the Levin, Lin & Chu (LLC) method, the Im method, the Pesaran and Shin (IPS) method, the ADF Fisher Chi-square (ADF Fisher), and the PP-Fisher unit root.

3.5. Cointegration Test

The researchers used the Levin, Lin & Chu (LLC), Im, Pesaran, and Shin (IPS) integration, ADF Fisher Chi-square (ADF Fisher), and the PP-Fisher unit root. Cointegration methods used Pedroni and KAO-based panels.

3.6. Determination of Optimal Lags

Determining the optimal lag length is needed for the time-series model stationarity test. To select lag order, various criteria can be used, namely Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ). In this study the determination of optimal lag was done using the Akaike Information Criterion (AIC) criteria. The smallest AIC value to be chosen aims to minimize the number of the residual sum of squares (RSS) or increase the value of R2 so that the error rate is the smallest model (Gujarati, 2003).

3.7. Short-Term Testing

Short term estimates can be seen below:

$$\Delta lnK_{j,t} = \alpha_{0i} + \sum_{i=1}^{n} \alpha_{1i} \Delta lnK_{j,t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta lnAK_{j,t-i} + \theta_1 ECT_{t-1} + u_{2it} \quad (3.5)$$

Short-term testing:

$H_0 : \alpha_{11} = \alpha_{21} = \alpha_{31} = \alpha_{41} = \alpha_{51} = 0$ There are no short-term influences

$H_a : \alpha_{11} \neq \alpha_{21} \neq \alpha_{31} \neq \alpha_{41} \neq \alpha_{51} \neq 0$ There are short-term influences

Where α1i and α3i are short-term dynamic coefficients for the speed of adjustment, and the Error Correction Term (ECT) is a short-term dynamic coefficient for the speed of balance adjustment. The ECM values are from 0 to -1.

4. Study Results and Discussions

4.1. Root Unit Panel Test Result

Levin (2002) introduced different unit root unit tests that have different specifications depending on assumptions about specific entity interception requirements and time trends. The LLC test increases homogeneity in the autoregressive coefficient (interception and trends can vary between individual series), which indicates the presence or absence of a unit root. This test, which is based on the ADF regression, is used to check unit root problems.

The level of integration and stationary properties of each variable was determined using the ADF (LLC) panel test proposed by Levin (2002) by assuming homogeneity in autoregressive coefficient dynamics for all panel units. Also, we used a nonparametric test (Maddala GS, 1999) as well as the Fisher-ADF test and Fisher-PP, taking into account the heterogeneity between units. Finally, we conducted the cross-sectional dependence unit root (CIPS) test. These tests show that poverty has a unit root at the level marked with ADF. PP and IPS values were more significant than the significance value of 1 percent, while health expenditures has ADF and IPS values above 5%. For the Fisher test, however, the PP value was not significant at 5 percent or 1 percent (Table 1).

Table 1. Root Unit Panel Test Result

Variabel	LLC	Fisher ADF	Fisher PP	IPS
Poverty	-19,6271**	23,3676**	4,07025	-3,61691**
Δ Poverty	-9,62987**	25,6430**	26,6175**	-2,67809**
Healty Budget	-4,61042**	14,9240*	4,13073	-2,02530*
Δ Healty Budget	-6,58165**	13,0318*	12,5522	-1,00933

Note: * Prob < 0,05 , ** Prob < 0,01 Lag

4.2. Panel Cointegration Test

In the second stage, we proceeded to panel cointegration tests after the specification of order of integration fot the series. Pedroni test is the most popular among panel cointegration tests. Pedroni tests includes seven different statistic : four of them belong to the within dimension, which are v -statistic, p-statistic, PP-statistic and ADF-statistic: three of them belong to the between dimension which are group p-statistic, group pp-statistic and group ADF-statistic. both kinds of test focus on the null hypothesis of no cointegration. these statistic are distributed asymptotically as standard normal.

Table 2. Cointegration Tests, Pedroni Tests and Kao Tests

Pedroni Cointegration Result			
Within Dimension Test Statistics		Between Dimension Test Statistics	
Panel v-Statistics	0,393250	Group rho-Statistics	1,160976
Panel rho-Statistics	0,259165	Group PP-Statistics	-0,316121
Panel PP-Statistics	-0,723314	Group ADF-Statistics	-3,271220**
Panel ADF-Statistics	-0,970415**		
Kao Test			
ADF			-3,571165**
Residual variance			3,831109
HAC Variance			3,620672

Catatan: * Prob < 0,05 , ** Prob < 0,01

Table 2 shows the cointegration panel test statistics. This statistical test is based on the individual autoregressive coefficient average associated with the unit root test of the residue for all panel data. All seven-panel cointegration tests rejected the null hypothesis without cointegration at a significance level of 1%. Table 2 shows cointegration with a significance level of 1 percent for the poverty model and health expenditures where cointegration occurs at a significance level of 1%., Therefore, the conclusions drawn indicate that Ha should be accepted, or, in other words, that there is a relationship in the short term and long term.

4.3. Model Estimation with Short and Long Term ARDL

Autoregressive Distributed Lag can be used to see the long-term and short-term effects of health expenditures on the poverty model. The influence of long-term and short-term health expenditures on poverty can be seen in Table 3.

Table 3. The long-term and short-term effects of ARDL on Poverty

Variabel	Coefficient	Prob
Long Run Education		
Kemiskinan	-6,110243**	0,0000
Short Run Education		
COINTEQ01	-0,800000	0,0000
D(KS)	0,883963	0,7998
D(KS(-1))	0,813724	0,8168
C	87,32809	0,0000

Note: * Prob < 0,05 , ** Prob < 0,01

Table 3 displays the results of the ARDL long-term and short-term coefficient estimates of poverty. The short-term coefficient of the poverty model shows a non-significant effect. This can be seen from the probability value of 0.80> 0.05, which explains that there is no effect of health expenditures on poverty in the short term. The speed of balance adjustment (ECT) is -0.800000 and is significant at the level of 1 percent and negative, as expected. This means that 80 percent of imbalances that occur in the short term will be adjusted in each quarter.

In the long term, the poverty coefficient shows a significant effect, with an elasticity coefficient of -6.11. This means that an increase in the health budget of 1 percent will reduce poverty by 6.11 percent in the long term. If we look at the coefficient value of 0.0000<0.01, it explains the influence of health expenditures on poverty in the long term.

4.4. Results of Estimation of Each Special Autonomy Recipient Region

Short-term estimation and the Error Correction Term (ECT) were found in order to determine the equilibrium that occurs between the dependent variable and the independent variable, where ECT functions to determine the rate of adjustment in the short-term balance towards the long term. In this case, when ECT is significant and has a negative sign, the

situation indicates that there is a balance at the long-term level. The magnitude of the ECT coefficient indicates the level of speed of adjustment in correcting imbalances in each variable so that the economy can return to the equilibrium point. The coefficient of ECT is 0 to -1.

Table 4. ARDL Panel Estimation Results of Aceh

Variabel	Coefficient	Std. Error	t-Statistics	Prob
COINTEQ01	-0,531542	0,029570	-17,97602	0,0004
D(KS)	2,698873	6,337889	0,425832	0,6989
D(KS(-1))	-2,988365	5,003999	-0,597195	0,5924
C	54,68131	386,5205	0,141106	0,8967

Table 4 shows that short-term poverty has an elasticity coefficient of 2.70, which means that an increase in the Aceh health budget of 1 percent in the short term increases poverty by 2.70 percent. The coefficient value of 0.6989>0.05 shows that there is no effect of Aceh health expenditures on poverty in the short term. The speed of balance adjustment (ECT) is -0.532542, which is significant at the level of 1 percent and negative, as expected, meaning that 53.25 percent of the imbalance that occurs in the short term will be adjusted in each quarter.

Table 5. ARDL Panel Estimation Results of West Papua

Variabel	Coefficient	Std. Error	t-Statistics	Prob
COINTEQ01	-0,967612	0,065666	-14,73534	0,0007
D(KS)	2,410306	14,35557	0,167900	0,8773
D(KS(-1))	7,736007	13,54813	0,571002	0,6080
C	103,1885	982,8195	0,104992	0,9230

Table 5 shows a coefficient value of 2.41, which means that an increase in the West Papua health budget of 1 percent in the short term increases poverty by 2.41 percent. The coefficient value found was 0.8773>0.05, which shows West Papua's health expenditures have no effect on poverty in the short term. The speed of balance adjustment (ECT) for West Papua Province is -0.967612, which is significant at the level of 1 percent and is negative, as expected, meaning that 96.76 percent of the imbalances that occur in the short term will be adjusted in each quarter.

Table 6. ARDL Panel Estimation Results of Papua

Variabel	Coefficient	Std. Error	t-Statistics	Prob
COINTEQ01	-0,967612	0,065666	-14,73534	0,0007
D(KS)	2,410306	14,35557	0,167900	0,8773
D(KS(-1))	7,736007	13,54813	0,571002	0,6080
C	103,1885	982,8195	0,104992	0,9230

For Papua the coefficient value was found to be -7.74, which means that an increase in the Papua health budget of 1 percent in the short term reduces poverty by 7.74 percent. The coefficient value was found to be 0.8327>0.05. This shows that in Papua, health expenditures have no effect on poverty in the short term. The speed of balance adjustment (ECT) is -0.900845, which is significant at the level of 1 percent and negative, as expected, meaning that 96.76 percent of the imbalances that occur in the short term will be adjusted in each quarter (table 6).

4.5. Study Result Implications

One of the objectives of the Indonesian government's special autonomy funds is poverty alleviation. Tables 3 - 6 show the results of this study in terms of the relationship between government healthcare expenditures and the poverty level in in the three regions in Indonesia that receive special autonomy funds.

The poverty coefficient shows that health expenditures have a non-significant effect. This can be seen from the probability value of 0.80>0.05, which shows that there is no effect of health expenditures on poverty in the short term. ARDL estimates in the short term show that

Aceh Province has a coefficient value of 0.6989>0.05, West Papua has a coefficient value of 0.8773>0.05, and Papua's coefficient is 0.8327>0.05. This is contrary to the research presented by Michael Keane (2018), which explained that health care spending by insurance companies can reduce expenditures and increase consumption and by these methods poverty can be reduced. The same conclusion was reached in Laura R. Wherry's (2017) study, which found that public health insurance provided financial benefits for low-income families. Expansion of public health insurance for children and low-income adults will reduce medical expenses, which can improve material well-being for families and have the effect of reducing poverty.

Misdawita (2013) found that government expenditures in the field of education were effective in reducing poverty, but government spending and subsidies in the health sector were not, due to inappropriate targeting of subsidized users in the field.

In the long term, the ARDL estimation results in a poverty coefficient with a significant effect, with an elasticity coefficient of -6.11. This means that a 1 percent increase in health expenditures reduces poverty by 6.11 percent in the long term. The coefficient value of 0.0000<0.01 shows that health expenditures have a significant effect on poverty. This is consistent with an economic theory where an increase in health expenditures can reduce poverty.

This is consistent with research conducted by Mahadi Bahtera (2018). The results of the study show that if the education budget is 20 percent of the total APBD and health expenditures are 10 percent of the total APBD budget; poverty in Aceh Province will decrease by an average of 49 percent per year. District/city governments are expected to be able to set the education budget and health budget through education and health Laws each year.

Musyoka's (2018) research also showed estimation results indicating that poverty reduction could be achieved through effective use of health insurance, which can reduce household health expenditures. This can be used as a factor in measuring poverty.

As discussed above, health expenditures do not affect poverty reduction; these results are troubling because they were unexpected. Supposedly, an increase in the health budget in three regions receiving special autonomy funds can reduce poverty. The findings in this study are caused by the lack of good governance of the special autonomy funds and income inequality, which results in high levels of poverty.

5. Conclutions

Based on the results of the data analysis and discussion, several conclusions can be drawn that in 2011 there was an increase in the health budget aimed at the Jamkesmas and Jampersal programs. The government also expanded the coverage of healthcare programs to cover the poor, the homeless, beggars, neglected children, and poor people with no identities. The poverty rate in 2006 was 17.75% due to an increase in inflation caused by the government raising the price of domestic fuel oil, followed by an increase in rice prices during this period.

The short-term poverty coefficient has a probability value is 0.80>0.05, which shows that health expenditures have no effect on poverty in the short term. However, when viewed in the long term, the coefficient value is 0.0000<0.01, meaning health expenditures have a significant effect on poverty in the long term. The long-term poverty coefficient showed a significant effect, with an elasticity coefficient of -6.11. This means that an increase in the health budget by 1 percent in the long-term reduces poverty by 6.11 percent, according to the theory presented in the hypothesis. Short term estimation results indicate that health expenditures from special autonomy funds do not have an effect on poverty reduction. This unexpected result gave a troubling picture of the situation. This is likely due to a lack of oversight of special autonomy funds and income inequality, which results in high levels of poverty.

Because this research is limited to only regions that receive special autonomy funds, it is hoped that subsequent studies can add other variables so that the research will be broader. In the long term, this study found a significant influence of health spending on poverty. Because of the chronological nature of the findings, it is suggested to increase the number of budget years studied. To accelerate the reduction of poverty, allocations for education expenditures by provincial governments must be at least 20 percent of the APBD, especially in regions with the highest poverty rates in Indonesia.

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A STOCHASTIC MODEL OF COMPETITION BETWEEN TWO CITIES FOR MEMBERS OF THE CREATIVE CLASS

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Abstract

Batabyal and Yoo (2019) have recently obtained a significant result in their analysis of the use of utilitarian and Rawlsian policies by two cities to attract the creative class. They show that if one city switches to a Rawlsian or more egalitarian objective when the other city remains utilitarian, the aggregate economy of two cities becomes less egalitarian. We show that this result depends fundamentally on the assumption that the creative class population can be described by a triangular probability distribution. If this population is modeled instead with an inverted triangular probability distribution then the above result is reversed in the sense that the welfare of the worst-off member of the creative class is always enhanced when one city switches to a Rawlsian or more egalitarian objective, irrespective of the objective of the other city.

Keywords: City, Competition, Creative Class, Rawlsian, Utilitarian
JEL classification: R11, D63

1. Introduction

The urbanist Richard Florida (2002, 2003, 2005, 2008, 2014) has contended in a number of research contributions that cities and regions that want to flourish in this era of globalization need to do all they can to attract and retain members of the so called creative class who are, we are told, the principal drivers of economic growth and development. Once one accepts Florida's assertion that cities seeking to prosper economically need to attract members of the creative class, the next logical question is the following: "How are cities to do this?" Florida (2002, 2008), Buettner and Janeba (2016) and Batabyal et al. (2019) have answered this query by demonstrating that cities can utilize local public goods such as cultural amenities, quality schools, and public transit to effectively carry out the "attract" function. (Readers interested in a more detailed discussion of this issue should consult Audretsch and Belitski (2013) and Batabyal and Nijkamp (2016)).

In an interesting recent contribution, Batabyal and Yoo (2019) have shed light on the question posed in the preceding paragraph by analyzing the competition between two cities that use utilitarian and Rawlsian policies to attract the creative class. Inter alia, these researchers show that if one city switches to a Rawlsian or more egalitarian objective when the other city remains utilitarian, the aggregate economy of two cities becomes less egalitarian. Given this finding, our objective in this paper is to show that this result obtained by Batabyal and Yoo (2019) depends essentially on the assumption that the creative class population can be described by a triangular probability distribution function. If this population is modeled instead with an inverted triangular probability distribution function then the Batabyal and Yoo (2019) result mentioned above is reversed in the sense that the welfare of the worst-off member of the creative class is always enhanced when one city switches to a Rawlsian or more egalitarian objective, regardless of the objective of the other city.

The remainder of this paper is organized as follows. Section 2 delineates our model of an aggregate economy consisting of two cities that builds on Batabyal and Yoo (2019). Note that for ease of comparison with the results obtained by Batabyal and Yoo (2019), the notation we use in our paper is the same as that used by these two researchers. The creative class of interest to us is made up of a heterogeneous group of individuals possessing creative capital.

Section 3 analyzes the welfare of the worst-off individual in the creative class in the case where one city switches from a utilitarian to a Rawlsian policy regardless of the objective of the other city. Section 4 concludes and then suggests two ways in which the research described in this paper might be extended.

2. The Theoretical Framework

Consider an aggregate economy of two cities denoted by $j = A, B$. Each of these two cities competes for members of the creative class with its choice of a particular policy. Note that we are using the word "policy" in a general way. As such, one such policy could be how much to provide of a local public good as in Batabyal *et al.* (2019) and a second policy might be how much funding to make available to creative class members wishing to undertake one or more entrepreneurial ventures. The policy choice of city j is represented by a point z_j on the closed interval $[0, 1]$.

Creative class members *differ* in their preference for alternate policies put in place by cities A and B. In particular, a creative class member of type ζ who elects to live in city j with policy z_j obtains utility given by the quadratic function

$$\tilde{U}(z_j, \zeta) = -(\zeta - z_j)^2. \qquad (1)$$

Clearly, equation (1) tells us that a type ζ creative class member's preferred policy is $z = \zeta$. In contrast to Batabyal and Yoo (2019), we suppose that the distribution of the creative class population can be described by an inverted triangular probability distribution function on the closed interval $[0, 1]$. (See Cui (2018, pp. 38-39) for additional details on the inverted triangular probability distribution function). Given the policy choice of each city, each creative class member selects the city with the policy that is closer to his most preferred policy. Finally, the equilibrium of interest to us has two aspects to it. First, no city wishes to change its policy given the policy of the other city. Second, no creative class member wishes to move given the policy choices of the two cities. With this description of our aggregate economy of two cities out of the way, our next task is to analyze the welfare of the worst-off individual in the creative class in the case where one city switches from a utilitarian to a Rawlsian policy regardless of the objective of the other city.

3. Move from a Utilitarian to a Rawlsian Policy

3.1. Utilitarian policies

Each city selects its policy in accordance with a utilitarian criterion. Specifically, this means that city A (B) maximizes the *sum* of the utilities of the creative class members who live in city A (B). Now, using the symmetry of the distribution of the preferences of the creative class members and the symmetry of the city objective function, we infer that in the equilibrium, the creative class population will be equally divided between cities A and B.

The optimal policy choice of the utilitarian city A is given by solving

$$max_{z_A} \int_0^{1/2} -(\zeta - z_A)^2 f(\zeta) d\zeta. \qquad (2)$$

where $f(\cdot)$ is the density function. The inverted triangular probability distribution function is given by

$$f(\zeta) = \begin{cases} 2 - 4\zeta, & 0 \leq \zeta \leq 1/2 \\ 4\zeta - 2, & 1/2 < \zeta \leq 1 \end{cases}. \qquad (3)$$

Using equation (3) we can simplify city $A's$ objective function given in equation (2). This gives us

$$U(z_A) = \int_0^{1/2} -(\zeta - z_A)^2(2 - 4\zeta)d\zeta. \quad (4)$$

Integrating the right-hand-side (RHS) of equation (4), we can rewrite city $A's$ objective function as

$$U(z_A) = 2z_A^2 - \frac{2z_A}{3} + \frac{1}{3}. \quad (5)$$

Differentiating equation (5) with respect to z_A and then simplifying the resulting expression gives us the utilitarian solution for city A. We get

$$\frac{dU(z_A)}{dz_A} = 4z_A - \frac{2}{3} = 0 \Rightarrow z_A = \frac{1}{6}. \quad (6)$$

Now, by symmetry, the utilitarian solution for city B is

$$z_B = \frac{5}{6}. \quad (7)$$

We now proceed to address the case in which the two cities adopt Rawlsian policies.

3.2. Rawlsian policies

When city A (B) adopts a Rawlsian policy, it maximizes the *minimum* utility of the creative class members who are resident in city A (B). Straightforward computations show that in this case, the analysis is unchanged from the analysis conducted by Batabyal and Yoo (2019). In other words, the actual policy choice of city A is $z_A = 1/4$ and that of city B is $z_B = 3/4$. In addition, the creative class population is equally divided between the two cities.

Note that in the Rawlsian case, the two cities choose policies that are at the *midpoint* of the preferences of the creative class members who choose to live in these two cities. As shown in figure 1, this gives us the numerical policy choices of $z_A = 1/4$, $z_B = 3/4$, and the letter "R" denotes Rawlsian. In contrast, when the two cities pursue utilitarian policies, they choose policies that are at the *center of*

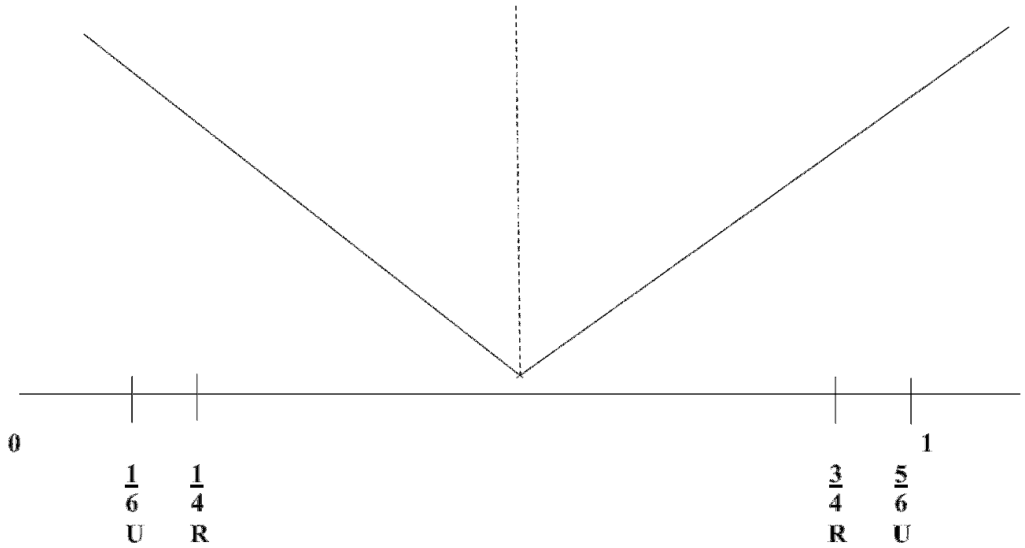

Figure 1: Rawlsian and utilitarian policy choices

gravity of the preferences of the creative class members who live in these same two cities. Figure 1 shows that this gives us the numerical policy choices of $z_A = 1/6$, $z_B = 5/6$, and

the letter "U" denotes utilitarian. Note that because we have chosen to delineate the distribution of the creative class population with the inverted triangular probability distribution function, the distance between the optimal policy choices in the utilitarian case $(5/6 - 1/6 = 2/3)$ is *bigger* than the corresponding distance in the Rawlsian case $(3/4 - 1/4 = 1/2)$. Let us now proceed to analyze the case where one city switches from a utilitarian to a Rawlsian policy regardless of the policy objective of the other city.

3.3. The switch

Without loss of generality, suppose that city A uses a Rawlsian policy and that city B pursues a utilitarian policy. We now make two claims. First, $z = 0.56$ represents the creative class member who is indifferent between living in the two cities. Second, city $A's$ Rawlsian policy involves choosing $z_A = 0.28$ and city $B's$ utilitarian policy involves selecting $z_B = 0.84$.

To demonstrate the validity of the two claims in the preceding paragraph, let us begin by using z to denote the creative class member who is indifferent between living in either the Rawlsian city A or the utilitarian city B. Then we know that city A will choose its policy to *minimize* the distance for its worst-off creative class member. This means that city $A's$ policy choice will be $z/2$.

Moving on to city B, this utilitarian city will select a policy that is at the center of gravity of the closed interval $[z, 1]$. Note that because we are modeling the creative class population distribution in our aggregate economy with the inverted triangular distribution, this center of gravity will always be closer to 1 than to z. In other words, the use of the inverted triangular distribution function means that more of the creative class population is closer to 1 than to z. Now, the equilibrium policy choice of the utilitarian city B will be $3z/2$ because we need the indifferent creative class member denoted by z to be *equidistant* from the two policy choices of $z/2$ and $3z/2$. This constraint and the utilitarian objective function given in equation (1) together tell us that the solution we seek is $z_A = 0.28, z_B = 0.84$, and the creative class member who is indifferent between living in the two cities is denoted by $z = 0.56$. This solution is illustrated in figure 2.

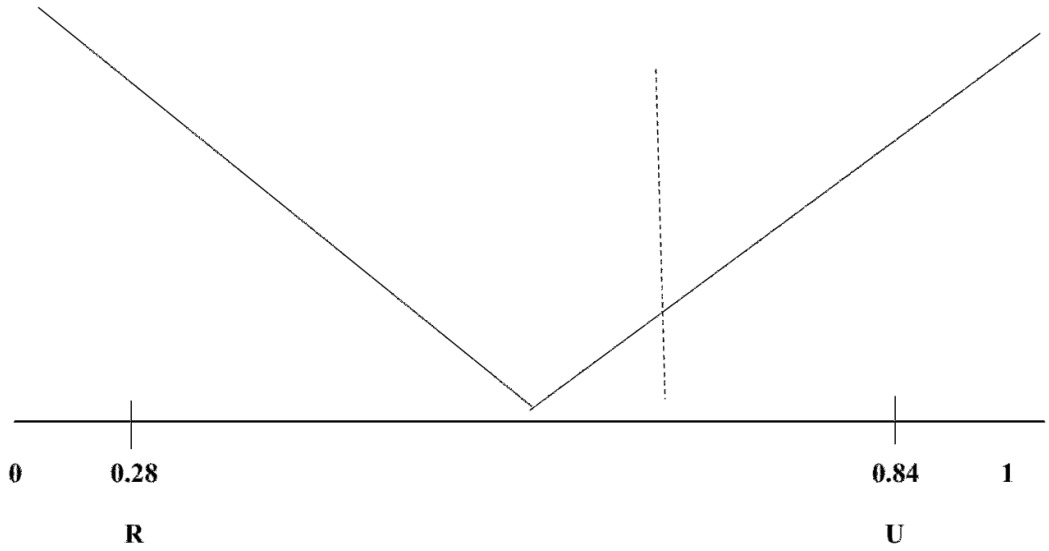

Figure 2: Policy choice leading to a more egalitarian aggregate economy

Our analysis thus far allows us to draw four conclusions. First, compared to the triangular distribution function utilized by Batabyal and Yoo (2019), the use of the inverted triangular

distribution function results in the shifting of the policy choices to the extremes of the distribution when the two cities are utilitarian. Second, this division in the two policy choices arises because of a shift in the center of gravity which is now closer to the extremes of the distribution than to its center. This shifting of the center of gravity results from the fact that more of the creative class population is now close to either 0 or 1 than to $1/2$. Third, with the inverted triangular distribution, the maximum distance of any creative class member from his preferred policy choice is 0.33 $(1/2-1/6\ or\ 5/6-1/2)$ in the pure utilitarian case, 0.28 $(0.56-0.28\ or\ 0.84-0.56)$ in the part-Rawlsian part-utilitarian case, and 0.25 $((1/2-1/4\ or\ 3/4-1/2)$ in the pure Rawlsian case. Finally, the preceding three conclusions together tell us that when we use the inverted triangular distribution and not the triangular distribution to model the distribution of the creative class population, the switch of one city to a Rawlsian or more egalitarian objective *always* enhances the utility of the worst-off member of the creative class irrespective of the objective of the other city. This completes our analysis of a probabilistic model of competition between two cities for members of the creative class.

4. Conclusions

In this paper we extended the recent work of Batabyal and Yoo (2019) who studied the competition between two cities to attract the creative class using utilitarian and Rawlsian policies. These researchers showed that if one city switched to a Rawlsian or more egalitarian objective when the other city remained utilitarian, the aggregate economy of two cities became less egalitarian. We first pointed out that this result depended fundamentally on the assumption that the creative class population can be effectively described by a triangular probability distribution function. Next, we showed that if this population is modeled instead with an inverted triangular probability distribution then the above result is reversed in the sense that the welfare of the worst-off member of the creative class is always enhanced when one city switches to a Rawlsian or more egalitarian objective, no matter what the objective of the other city.

The analysis in this paper can be extended in a number of different directions. In what follows, we suggest two possible extensions. First, it would be useful to model the interaction between the creative class and the two cities as a cooperative game in which the two cities cooperate among themselves in one or more ways when they seek to attract members of the creative class to their respective cities. Second, it would also be instructive to embed the aggregate economy of two cities analyzed here in a dynamic environment in which it is possible for one or both cities to switch between utilitarian and Rawlsian policies over time. Studies that examine these facets of the underlying problem will provide further insights into the roles that members of the creative class can play in expanding the economic well-being of cities.

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THE URBAN STRUCTURE OF SPAIN AND ITALY (1900-2011)

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Abstract
Our main purpose is to study the evolution of the urban structure of Spanish and Italian municipalities from 1900 to 2010. We use the estimation of the Pareto exponents to show that the most important behavior is the increase of inequality in the distribution over time. Convergence is more likely in Italy and for larger urban units.

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Keywords: urban evolution, Spain, Italy, Pareto exponent
JEL classification: R11, R12

1. Introduction

The study of the statistical distribution of a quantifiable phenomenon has a long tradition in many disciplines. It has been applied to the intensity of earthquakes, to the number of victims in armed conflicts (González-Val, 2016), to the flow of rivers, to the frequency with which musical notes appear in famous compositions (Zanette, 2006), to the magnitude of migratory movements (Clemente et al., 2011) and in what constitutes the most famous case, to the number of times different words are included in Joyce's Ulysses (Zipf, 1949).

This is an empirical work of Urban Economics. It aims to describe how the urban structure of all the Spanish and Italian municipalities has evolved during the period 1900 to 2010. In other words, the city size distribution of these countries is analyzed, trying to determine whether its temporal evolution has been convergent or divergent, that is, whether inequality has increased or not. The literature on city size distribution is vast; a non-exhaustive list of papers could be the following: Black and Henderson (2003), Ioannides and Overman (2004), Eeckhout (2004), Anderson and Ge (2005), Bosker et al. (2008ª), González-Val (2011), Berry and Okulicz-Kozaryn (2012), Ioannides and Skouras (2013), Luckstead and Devadoss (2014), Soo (2014), González-Val et al. (2015), Berliant and Watanabe (2015) and Fang et al. (2017).

Why is it interesting to analyze the size distribution of urban units? Following Malevergne et al. (2011), three main reasons can be proposed. One, the study of the shape of the distribution is potentially very informative to know the underlying growth-generating process of the population and, therefore, to predict its future evolution. Two, the distribution and its characteristics (unimodal or not, asymmetric or not, more or less platykurtic) have important socio-economic consequences which affect the welfare of many citizens in the real world. And three, the upper tail is, by definition, quantitatively very relevant in terms of population.

We have had to make several decisions. First, the study of city size distribution should be a long-term one (Parr, 1985, Gabaix and Ioannides, 2004); consequently, we have considered the longest period that the availability of online data has allowed, that is to say, the twelve population census for both countries from 1900 (1901 for Italy) to 2010 (2011 for Italy). Second, it is well known (Eeckhout, 2004, González-Val et al., 2013) that the results are sensitive to the number of urban units considered; hence, for each year, we have performed the analysis for twenty-one different sample sizes. Third, we have used all the population entities, even the smallest ones. Eeckhout (2004) proved that limiting the analysis to the H larger urban units introduces biases in the results; moreover, the election of H is arbitrary. In

this context, settlements with (very) few inhabitants are not important in terms of population share, but are relevant with regards to the number of municipalities.

Fourth, why more than one country? The consideration of two is, by definition, more complete and more informative and raises the possibility of detecting common or mixed behaviors between the two nations. Why precisely these two? There are three main reasons. One, because the temporal period considered is exactly the same for both countries. Two, because the number of urban units in Spain and Italy is very similar and practically time-invariant, which simplifies the analysis. And three, because the Spanish and Italian urban structures have seldom been analyzed (see Section 5), unlike, for example, those of China and the USA.

The main results, in a nutshell, are the following. In both countries, although more intensely in Spain, the inequality within the distribution has increased from 1900 to 2010. It is true that there have been convergence episodes in which the distributions have experienced a trend towards a greater equality, but they have been very limited in time and restricted to intermediate and large urban units.

The rest of the paper is structured as follows. Section 2 describes the methodology and Section 3 the data. Results are reported in Section 4, while Section 5 is devoted to a discussion of the results and to comparing them with others in the literature. The conclusions close the paper.

2. Methodology

2.1. The Pareto distribution and Zipf's Law

One of the most frequently used functions to describe city size distributions is the Pareto (1896) density, especially for the larger urban units (upper tail). A quantifiable phenomenon follows a Pareto distribution (or a power law) as long as it verifies:

$$P(Size > S_R) = \frac{a}{S_R^{\ b}} \tag{1}$$

where a is a positive constant, S_R is the population or size of the city of rank R (for Spain, R=1 for Madrid, R=2 for Barcelona and so forth, until R=N for the smallest city) and b is the so called Pareto exponent. We also have, empirically:

$$P(Size > S_R) = \frac{R}{N} \tag{2}$$

Equalizing (1) and (2):

$$RS_R^b = aN \tag{3}$$

When b=1, a particular case of (1), known as Zipf's law, is obtained. If this law is fulfilled, the city with rank k will have a population (1/k) times the population of the largest city of the urban system. Taking logarithms in (3):

$$\ln(R) = C - b\ln(S_R), \qquad C = \ln(aN) = const \tag{4}$$

An equation like (4) defines a negative and lineal relationship between the log of the rank and the log of the size in such a way that $\hat{b}$ is always positive (a lower rank is associated with a larger population). The estimated parameter $\hat{b}$ is a measure of the degree of inequality within the distribution: the larger the Pareto exponent, the more equal the distribution and vice versa. If $\hat{b} \to \infty$ the relationship between lnR and $\ln S_R$ is a vertical line and represents the case where all urban units have the same population.

Following Gabaix and Ibragimov (2011), the equation finally estimated by ordinary least squares is:

$$\ln(R - \frac{1}{2}) = const - b\ln S_R \tag{5}$$

And the correct asymptotically standard error is computed as $(2/N)^{1/2}b$.

2.2. Non linear models: Specifications of Rosen and Resnick (1980) and Fan and Casetti (1994)

A Pareto distribution implies that the Zipf plot, which relates lnR to $\ln S_R$, is linear. However, it is easy to find nonlinear Zipf plots (see Figures 3 and 4 in this paper). A generalization of (4) which contemplates this possibility can be found in Rosen and Resnick (1980):

$$\ln R = const + c \ln S_R + g(\ln S_R)^2 \quad (6)$$

The key parameter is now g, so the Zipf plot will be concave (convex) as long as g is negative (positive). Another interesting extension of (4) is based on Fan and Casetti (1994), who define what they call the 'extended rank-size rule'. Here, the Pareto exponent depends on the size:

$$-b = h + mS_R \quad (7)$$

Where h and m are parameters. Introducing (7) into (4), the equation finally estimated is given by:

$$\ln R = const + h \ln S_R + mS_R \ln S_R \quad (8)$$

The key parameter is now m. –b will always be negative but, if m is positive, an increase in the city size will make the absolute value smaller, increasing inequality.

On the contrary, if m is negative, inequality decreases as city size grows.

3. Data

The geographical unit of reference for both countries is administratively the same, municipalities for the case of Spain and communes for Italy. This allows the direct comparison of outcomes, as they correspond to the smallest spatial units, the local governments of the lowest rank. For each year, all the urban units are considered and, therefore, 100% of the territory and 100% of the population of each country is analyzed. We will refer to these unit as urban units.

Population data have been taken from the official census: Istituto Nazionale di Statistica, www.istat.it, for Italy and Instituto Nacional de Estadística, www.ine.es, for Spain. Twelve census have been used, all those carried out from 1900 (or 1901), the first available online, to the last one, 2010 (or 2011). Table 1 summarizes the basic features of the data base.

From the contents of Table 1, several comments can be made. Firstly, the sample sizes are almost time-invariant and very similar, around 8000 urban units; the largest difference between consecutive census occurs in Italy between 1911 and 1921: after the First World War, 389 municipalities in Trentino Alto passed from Austria to Italy. Secondly, the average city size in both countries increases over time and the Italian figure is always superior to the Spanish one. Thirdly, the smallest nucleus tends, in general, to decrease from 1900 to 2010, reaching one-digit figures in Spain. Finally, the biggest urban units are always Madrid and Rome.

Table 1. Basic features of the data base (N: number of urban units; Max.: population of the largest nucleus; Min.: population of the smallest nucleus; Average: average population of all the urban units)

SPAIN					ITALY				
Year	**N**	**Max.**	**Min.**	**Average**	**Year**	**N**	**Max.**	**Min.**	**Average**
1900	7800	539835	78	2282	**1901**	7711	621213	56	4275
1910	7806	599807	92	2452	**1911**	7711	751211	58	4648

SPAIN					ITALY				
Year	**N**	**Max.**	**Min.**	**Average**	**Year**	**N**	**Max.**	**Min.**	**Average**
1920	7812	750896	82	2622	**1921**	8100	859629	58	4864
1930	7875	1005565	79	2892	**1931**	8100	960660	93	5067
1940	7896	1088647	11	3181	**1936**	8100	1150338	116	5234
1950	7901	1618435	64	3480	**1951**	8100	1651393	74	5866
1960	7910	2259931	51	3802	**1961**	8100	2187682	90	6250
1970	7956	3146071	10	4241	**1971**	8100	2781385	51	6684
1981	8034	3188297	5	4702	**1981**	8100	2839638	32	6982
1991	8077	3084673	2	4882	**1991**	8100	2775250	31	7010
2001	8077	2938723	7	5039	**2001**	8100	2546804	33	7021
2010	8114	3273049	5	5795	**2011**	8094	2761477	34	7490

4. Results

4.1. A first descriptive analysis

Figures 1 and 2 show, for Spain and Italy, respectively, adaptive Epanechnikov kernels with a bandwidth of 0.5 (see Silverman, 1986, for details) for three representative years.

From Figures 1 and 2, it can be deduced that inequality has increased in both countries, especially in Spain. In Spain, in 1900, most of the population is located in intermediate sized urban units. In 2010, the changes are remarkable: the distribution is now more platykurtic and right-skewed and both tails are thicker (the bigger urban units are bigger in 2010 than in 1900 and the smaller urban units are smaller in 2010 than in 1900).

In Italy, the three distributions are symmetric and have the same average but become more platykurtic from 1901 to 2011. Both tails are somewhat thicker in 2010, so inequality has increased, although less in Italy than in Spain.

Image 1. Kernels for Spain 1900, 1960 and 2010. Population size of each nucleus on the horizontal axis in log scale

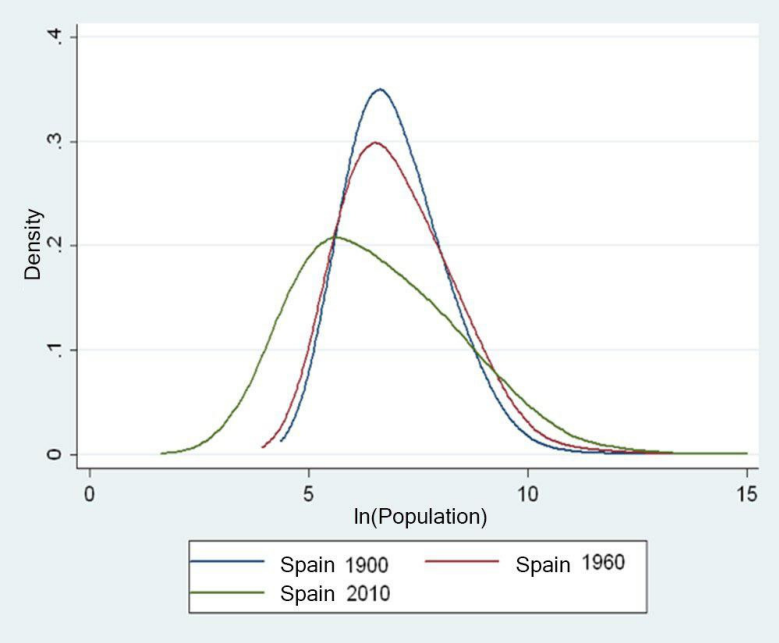
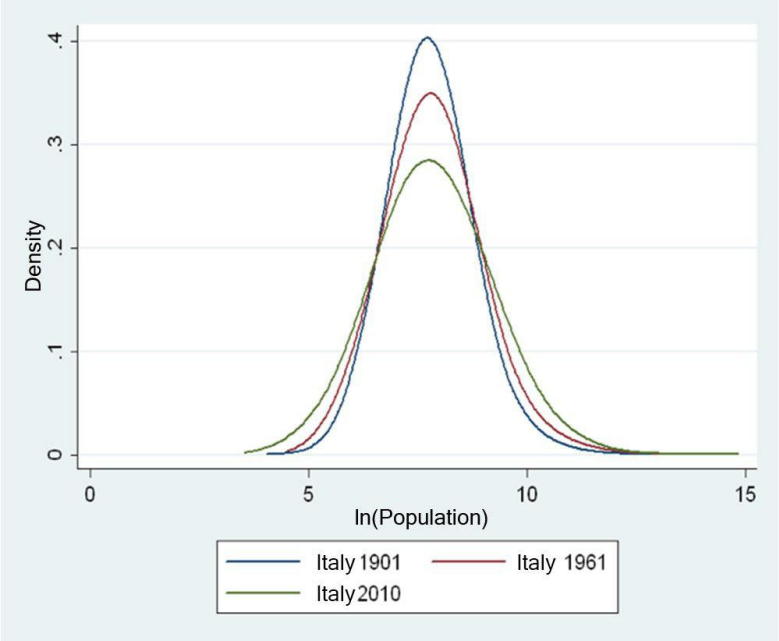


Image 2. Kernels for Italy 1901, 1961 and 2011. Population size of each nucleus on the horizontal axis in log scale



4.2. The estimated Pareto exponents

Table 2 (3) shows the $\hat{b}$ values obtained by estimating (5) with ordinary least squares for Spain (Italy). For each year, we consider 21 sample sizes, beginning with the largest 50 urban units and ending with the whole sample. The results, as expected, depend strongly on the sample size. In both tables, all the estimated Pareto exponents are statistically significant at 1%. The last two rows show the minimum and the maximum R^2 of each year: the smallest value in both tables explains 85.15% of the variation of the dependent variable and the largest practically explains 100%. In both tables, the maximum $\hat{b}$ of each column (minimum $\hat{b}$ of each row) is highlighted in green (yellow).

First, we can analyze the relationship between the Pareto exponent and the sample size. Eeckhout (2004) demonstrates that, under certain theoretical conditions, $\frac{d\hat{b}}{dN} < 0$ by construction. In other words, as the number of municipalities increases, inequality also increases. Do the estimations for Spain confirm Eeckhout's result? No, but almost. From 1900 to 1960 the relationship between $\hat{b}$ and N (see the columns of Table 2) has, in general, an inverted U-shape, in such a way that the Pareto exponent is maximum for N=600 in 1900 and 1910, for N=800 in 1920, 1930, 1940 and 1960 and for N=1000 in 1950. Consequently, until this maximum is reached, $\frac{d\hat{b}}{dN} > 0$. They almost confirm Eeckhout's result because the predominant behavior in Table 2 is $\frac{d\hat{b}}{dN} < 0$ after 1970 and with N=50 or greater.

The case of Italy (Table 3) is similar to that of Spain, but now the inverted U-shape is even more predominant as it happens in all years. A second topic to be analyze is the evolution of the estimated Pareto exponent by rows (that is, over time). There are two different behaviors. On the one hand, the relationship between the Pareto exponent and time has an U-shape for certain sample sizes: Spain for N=50 with the minimum in 1930, for N=100 and N=200 with the minimum in 1970, for N=400 and N=600 with the minimum in 1981 and for N=800, N=1000 and N=1500 with the minimum in 1991; Italy for N=50, N=100, N=200 and N=400 with the minimum in 1961, for the five sample sizes between N=600 and N=2000 with the minimum in 1971, for N=2500 and N=3000 with the minimum in 1981 and, finally, for N=3500 with the minimum in 1991. In all these cases, the decreasing (increasing) part of the U is associated with a divergent (convergent) evolution in those years. On the other hand, for N equal to or larger than 2000 in Spain and equal to or larger than 4000 in Italy, $\frac{d\hat{b}}{dt} < 0$ always, inequality always increases over time.

The main result of this temporal analysis lies in the fact that the predominant behavior in both countries is that inequality, in general, increases from 1900 to 2010. This happens for 13 sample sizes (out of 21) in Spain and for 9 in Italy.

Finally, both from the analysis by columns (N varies and t is fixed) and by rows (N is fixed and t varies) of Tables 2 and 3, it can be deduced that convergence is easier to find in Italy than in Spain.

The important question now is the following: is there more equality in Spain or in Italy? The answer can be found in Table 4 in which we compute the Spanish $\hat{b}$ minus the Italian $\hat{b}$, both in the same location in Tables 2 and 3 (the same N and practically the same year). A negative result, in green letters in the table, indicates a more equal distribution in Italy. The result is very conclusive: of 252 cells, the Spanish distribution only shows more equality in 37. These cases are found for N=50 and for sample sizes equal to or smaller than 1000 from 1900 to 1930.

The green numbers tend to be, in absolute value, larger than the black ones, that is, when the Spanish distribution is more equal, it is by a smaller margin than when the Italian distribution presents more equality.

Table 2. Estimated values of the Pareto exponent for Spain. Twenty one different sample sizes for each year (1900 to 2010)

N	1900	1910	1920	1930	1940	1950	1960	1970	1981	1991	2001	2010
50	1.3013	1.3185	1.3014	1.2637	1.2785	1.2655	1.265	1.2775	1.4053	1.4614	1.4988	1.5174
100	1.4001	1.3881	1.352	1.3138	1.2732	1.236	1.1981	1.1942	1.2426	1.288	1.33	1.4069
200	1.4871	1.4698	1.4221	1.3723	1.3039	1.2269	1.1802	1.1217	1.1226	1.1583	1.2241	1.2853
400	1.5601	1.5433	1.4847	1.4229	1.34	1.2681	1.2129	1.1363	1.0972	1.1096	1.1645	1.2115
600	1.5957	1.5709	1.514	1.4562	1.369	1.3097	1.2494	1.1601	1.0973	1.1009	1.1469	1.1798
800	1.5912	1.5665	1.5175	1.4666	1.381	1.3285	1.2745	1.1693	1.0862	1.0801	1.1178	1.1399
1000	1.5819	1.5606	1.5079	1.4635	1.3784	1.331	1.2739	1.1598	1.0711	1.0572	1.0809	1.0992
1500	1.534	1.5134	1.464	1.4289	1.3543	1.3185	1.2621	1.1343	1.0377	1.0107	1.021	1.0219
2000	1.4688	1.454	1.413	1.3844	1.3151	1.2874	1.2262	1.1014	0.9996	0.964	0.9604	0.955
2500	1.3997	1.3871	1.3559	1.3305	1.2662	1.2417	1.1812	1.0649	0.9645	0.9261	0.9146	0.9001
3000	1.3408	1.3267	1.2973	1.2714	1.2141	1.1947	1.1361	1.02	0.9264	0.8868	0.8727	0.8493
3500	1.2868	1.2707	1.2438	1.2177	1.1671	1.1513	1.0924	0.9787	0.8888	0.8499	0.8312	0.8045
4000	1.2371	1.2207	1.1958	1.1705	1.1222	1.107	1.0498	0.9434	0.8539	0.8137	0.7923	0.7638
4500	1.1956	1.179	1.1528	1.1264	1.0821	1.0672	1.0097	0.9074	0.8214	0.7802	0.7575	0.7275
5000	1.1571	1.1394	1.1124	1.0844	1.0438	1.0284	0.9721	0.8745	0.7912	0.7494	0.7258	0.6951
5500	1.1176	1.1001	1.0738	1.045	1.0077	0.9918	0.9369	0.8445	0.7629	0.7207	0.6968	0.6654
6000	1.0777	1.0612	1.036	1.0076	0.9743	0.9574	0.9042	0.8147	0.7358	0.6939	0.6701	0.6378
6500	1.0398	1.0238	0.9981	0.9709	0.9403	0.9238	0.8728	0.7843	0.7075	0.6672	0.6444	0.6121
7000	1.0002	0.9841	0.9588	0.9338	0.9062	0.8892	0.8402	0.7526	0.6786	0.6401	0.6186	0.5871
7500	0.9503	0.9359	0.912	0.8898	0.8655	0.8492	0.8025	0.7165	0.6456	0.6099	0.5912	0.5609
All	0.8994	0.8857	0.8632	0.8357	0.8089	0.7953	0.7515	0.6592	0.5824	0.5512	0.5394	0.5105
R^2 mín.	0.9193	0.9192	0.9192	0.9172	0.9196	0.9206	0.9197	0.9092	0.8892	0.8988	0.901	0.8941
R^2 máx.	0.9955	0.9962	0.9965	0.9966	0.9977	0.9971	0.9966	0.9968	0.9955	0.9935	0.9931	0.992

Table 3. Estimated values of the Pareto exponent for Italy. Twenty one different sample sizes for each year (1901 to 2011)

N	1901	1911	1921	1931	1936	1951	1961	1971	1981	1991	2001	2011
50	1.3091	1.2658	1.2224	1.1829	1.1585	1.1453	1.1315	1.1658	1.1984	1.241	1.2751	1.3043
100	1.3948	1.3413	1.297	1.2725	1.2464	1.2409	1.213	1.231	1.2686	1.316	1.3576	1.3787
200	1.4543	1.4137	1.3591	1.328	1.3104	1.3041	1.2597	1.2748	1.3203	1.3841	1.4317	1.4568
400	1.4953	1.4575	1.4066	1.3868	1.3652	1.3363	1.2886	1.2988	1.3459	1.4077	1.4577	1.4801
600	1.5195	1.4841	1.4258	1.407	1.3878	1.3538	1.2958	1.2838	1.3171	1.3766	1.4235	1.4512
800	1.5316	1.5026	1.45	1.433	1.4128	1.372	1.3025	1.2683	1.3002	1.3512	1.3943	1.4241
1000	1.5414	1.5134	1.4587	1.4429	1.4257	1.3809	1.3058	1.2613	1.2925	1.3349	1.3756	1.4064
1500	1.5444	1.5209	1.4713	1.4554	1.4384	1.3906	1.3109	1.2521	1.27	1.3	1.3334	1.3634
2000	1.5477	1.5266	1.4823	1.4696	1.4526	1.4003	1.314	1.2448	1.2529	1.2753	1.3001	1.3217
2500	1.5473	1.5253	1.4827	1.4695	1.4535	1.4022	1.3119	1.2331	1.2326	1.2454	1.263	1.2747
3000	1.5404	1.515	1.4731	1.4588	1.4433	1.3952	1.305	1.2191	1.2086	1.2148	1.2238	1.2274
3500	1.5229	1.4993	1.4589	1.4366	1.4221	1.3767	1.2904	1.2016	1.1815	1.1808	1.1844	1.181
4000	1.4976	1.474	1.4361	1.4075	1.3935	1.3503	1.2689	1.1778	1.1503	1.1455	1.145	1.137
4500	1.4688	1.4445	1.4077	1.3781	1.3646	1.3211	1.2422	1.1503	1.1186	1.1101	1.1058	1.0935
5000	1.4351	1.4109	1.3766	1.3486	1.3335	1.2898	1.214	1.1202	1.0837	1.0718	1.0657	1.0505
5500	1.3942	1.3688	1.3412	1.3131	1.2962	1.2538	1.1818	1.0889	1.0493	1.0343	1.0257	1.0079
6000	1.3444	1.3183	1.299	1.2688	1.2523	1.2102	1.1442	1.0552	1.013	0.9951	0.9847	0.9649
6500	1.283	1.2578	1.2489	1.2174	1.2017	1.1603	1.1001	1.0155	0.9717	0.9516	0.9399	0.9184
7000	1.2101	1.1879	1.1913	1.1593	1.1424	1.1019	1.0476	0.9692	0.9243	0.903	0.8897	0.8675
7500	1.1113	1.0901	1.1226	1.0903	1.072	1.0319	0.9831	0.9117	0.8668	0.8439	0.83	0.8081
All	1.0269	1.0098	0.9782	0.948	0.9287	0.8926	0.8543	0.7942	0.7512	0.7249	0.7074	0.6867
R^2 mín.	0.8893	0.89	0.8924	0.8884	0.8845	0.8825	0.8892	0.8911	0.8806	0.8689	0.8594	0.8515
R^2 máx.	0.9985	0.9981	0.998	0.9976	0.9976	0.9984	0.999	0.9986	0.9976	0.9961	0.9958	0.9963

Table 4. Spanish $\hat{b}$ minus Italian $\hat{b}$. (In the table, the years correspond to Spain, practically the same as the Italian ones)

N	1900	1910	1920	1930	1940	1950	1960	1970	1981	1991	2001	2010
50	-0.0078	0.0527	0.079	0.0808	0.12	0.1202	0.1335	0.1117	0.2069	0.2204	0.2237	0.2131
100	0.0053	0.0468	0.055	0.0413	0.0268	-0.0049	-0.0149	-0.0368	-0.026	-0.028	-0.0276	0.0282
200	0.0328	0.0561	0.063	0.0443	-0.0065	-0.0772	-0.0795	-0.1531	-0.1977	-0.2258	-0.2076	-0.1715
400	0.0648	0.0858	0.0781	0.0361	-0.0252	-0.0682	-0.0757	-0.1625	-0.2487	-0.2981	-0.2932	-0.2686
600	0.0762	0.0868	0.0882	0.0492	-0.0188	-0.0441	-0.0464	-0.1237	-0.2198	-0.2757	-0.2766	-0.2714
800	0.0596	0.0639	0.0675	0.0336	-0.0318	-0.0435	-0.028	-0.099	-0.214	-0.2711	-0.2765	-0.2842
1000	0.0405	0.0472	0.0492	0.0206	-0.0473	-0.0499	-0.0319	-0.1015	-0.2214	-0.2777	-0.2947	-0.3072
1500	-0.0104	-0.0075	-0.0073	-0.0265	-0.0841	-0.0721	-0.0488	-0.1178	-0.2323	-0.2893	-0.3124	-0.3415
2000	-0.0789	-0.0726	-0.0693	-0.0852	-0.1375	-0.1129	-0.0878	-0.1434	-0.2533	-0.3113	-0.3397	-0.3667
2500	-0.1476	-0.1382	-0.1268	-0.139	-0.1873	-0.1605	-0.1307	-0.1682	-0.2681	-0.3193	-0.3484	-0.3746
3000	-0.1996	-0.1883	-0.1758	-0.1874	-0.2292	-0.2005	-0.1689	-0.1991	-0.2822	-0.328	-0.3511	-0.3781
3500	-0.2361	-0.2286	-0.2151	-0.2189	-0.255	-0.2254	-0.198	-0.2229	-0.2927	-0.3309	-0.3532	-0.3765
4000	-0.2605	-0.2533	-0.2403	-0.237	-0.2713	-0.2433	-0.2191	-0.2344	-0.2964	-0.3318	-0.3527	-0.3732
4500	-0.2732	-0.2655	-0.2549	-0.2517	-0.2825	-0.2539	-0.2325	-0.2429	-0.2972	-0.3299	-0.3483	-0.366
5000	-0.278	-0.2715	-0.2642	-0.2642	-0.2897	-0.2614	-0.2419	-0.2457	-0.2925	-0.3224	-0.3399	-0.3554
5500	-0.2766	-0.2687	-0.2674	-0.2681	-0.2885	-0.262	-0.2449	-0.2444	-0.2864	-0.3136	-0.3289	-0.3425
6000	-0.2667	-0.2571	-0.263	-0.2612	-0.278	-0.2528	-0.24	-0.2405	-0.2772	-0.3012	-0.3146	-0.3271
6500	-0.2432	-0.234	-0.2508	-0.2465	-0.2614	-0.2365	-0.2273	-0.2312	-0.2642	-0.2844	-0.2955	-0.3063
7000	-0.2099	-0.2038	-0.2325	-0.2255	-0.2362	-0.2127	-0.2074	-0.2166	-0.2457	-0.2629	-0.2711	-0.2804
7500	-0.161	-0.1542	-0.2106	-0.2005	-0.2065	-0.1827	-0.1806	-0.1952	-0.2212	-0.234	-0.2388	-0.2472
All	-0.1275	-0.1241	-0.115	-0.1123	-0.1198	-0.0973	-0.1028	-0.135	-0.1688	-0.1737	-0.168	-0.1762

Image 3. Zipf plots for Spain 1900, 1960 and 2010

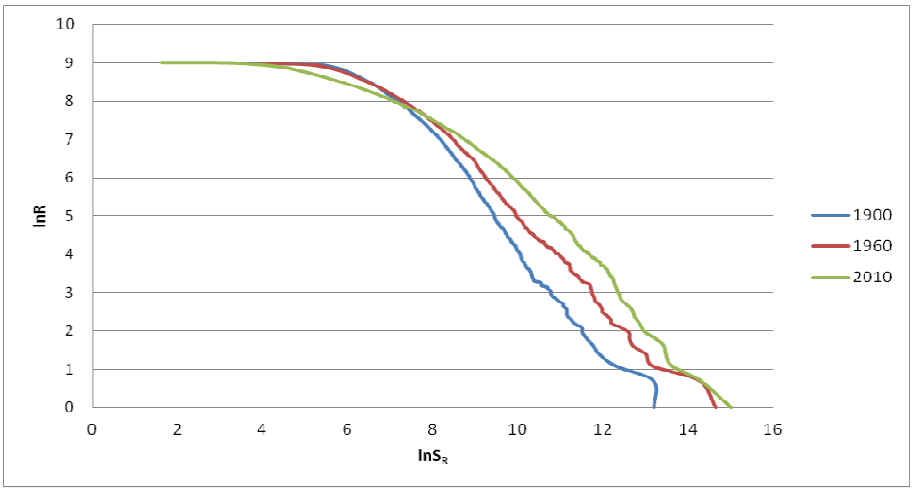
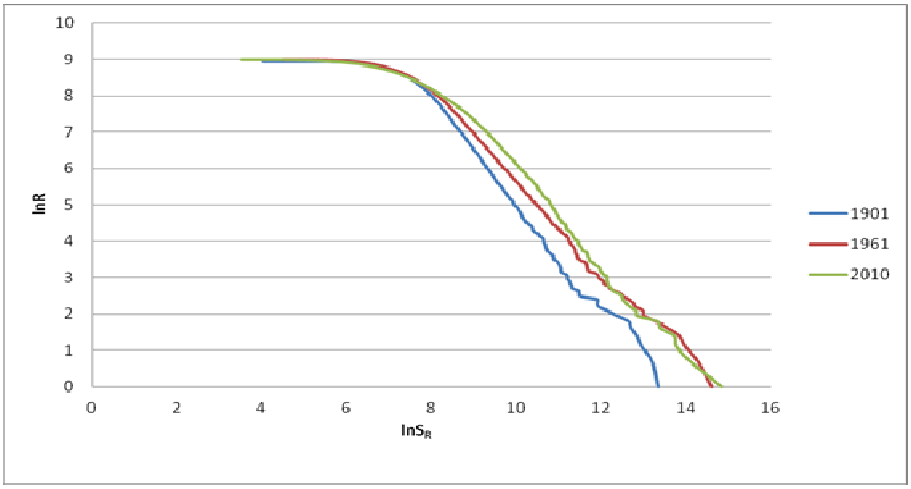


Image 4. Zipf plots for Italy 1901, 1961 and 2011



4.3. Beyond Pareto: The specifications of Rosen and Resnick (1980) and Fan and Casetti (1994)

In this subsection, we consider the whole sample. Figures 3 and 4 show the Zipf plots for, respectively, Spain 1900, 1960 and 2010, and Italy 1901, 1961 and 2011. In spite of the existence of some stretches in which the linear approximation is correct, there are others, especially in the tails, with clear curvatures, mainly concavities; therefore, it makes sense to estimate a specification like (6), proposed by Rosen and Resnick, which allows for curvatures in the Zipf plot. The maximum value on the horizontal axis, log of the size, is similar in both countries; this is not the case for the minimum value on that axis: it is significantly smaller in Spain, especially in 2010. Moreover, the expected behavior when Zipf plots of different years are shown in a single figure is that they do not touch each other and move to the right as time progresses. This is the case in Figures 3 and 4 with two important exceptions, namely, Spain in the lower tail and Italy in the upper tail.

Finally, Table 5 shows the estimated key parameters in the specifications of Rosen and Resnick (1980), according to (6), and Fan and Casetti (1994), according to (8). Both $\hat{g}$ and $\hat{m}$ are always significant at 1% and the R^2 is almost one. The estimated g is always negative for both countries, confirming something we deduced from the Zipf plots, that is, that they are essentially concave.

The sign of the estimated m is always negative for both countries. Consequently, inequality decreases with the size of the urban units in such a way that the main cause of the predominant evolution in time towards a greater inequality lies in the behavior of the intermediate and, especially, the small urban units. We had already deduced this outcome when analyzing Tables 2 and 3: the only evidence of a convergent evolution remains in the upper tail or the larger urban units; as the sample size increases, adding intermediate and small municipalities to the sample, divergence, or an increase in equality, **is** always found.

5. Discussion

We first want to compare our results regarding the Pareto exponents with those obtained in other works. We base this comparison on Nitsch (2005), who carries out a meta-analysis of all the estimations, until that date, of an equation like (4) with city data: 515 estimations in 29 different articles. His main results are the following: i) $0.49<\hat{b}<1.96$; in our paper, the Spanish estimated Pareto exponent belongs to the interval (0.5105; 1.5957) and the Italian to (0.6867; 1.5477); ii) Nitsch (2005) finds that the Pareto exponent tends to decrease as time goes by, something we confirm; iii) the average $\hat{b}$ in Nitsch (2005) is 1.09: our Spanish average $\hat{b}$ is 1.0888 and our Italian average is 1.2577.

The Spanish case has been analyzed in Lanaspa *et al*. (2003 and 2004) and in Le Gallo and Chasco (2008). The three papers use data from the whole of the twentieth century. They all conclude that the evolution of the Spanish urban structure has been divergent from 1900 to 1970-80 and convergent from then on. We arrive at the same results if we take into account the sample sizes of these papers and the content of our Table 2. In effect, Lanaspa *et al*. (2003) consider the 100 largest urban units of each year, Lanaspa *et al*. (2004) the largest 100, 300, 500 and 700 and LeGallo and Chasco (2008) the same 722 municipalities during the whole century. In turn, González-Val *et al*. (2014) use a data base very similar to ours to explore whether the evolution has been convergent or divergent using the test of the so called Gibrat's law, which establishes that the growth rate does not depend on the initial size. When comparison is possible, their results are reasonable coherent with our conclusions.

The Italian case has been analyzed from a historical perspective in Bosker *et al*. (2008b) and Percoco (2013). The former uses data from 1300 to 1861 of more than 500 Italian urban units to determine that the main explanatory factors of the growth of the population are geography and institutions; furthermore, they are able to detect shocks such as those associated with the great plagues. The latter carries out a similar analysis, even considering the same period.

What can we conclude from our results? Firstly, Eechout's (2004) conclusion that the Pareto exponent diminishes as the sample size increases is a theoretical proposition that can

be demonstrated. Our empirical results call into question its universal validity, although it constitutes the predominant behavior. Eeckhout's proposition is valid as long as the data generating process is lognormal; empirical evidence indicates that there are other distributions that clearly outperform the lognormal (Giesen *et al*., 2010, Kwong and Nadarajah, 2018), which may explain the lack of general validity of Eeckhout's proposition. Secondly, the analysis of the sensitivity of the results to the consideration of different sample sizes is a necessary and interesting step you have to take if you want to properly describe the urban structure of a country. Having said that, Gabaix and Ioannides (2004) prove that the true value of the Pareto exponent is obtained as $N \to \infty$ and, therefore, our best approximations are associated with the consideration of the whole sample, around 8000 urban units.

Table 5. $\hat{g}$ and $\hat{m}$ in the specifications of Rosen and Resnick (1980) and Fan and Casetti (1994)

Spain			Italy		
Year	**Estimated g**	**Estimated m**	**Year**	**Estimated g**	**Estimated m**
1900	-0.161	-8.22E-07	**1901**	-0.195	-6.71E-07
1910	-0.176	-7.45E-07	**1911**	-0.187	-5.01E-07
1920	-0.171	-5.70E-07	**1921**	-0.175	-4.18E-07
1930	-0.174	-3.89E-07	**1931**	-0.172	-3.60E-07
1940	-0.158	-3.57E-07	**1936**	-0.168	-3.06E-07
1950	-0.158	-2.37E-07	**1951**	-0.16	-1.72E-07
1960	-0.142	-1.69E-07	**1961**	-0.142	-1.75E-07
1970	-0.112	-1.40E-07	**1971**	-0.13	-1.55E-07
1981	-0.088	-1.71E-07	**1981**	-0.132	-1.79E-07
1991	-0.077	-1.94E-07	**1991**	-0.136	-2.11E-07
2001	-0.072	-2.20E-07	**2001**	-0.138	-2.53E-07
2010	-0.065	-2.13E-07	**2011**	-0.138	-2.46E-07

6. Conclusions

In this paper, the evolution of the urban structure from 1900 to 2010 of two Mediterranean countries, Spain and Italy, has been analysed, using the population of the smallest urban units available. All the municipalities have been considered so 100% of the territory and 100% of the population is analyzed.

The methodology is based on kernels and, especially, on the estimation of the Pareto exponent, which constitutes a measure of the degree of inequality within the distribution, for all the years and for different sample sizes. Finally, the empirical analysis is completed with the extensions of the rank size rule proposed by Rosen and Resnick (1980) and Fan and Casetti (1994). There are five main conclusions: One, the changes in the distribution in the period considered have been remarkable, especially in Spain. Two, in general, the predominant behavior, in time as well as for different sample sizes, has been an increase in inequality; in other words, the evolution can be defined as divergent. Three, Eeckhout's (2004) proposition, according to which adding more urban units to the analysis always makes inequality grow, is fulfilled in the majority of cases, but not in all. Four, there have been some episodes of convergence, especially in Italy and, for both countries, for the largest urban units. Five, the part of the distribution responsible for the divergent behavior is located in the lower tail, particularly in the Spanish case.

7. References

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ASSESSMENT AND MECHANISM OF REGULATING INTER-REGIONAL SOCIO-ECONOMIC DIFFERENTIATION (CASE STUDY OF THE RUSSIAN FEDERATION)

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Abstract

The existence of significant differences in the levels of socio-economic development of Russian regions and the need to determine state impact methods aimed at reducing inequality indicate the existence of territorial differentiation; this is the problem the article authors address. The paper proposes a methodological approach to the assessment of inter-regional differentiation, which helps solve a set of inter-related tasks on the basis of the data of state statistics and expert surveys. To assess the extent and size of territorial inequalities, the variation and Theil indices are used. The correlation and regression analysis discloses a trend to reduce differences among Russian regions in 2005-2017. On the basis of the author's method, the integral index (aggregating 22 private indicators) is calculated; on its basis, RF subjects are grouped according to a socio-economic development level. The complexity and scale of the differentiation problem is emphasized by the fact that at the end of 2017, 43 subjects belong to the groups with below average and low development levels. The work identifies "backward regions" (18) and "regions with a sign of depression" (13), which should become a priority object of the federal regional policy. The analysis proves the hypothesis about weak influence of the state policy tools of regional development in Russia on processes of territorial development and confirms reduction in the scale and consequences of differentiation. The authors propose a conceptual scheme of the mechanism to manage the process of reducing inter-regional differentiation and overcoming its consequences, which can be used when implementing the Strategy for Spatial Development of the Russian Federation and other strategic planning documents. The results can be used by federal authorities to improve methods and tools for implementing the state policy of regional development, as well as serve as the basis for further research on this topic.

Keywords: Russian Federation, region (RF subject), inter-regional differentiation, gross regional product, convergence.

JEL classification: R1, R5

1. Introduction

The country's economic space is characterized by significant heterogeneity, which is gradually increasing due to innovations introducing in all spheres of human activity. Differences in resources, opportunities and development conditions cause significant gaps in key socio-economic parameters of countries, regions (RF subjects) and municipalities. Differentiation of Russian regions is one of the highest among most world countries, while the level of differences in the socio-economic development among municipalities is higher than among RF subjects. An increase in uneven development leads not only to a rise in the number of problem areas that require special state support measures, but also to slowing down of development and "extinction" of entire settlements. Recognizing the existence of differentiation as an objective reality, it is necessary to assess its depth and scale, causes of the existing differences in the level of socio-economic development of territories in order to overcome excessive inequality and its negative consequences. The current mechanisms of

territorial development management are mainly focused on equalizing a level of budgetary provision of territories and do not take into account the specifics of their socio-economic development and potential. Hence, it is necessary to find such forms and methods of governance that would take into account features of territorial development (both at federal and regional levels) and prevent destructive phenomena and growing disunity of residents of a huge federal state.

The urgency of solving these problems in Russia is discussed at the federal level. Thus, in accordance with the Strategy for Spatial Development of the Russian Federation 2025 (approved by the Order of the RF Government as of February 13, 2019, No. 207-p), the objective of spatial development of the Russian Federation is to ensure sustainable and balanced spatial development of the Russian Federation, aimed at reducing inter-regional differences in the living standard and life quality of the population, accelerating economic growth and technological development, as well as ensuring the country's national security.

Similar goals and objectives to reduce inter-territorial differences are stated in many other world countries. It should be noted that the spatial development policy in the European Union is aimed at striving for a balanced and sustainable development of the EU territory. Three fundamental objectives of European policy should be equally achieved in all EU regions: 1) economic and social unity; 2) conservation and rational use of natural resources and cultural heritage; 3) more balanced competitiveness of the European territory [21].

The Territorial Agenda of the European Union 2020 stipulates that the challenges to territorial development require common attention and, where appropriate, joint efforts to address them and use territorial potential. This document identifies 6 territorial priorities for the EU that can contribute to successful implementation of the Europe 2020 strategy: 1) promoting polycentric and balanced territorial development; 2) encouraging integrated development in cities, rural areas and individual regions; 3) territorial integration in cross-border and transnational functional regions; 4) ensuring global competitiveness of regions on the basis of a strong local economy; 5) improving territorial relations between individuals, communities and enterprises; 6) management and connection of environmental, landscape and cultural values of regions [26].

Thus, the scientific and practical task to assess importance (depth and scale) of regional development differentiation and substantiate the mechanism aimed at reducing and overcoming its negative consequences is relevant.

2. Research methods

Russian and foreign scientists offer different methodological approaches to the assessment of territorial socio-economic differentiation.

The most common is the approach presented in works of A.G. Granberg [4], R.M. Mel'nikov [9], S.A. Suspitsyn [15], O.A. Polynev [14], I. Nikolaev [11], etc., which involves the use of certain statistical indicators to assess variation and then differentiation (indicator average value; variation range; variation coefficient; oscillation coefficient; asymmetry and kurtosis coefficients; share (in %) of each territory in the total value of the variation coefficient; Theil index).

Another widely used approach is based on the construction of various kinds of integrated ratings of RF subjects and municipalities[1]: investment attractiveness, level of socio-economic

[1] For example: Investment climate of regions – 2017 // Rating Agency "Expert RA". – Available at: https://raexpert.ru/ratings/regions/2017/att1; Results of the V annual rating of investment attractiveness of Russian regions // National Rating Agency. – Available at: http://www.ra-national.ru/sites/default/files/analitic_article/Инвестрегионы%202017.pdf; Abdrakhmanova I.G., Bakhtin P.D., Gokhberg L.M. Rating of innovative development of RF subjects. Issue 5; under editorship of L.M. Gokhberg. – Moscow: Higher School of Economics, 2017. – 260 p.; Rating of Regions (Methodological Approaches to the Comparative Assessment of Socio-Economic Development of the Russian Federation). – Moscow: Publishing house "State Scientific Institution "State Research Institute of System Analysis of the Accounts Chamber of the Russian Federation", 2009. 155 p.; Rating of socio-economic situation of RF subjects. Results of 2016 // RIA Rating. – Available at: http://vid1.rian.ru/ig/ratings/rating_regions_2017.pdf

development, innovation activity, government performance, etc. Its advantage is a clear character of the differences among territories according to various indicators and development areas, and thepossibility of identifying types (groups) of territories, where differentiated measures of state support should be applied.

Some scientists propose to assess the possibility of reducing inter-regional inequality by key socio-economic parameters in terms of establishing presence/absence of conditional and unconditional convergence [8; 19].

It should be noted that in the framework of the above approaches researchers solved various scientific and applied, often quite narrow, problems. Still we think it important to elaborate an integrated approach to the analysis and assessment of inter-regional differentiation, which will help use acquired results and conclusions for purposes of managing spatial development of the country. The content of the proposed approach is revealed in the following stages.

Stage 1. The depth and scale of differentiation is estimated on the basis of calculated dynamics of variation indicators selected for the analysis of indicators (in this article we will present results of calculating a variation coefficient, a ratio between maximum and minimum values of the index among RF subjects, and a Theil index). This will make it possible to assess the depth and scale of inter-regional differentiation at a certain point in time, as well as identify areas of socio-economic development, where differences in key parameters should be reduced in the first place. In this article the level and scale of Russian regions differentiation is studied on the basis of the indicator of gross regional product per capita.

Stage 2. Analysis of trends in inter-regional differentiation will show the possibility of reducing differences between regions both due to objective, natural conditions, and due to the impact of certain factors of state regulation.

Stage 3. Identification of groups (types) of regions (RF subjects) with similar indicators and features of socio-economic development will be the basis for implementing a differentiated approach to the provision of state support measures to RF subjects with different levels and characteristics of development.

Next, in the framework of the proposed approach we will consider the specifics of calculating individual indicators.

The Theil index was proposed in 1967 by the Dutch scientist Henri Theil to measure social inequality. Later it was interpreted for the purpose of assessing the extent of economic inequality, in particular in the work of R.M. Mel'nikov [9]. Calculation of this index is of particular relevance at the present time, as the coordination of management of spatial development of the country is currently being considered within the 12 macro-regions. However, strategic documents on macro-region development have not been adopted and management system has not been formed yet. Therefore, in this study 8 federal districts are considered as macro-regions.

The Theil index (TI) for each indicator is determined by the formula:

$$IT = \sum_{j=1}^{n} \frac{X_j}{X} \cdot \ln\left(\frac{X_j/P_j}{X/P}\right) = \sum_{j=1}^{n} \frac{X_j}{X} \cdot \ln\left(\frac{x_j}{x}\right), \qquad (1)$$

where X_j – absolute value of the indicator in the j-th territory; X – total value of the indicator for all territories; P_j – population in the j-th territory; P – total population; x_j – value of the indicator in the j-th territory per capita; x – average value of the indicator for all territories per capita; n – number of territories; $\ln(x_j/x)$ – natural logarithm of quotient of two numbers.

The Theil index is used to decompose the overall inter-regional inequality into 2 components that reflect inter-group (TI_{interg}; among groups of regions, selected according to any indicator) and intra-group (TI_{intrag}; among regions within each separate group) inequality:

$$IT = IT_{interg} + IT_{intrag}, \qquad (2)$$

where

$$IT_{interg} = \sum_{k=1}^{5} \frac{X_k}{X} \cdot \ln\left(\frac{X_k/P_k}{X/P}\right), \qquad (3)$$

$$IT_{intrag} = \sum_{k=1}^{5} \frac{X_k}{X} \cdot IT_k, \qquad (4)$$

$$IT_k = \sum_{j=1}^{J_k} \frac{X_{kj}}{X_k} \cdot \ln\left(\frac{X_{kj}/P_{kj}}{X_k/P_k}\right), \quad (5)$$

where X_{kj} – absolute value of the indicator of the j-territory for the k-th group; P_{kj} – population of the j-th territory for the k-th group; X_k – absolute value of the indicator for the k-th group; P_k – population of the k-th group; X – total value of the indicator for all territories; P – total value of the population.

In case of absolute inter-regional parity (equality of per capita values of indicators in all territories), IT has a minimum value, equal to zero. The greater inter-regional inequality degree, the greater IT.

In addition, it should be noted that climatic and territorial differences of regions cause significant differences in living conditions of the population and farming (rising costs). The value of a fixed set of goods and services calculated and published by the Federal State Statistics Service of the Russian Federation is an indicator that helps assess these differences in a general way. Therefore, most scientists note that to correctly compare regions in terms of gross regional product (including differentiation assessment), it is necessary to take into account inter-regional differences in the price level with the help of Formula 6:

$$GRP_{adji} = GRP_i \cdot \frac{S_{RF}}{S_i}, \quad (6)$$

where GRP_{adji} – gross regional product of the i-th region in the corresponding year, adjusted for the cost of a fixed set of goods and services (inter-regional differences in the price level); GRP_i – initial value of gross regional product in the i-th region; S_{RF} – average annual cost of a fixed set of consumer goods and services in Russia at the end of the year; S_i – average annual cost of a fixed set of consumer goods and services in the i-th region at the end of the year.

As mentioned above, it is more appropriate to study territorial inequality both with the help of statistical indicators and results of the analysis of the level of socio-economic development of territories and their subsequent typology. Determination of groups of territories, similar in certain parameters, is the basis for a differentiated approach to management of socio-economic development that takes into account specific features of territories and a degree of their inequality. Scientific literature presents various methods for assessing socio-economic development levels. They have shortcomings hindering their use at the regional level, such as presence of a large number of indicators, complexity of the mathematical apparatus of their processing, and use of techniques that significantly smooth out differences and fail to obtain adequate estimates.

We believe that the methodological approach, the key ideas of which are presented in [3], based on determination of an integral index of the level of socio-economic development of territories and their subsequent grouping on its basis, can overcome these disadvatages. In addition, the proposed method is universal in its own way, i.e. it can be used for any type of territory (regions or municipalities). The sequence of assessing a territorial development level is represented by the following algorithm:

The *first stage* involves the formation of blocks and a list of indicators that reflect various aspects of socio-economic development of territories (Table 1).

Table 1. Indicators that assess a level of socio-economic development of regions [3]

Block of indicators	Indicator	Type of indicator
R_1 Economy	1. Gross regional product per 1 resident, thousand rubles	+
	2. Depreciation of fixed assets, %	-
	3. Volume of investment in fixed capital per 1 resident, thousand rubles	+
	4. Innovative activity of organizations,%	+
	5. Specific weight of unprofitable organizations, %	-
	6. Retail trade turnover per 1 resident, thousand rubles	+
	7. Expenses of the consolidated budget of RF subjects per 1 resident, thousand rubles	+
R_2 Demography and healthcare	1. Total fertility rate, ‰	+
	2. Total mortality rate, ‰	-
	3. Total infant mortality rate, ‰	-
	4. Number of doctors per 10,000 population	+
	5. Number of hospital beds per 10,000 population	+
R_3 Living standard	1. Average monthly nominal accrued salary, rubles	+
	2. Share of population with monetary income below subsistence level, %	-
	3. Volume of paid services per 1 resident, thousand rubles	+
	4. Consumer price index, in % to the previous year	-
	5. Level of officially registered unemployment, %	-
R_4 Provision of public amenities	1. Total area of residential premises per 1 resident, m^2	+
	2. Share of housing equipped with water supply, %	+
	3. Percentage of dwellings equipped with the sewage system, %	+
	4. Share of housing equipped with central heating, %	+
	5. Commissioning of residential buildings per 1 resident, m^2	+

Note: (+) – direct indicator; (-) – reverse indicator.

At the *second stage* the indicators that make up block content are standardized relative to the national average values:

$$k_i = x_i / x_{avRF}, \quad (7)$$

$$k_i = x_{avRF} / x_i, \quad (8)$$

where k_i – standardized coefficient, calculated by Formula 7 for direct indicators[2] and by Formula 8 for reverse ones[3]; x_i – value of the i-th indicator in a RF subject; x_{avRF} – mean value of the i-th indicator in all RF regions.

On the basis of standardized indicators, a synthetic indicator for each block (R_j) is determined by the formula:

$$R_j = \left(\sum_{i=1}^{n} k_i \right) / n, \quad (9)$$

where n – number of indicators in the block.

At the *third stage*, an integral index of the socio-economic development level of a territory is calculated (I):

$$I = (R_1 + R_2 + R_3 + R_4)/4, \quad (10)$$

[2] The increase in values of direct indicators indicates positive development trends, improvement of the situation.

[3] The increase in the values of reverse indicators indicates deterioration of the situation, problems in development.

where R_1 – integral index for the block "Economy"; R_2 – integral index for the block "Demography and healthcare"; R_3 – integral index for the block "Standard of living"; R_4 – integral index for the block "Improvement".

The final (*fourth*) stage includes grouping of territories of RF subjects according to the level of socio-economic development, determined by the following interval estimates of the integral index I_{total}:

Level	Range I
High	$I \geq 1.15$
Above average	$1.05 \leq I < 1.15$
Average	$0.95 \leq I < 1.05$
Below average	$0.85 \leq I < 0.95$
Low	$I < 0.85$

The choice of 5 gradations of the development level involves a more detailed interpretation of results, especially at the municipal level, where, as already mentioned, the degree of differentiation is more significant.

When studying socio-economic differentiation of territories, it is important to determine the trajectory of regional growth, dynamics of the gap in parameters of socio-economic development and reduction opportunities. Russian and foreign researchers' works show that these issues are considered in the framework of the convergence theory [8; 19; 20].

There are two concepts of convergence. The first concept is the following: σ-convergence is observed when the variance (variation coefficient) of development indicators tends to decrease; the second concept (β-convergence) shows that when less developed territories have higher rates of economic growth than more developed ones, in the long term the levels of economic development of territories are equalized. In the framework of β-convergence, unconditional and conditional convergence is singled out. Unconditional β-convergence implies that all regions aspire to a single trajectory of proportional growth. Conditional β-convergence suggests that different regions have different trajectories of proportional growth, determined by specific regional development factors [8; 19].

Presence of unconditional β-convergence is estimated by the following formula:

$$\gamma = a + \beta Y0 + \varepsilon, \quad (11)$$

where γ – logarithm of the average growth rate of the Y indicator (e.g. GRP per capita, income per capita, etc.) for the period ($\gamma = [\ln Y - \ln Y0]/T$, where T –number of years; a and β – coefficients of the linear equation). The conclusion about convergence (divergence) is made according to a sign of the β coefficient. If $\beta<0$, we observe convergence for the variable under consideration; if $\beta>0$, – divergence (increase in the gap in indicators among regions). The rate of convergence (divergence) is determined by a value of the β coefficient and calculated by the formula [8]:

$$\lambda = -\mathrm{Ln}(1 + T\beta)/T \quad (12)$$

Another characteristic of the process of convergence (divergence) is the time to overcome half the distance separating region's economy from the trajectory of balanced state, calculated as follows [4]:

$$hl = \mathrm{Ln}(2)/\lambda \quad (13)$$

The model of conditional β-convergence studies dependence of the growth trajectory of regions not only in terms of an initial level of the indicator, but also additional factors (Z) (for example, level of budgetary support of regions) [8]:

$$y = a + \beta Y0 + Z\varphi + \varepsilon \quad (14)$$

Thus, the use of certain provisions of the convergence concept helps expand the approach used to study socio-economic differentiation of territories.

Domestic researchers, paying considerable attention to the study of spatial development, territorial differentiation in Russia, and elaboration of mechanisms to reduce its excessive level and overcome negative effects, are S.S. Artobolevskii, S.V. Baranov, A.G. Granberg, G.G. Gospodarchuk, S.V. Kuznetsov, B.L. Lavrovskii, G.M. Lappo, V.N. Leksin, R.M. Mel'nikov, P.A Minakir, V.P. Oreshin, A.O. Polynev, V.E. Rokhchin, V.I. Seliverstov, T.P. Skuf'ina, L.L. Smirnyagin, S.A. Suspitsyn, T.V. Uskova, A.N. Shvetsov, B.M. Shtul'berg, G.G. Fetisov and others. They have proposed various mechanisms and tools for regulating territorial differentiation, and attempted to justify differentiated measures of state support for

different types of territories. These issues have long been in focus of foreign scientists' attention [21; 22; 23; 24; 25; 26].

Thus, the methodological approach to the study of inter-regional differentiation presented in this article will help assess this problem and can become the basis for authorities when determining regulatory impacts.

3. Key results of the study

The results of testing the methodological approach to inter-regional differentiation assessment allow us to draw the following key conclusions.

1. In 2000-2010 the differences of all RF subjects in GRP per capita were growing(from 44 to 72 times), in 2011-2015 this trend changed its vector and inequality began to reduce (up to 48 times; tab. 2); however in 2016-2017 we again observed a slight increase in differences. At the same time, without taking into account 3 autonomous okrugs, significant reduction in differentiation is recorded – by 1.8 times (from 30.1 times in 2000 to 16.6 times in 2017). This fact is confirmed by variation coefficients dynamics.

Dynamics of the Theil index (Table 2) shows a slight decrease in intra-group and inter-group differentiation by 2004, with the exception of 2005, when there was a sharp increase, and a gradual decline by 2016, which reached the minimum values of the Theil index for 17 years. In addition, it can be noted that the structure of territorial inequality in terms of GRP per capita is dominated by intra-group inequality, which amounted to 65-75% of the total inequality in 2000-2017. This is due to the fact that each federal district has 1 or 2 subjects, which significantly exceed the rest in terms of GRP per capita: city of Moscow in the Central District, Nenets Autonomous Okrug – in the Northwestern, Tyumen Oblast and its two autonomous okrugs – in the Ural, Krasnoyarsk Krai – in the Siberian, Sakhalin Oblast and Chukotka AO – in the Far East.

Table 2. Indicators of differentiation of gross regional product per capita

Indicator	Type of data	2000	2008	2009	2010	2015	2016	2017
Ratio of maximum and minimum values for 85 RF subjects, times	Init.**	49.7	46.7	67.2	72.1	48.8	53.4	55.1
	Adj.**	42.3***	25.6	34.2	37.4	31.6	34.4	37.2
Ratio of maximum and minimum values for 82* RF subjects, times	Init.**	30.1	19.9	19.1	20.4	16.2	15.1	16.6
	Adj.**	27.3***	13.9	12.9	13.8	11.8	11.3	12.8
Variation coefficient in 85 RF subjects, %	Init.**	124.5	127.0	167.6	159.7	150.0	157.7	163.0
	Adj.**	88.1***	85.7	104.4	107.0	113.5	122.0	129.4
Variation coefficient for 82* RF subjects, %	Init.**	63.9	63.3	69.4	65.8	64.3	62.1	62.2
	Adj.**	47.7***	48.2	48.3	49.1	51.0	48.5	49.8
Theil index (IT) for 85 subjects	Init.**	0.275	0.263	0.234	0.230	0.208	0.206	0.220
	Adj.**	0.139***	0.149	0.130	0.132	0.127	0.125	0.138
Theil index (IT) for 82* subjects	Init.**	0.245	0.245	0.214	0.212	0.187	0.183	0.194
	Adj.**	0.129***	0.144	0.124	0.126	0.114	0.109	0.119

* Excluding autonomous okrugs within the Tyumen and Arkhangelsk oblasts (Khanty-Mansi, Yamalo-Nenets and Nenets Autonomous okrugs).

** Init. – calculations are carried out on the basis of initial statistical data on GRP volume in RF subjects;

Adj. – calculations are carried out on the basis of data on GRP volume adjusted for inter-regional differences in price level (by means of the indicator of cost of a fixed set of goods and services) in RF Russian Federation.

*** Data for 2002 are presented.

2. When calculating different β-convergence models, we find out that the most significant are those models that do not consider separately autonomous okrugs, which are part of the Arkhangelsk and Tyumen oblasts. The analysis of β-convergence presence in 2000-2005 and 2005-2016 (in 2017 there was an increase in inter-regional differences, so this year was not taken into account) shows that the concept of β-convergence is not confirmed in the first period and is proved in the second (Table 3), though with an insignificant level of the β coefficient reliability, as well as in the whole equation (this equation describes 16.9% of the indicator variation, which is higher than for the model as a whole for the 2000-2017 period).

Table 3. Assessment of the unconditional convergence model for GRP for 2005-2017, excluding autonomous okrugs within the Russian Federation

Variable	Coefficient	Standard error	t-statistics	p-value
Constant of linear equation	0.19011	0.015185	12.51965	2.99E-20
Logarithm of GRP for 2000	-0.0135	0.00341	-3.96018	0.000166
Determination coefficient				0.169
F-test	15.683	Significance of F		0.000165834

The rate of unconditional β-convergence (Formula 12) is estimated at 1.48% per year. At this rate of convergence, inter-regional differences in GRP per capita are reduced by 1.5 times for 27.3 years and by 2 times for 46.7 years.

Thus, the obtained results do not reject the hypothesis about absolute β-convergence for Russian regions from 2000 (2005) to 2016, but the rate of convergence was low. To estimate unconditional β-convergence, we used two controlling variables: a ratio of aggregate financial assistance from the federal budget to a RF subject's consolidated budget (grant income), average for the period (2005-2016), to GRP; a ratio of amount of budget investments in the region's economy, average for the period (2005-2016), to GRP.

The hypothesis about conditional convergence suggests that in such a regression the sign at the initial level of GRP per capita should be (as before) negative, and the sign at the controlling variable – positive, i.e. a larger volume of transfers or amount of budget's investment in a region lead to a faster growth of GRP per capita. The results of model evaluation with these controlling variables are presented in Table 4.

As can be seen from the presented estimates (Table 4), the coefficients of controlling variables in all cases have a positive sign, but low statistical significance.

Table 4. Estimation of the conditional convergence model (dependence of GRP per capita growth rates on the initial level of GRP with the inclusion of additional variables) for GRP for 2005-2016 excluding autonomous okrugs within the Russian Federation

Variable	Coefficient	Standard error	t-statistics	p-value
Constant of linear equation	0.173697	0.01811	9.591151	8.75E-15
Average annual share of inter-budgetary transfers in GRP	0.035467	0.019989	1.774304	0.079966
Logarithm of GRP for 2005	-0.01045	0.003859	-2.70878	0.008318
Determination coefficient				0.226
F-test	11.250	Significance of F		5.17271E-05
Variable	**Coefficient**	**Standard error**	**t-statistics**	**p-value**
Constant of linear equation	0.171655	0.01786	9.610986	8.02E-15
Average annual share of budget investments in GRP	0.11153	0.055372	2.014206	0.047481
Logarithm of GRP for 2005	-0.01051	0.003697	-2.84205	0.005735
Determination coefficient				0.234
F-test	11.814	Significance of F		3.35103E-05

The results prove that the hypothesis about both conditional and unconditional convergence can not really be rejected for Russian regions in the time interval of 2005-2017, and the federal regional economic policy affects reduction in inter-regional differentiation only slightly so far. Thus, positive signs in the controlling variables mean that the regions that received large transfers from the federal budget show relatively higher growth rates of GRP per capita.

Thus, the study of β-convergence presence in Russian regions development is successful. Differences between Russian subjects in terms of gross regional product have a weak tendency to decline since 2005 (a number of lagging regions in terms of GRP per capita have higher growth rates than developed regions), but if this trend continues, inter-regional differences will decrease 2-fold in no earlier than 47 years. Hence, it is advisable to strengthen the regulatory impact of federal regional economic policy, increase budget support, which, as the study indicates, will have a positive impact on reduction in inter-regional differences.

3. Grouping of Russian regions by the *socio-economic development* level are presented in Table 5.

Table 5. Grouping of Russian regions by the socio-economic development level at the end of 2017

Level of socio-economic development	Composition of RF subjects in the group by the development level
High	1. (3*) Nenets AO (2.633**); 2. (1) Yamalo-Nenets AO (2.269); 3. (16) Sakhalin Oblast (1.549); 4. (7) Chukotka AO (1.503); 5. (2) Khanty-Mansi AO – Yugra (1.472); - (4) Tyumen Oblast with AO (1.440); 6. (5) Moscow (1.394); 7. (8) Saint Petersburg (1.359); 8. (9) Magadan Oblast (1.318); 9. (6) Republic of Sakha (Yakutia) (1.244); 10. (39) Leningrad Oblast (1.206); 11. (18) Moscow Oblast (1.202); 12. (11) Republic of Tatarstan (1.176); 13. (-) Tyumen Oblast without AO (1.171); 14. (10) Kamchatka Krai (1.169); 15. (21) Lipetsk Oblast (1.161)
Above average	16. (-***)Sevastopol (1.134); 17. (20) Krasnodar Oblast (1.108); 18. (24) Belgorod Oblast (1.089); 19. (37) Kaliningrad Oblast (1.064); 20. (44) Kaluga Oblast (1.054)
Average	21. (29) Nizhny Novgorod Oblast (1.048); 22. (46) Voronezh Oblast (1.043); 23. (13) Murmansk Oblast (1.040); 24. (17) Khabarovsk Krai (1.034); 25. (69) Tambov Oblast (1.034); 26. (31) Sverdlovsk Oblast (1.015); 27. (51) Republic of Chuvashia (0.989); 28. (27) Tomsk Oblast (0.988); 29. (22) Krasnoyarsk Oblast (0.985); 30. (12) Komi Republic (0.984); 31. (47) Tula Oblast (0.983); 32. (30) Novosibirsk Oblast (0.978); - (48) Arkhangelsk Oblast with AO (0.975); 33. (71) Penza Oblast (0.974); 34. (52) Ryazan Oblast (0.969); 35. (15) Samara Oblast (0.960)
Below average	36. (23) Republic of Bashkortostan (0.945); 37. (66) Kursk Oblast (0.943); 38. (61) Ulyanovsk Oblast (0.942); 39. (56) Amur Oblast (0.941); 40. (40) Yaroslavl Oblast (0.937); 41. (25) Astrakhan Oblast (0.935); 42. (14) Perm Krai (0.931); 43. (35) Rostov Oblast (0.928); 44. (41) Republic of Udmurtia (0.926); 45. (50) Primorsky Krai (0.924); 46. (45) Irkutsk Oblast (0.914); 47. (47) Arkhangelsk Oblast without AO (0.911); 48. (78) Republic of Dagestan (0.908); 49. (54) Tver Oblast (0.904); 50. (49) Novgorod Oblast (0.903); 51. (81) Republic of Ingushetia (0.896); 52. (34) Volgograd Oblast (0.895); 53. (-) Chechen Republic (0.894); 54. (63) Republic of Mordovia (0.894); 55. (64) Vladimir Oblast (0.894); 56. (32) Stavropol Krai (0.891); 57. (65) Republic of Adygea (0.890); 58. (53) Saratov Oblast (0.888); 59. (36) Republic of North Ossetia – Alania (0.886); 60. (26) Chelyabinsk Oblast (0.885); 61. (33) Orel Oblast (0.884); 62. (59) Omsk Oblast (0.879); 63. (-) Republic of Crimea (0.878); 64. (19) Orenburg Oblast (0.878); 65. (70) Kirov Oblast (0.868); 66. (74) Mari El Republic (0.867); 67. (42)

	Smolensk Oblast (0.864); 68. (77) Bryansk Oblast (0.863); 69. (28) Vologda Oblast (0.857); 70. (38) Republic of Karelia (0.856); 71. (62) Kostroma Oblast (0.853)
Low	72. (75) Ivanovo Oblast (0.850); 73. (43) Kemerovo Oblast (0.849); 74. (55) Republic of Kabardino-Balkaria (0.849); 75. (60) Republic of Khakassia (0.839); 76. (73) Jewish Autonomous Oblast (0.836); 77. (57) Altai Krai (0.829); 78. (72) Zabaykalsky Krai (0.816); 79. (67) Republic of Buryatia (0.815); 80. (80) Altai Republic (0.808); 81. (82) Tuva Republic (0.805); 82. (76) Pskov Oblast (0.802); 83. (68) Republic of Karachay-Cherkessia (0.780); 84. (58) Republic of Kalmykia (0.771); 85. (79) Kurgan Oblast (0.759)

* Place occupied by RF subject according to the integral index value in 2000

** The integral index value of the socio-economic development level in 2017 is presented in brackets next to each subject.

*** The integral index for the Chechen Republic was not calculated at the end of 2000 due to the absence of most initial statistical indicators for this subject of the Russian Federation.

According to Table 5, both in 2000 and 2017 more than half of the regions (43-50) fell into the group with below average and low development levels; it indicates the presence of many complex problems in their development. In 2017, compared to 2000, 27 RF subjects moved to the group with a higher level, the situation worsened in 13 regions. This requires the identification of problem regions, which should become *a special (priority) object of state regional policy*. There are two types of problem regions: backward regions and regions with a sign of depression.

The following criterion to classify a region as *backward* is offered[4]: a region belongs to the group with a low socio-economic development level and the integral index value is below 0.85 for several years. Thus, the territories with a low socio-economic development level are as such: the Ivanovo, Pskov, Kurgan oblasts, the republics of Kalmykia, Tuva, and Karachay-Cherkessia. In certain years this group included the Bryansk and Kirov oblasts, the republics of Adygea, Altai, Dagestan, Ingushetia, Kabardino-Balkaria, Mari El, Khakassia, Chechnya, Zabaykalsky and Altai krais (the average value of the integral index of the socio-economic development level for 2000-2017 is below 0.85).

Regions with signs of depression, in our opinion, include those RF subjects that by the socio-economic development level moved downwards by 2 groups, and/or in the integral rating moved downwards more than by 15 places for the studied period (not less than for 10 years, in our case it is 2000-2017) and thus did not belong to the backward category. These are the Astrakhan, Volgograd, Vologda, Orenburg, Orel, Samara, Smolensk, Chelyabinsk oblast, Stavropol and Perm krais, the republics of Karelia, Komi, North Ossetia – Alania.

Thus, the analysis of socio-economic differentiation of Russian regions reveals that:

1) differentiation of regions in terms of GRP per capita remains quite significant, although there is a trend for its reduction;

2) reduction in inter-regional differences in GRP per capita will require considerable time in the absence of active state policy;

3) in Russia there is a large group of problem regions that are in dire need of state support.

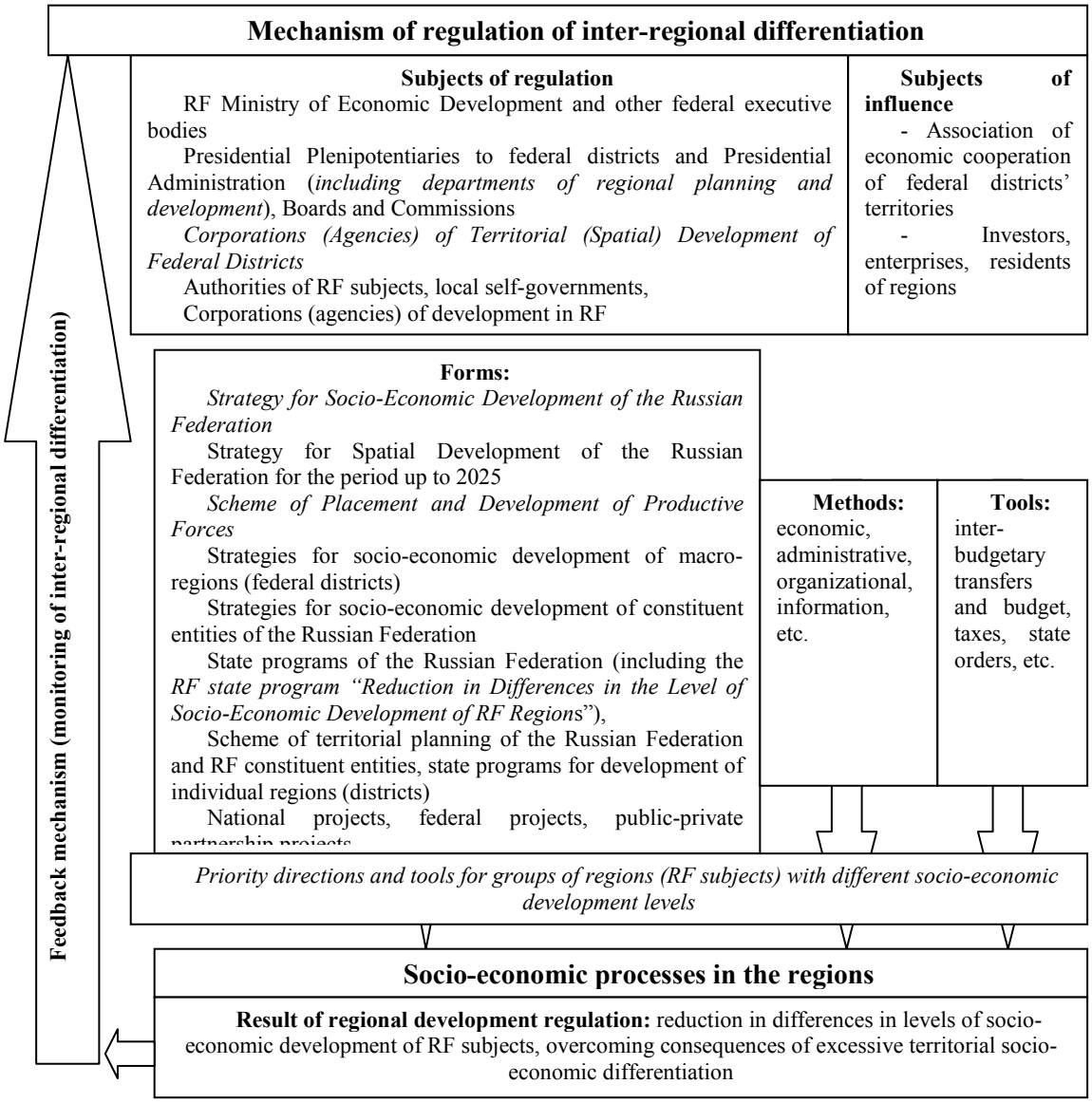
4. Mechanism of regulation of inter-regional differentiation and its mitigation

For Russia, characterized by a large territory and length, federal regional policy is of paramount importance for revitalizing and developing regional economy, reducing inter-regional differences, and overcoming negative consequences of territorial differentiation. This policy effectiveness largely depends on the mechanism that helps coordinate strategic objectives, goals, tasks and activities of authorities of all levels and takes into account Russian regions' specifics.

[4] Voroshilov N.V., Gubanova E.S. Assessment of the level of socio-economic development of regions of Russia // Journal of Economy and entrepreneurship. – 2013. – No. 12 (part 3). – Pp. 325-332.

We propose the following scheme (model) of managing the process of territorial differentiation (Figure). The currently missing organizational and program elements are shown in italics.

Figure: Model (conceptual scheme) of regulation of territorial differentiation processes



Within the framework of inter-regional differentiation regulation in accordance with the proposed model, it is important to:

1. analyze and forecast socio-economic development of federal districts and their constituent entities, identify key problems and parameters of underdevelopment, analyze development capacities of districts and RF subjects, and elaborate a typology of regions;

2. work out tools and measures of regional policy (inter-budgetary relations, investment, tax, structural policy) for territories with different socio-economic development levels; develop clusters, territories of advanced socio-economic development, and zones of territorial development;

3. develop and implement investment projects in economic and social spheres, aimed at reducing the backlog of RF subjects by key indicators from average Russian values using PPP mechanisms; seek for investors, create and upgrade infrastructure; attract personnel to certain territories;

4. encourage and support inter-regional and inter-municipal cooperation processes (including economic); develop and implement joint projects.

To implement this scheme in Russia, it is necessary to build a unified system of state bodies that will engage in the implementation of state regional policy. The main role in this system should be played by the *RF Ministry of Economic Development*, working out key directions of the country's economy development with regard to regional specifics, realizing and adjusting the implementation of state policy measures on the basis of the actual situation.

The creation of 7 federal districts (currently 8) in 2000 played a significant role in the formation of a single legal and economic space of Russia. However, while the role of Presidential Plenipotentiaries to federal districts and the Presidential Administration is reduced only to management and supervisory functions, as well as ensuring consistency of public authorities' actions. Therefore, it is advisable to create *departments of territorial planning and development* in the structure of the Office of Plenipotentiaries; they which will adjust and implement strategies for district development, analyze and forecast development of district regions together with authorities of a RF subject, identify key problems in their development, priorities of state policy, including the ones differentiated for areas with different development levels, the implementation of which is required to reduce the backlog of district's regions by various parameters of socio-economic development from the national average and other acceptable standards.

Creation of a Corporation (Agency) for Spatial Development and Territorial Planning will boost development and implementation of major investment projects, including inter-regional ones, and facilitate work with investors, regional authorities, and associations of economic cooperation of district territories. Such associations may participate in elaboration of a unified and coordinated socio-economic policy of the Russian Federation and realization of inter-regional projects.

The country's Strategy for Socio-Economic Development should clearly identify territorial priorities, the role of different regions, and mechanisms for managing spatial development. This should also be reflected in more detail in the RF Strategy for Spatial Development and the Scheme of Placement and Development of Productive Forces.

The Northwestern Agency for Development and Investment, established in 2002, is currently one of the leading regional organizations in the field of implementation of regional policy to attract investment and create a positive image of the region in Russia and abroad. The main objectives of the Agency are to ensure realization of the investment policy adopted in the Northwestern Federal District and promote creation of an investment-friendly environment to attract Russian and foreign investors to the region's economy.

Inter-regional associations of economic cooperation were set up in Russia in the 1990s. For example, the Association for Economic Cooperation of the Territories of the North-West of the Russian Federation was founded in January 1991 by executive and legislative authorities of RF subjects located within the Northwestern Federal District. The Association's activities are focused on developing programs and projects that are attractive for investment, coordinating work of permanent specialized committees, commissions and meetings, making contacts with business partners, and providing information support to territorial governing bodies, and, if necessary, the RF Government. The Strategic Partnership "North-West" is a new format of this Association created September 28, 2012. Its founders were 11 constituent entities of the Russian Federation included in the Northwestern Federal District, as well as 42 largest regional companies and business associations [12].

Let us note that such corporations and association can become active participants in development and implementation of the RF State Program "Reduction in Differences in the Level of Socio-Economic Development of Russian Regions" (a similar federal target program for RF subjects to reduce the level of regional development existed in the 2000s). The Program should focus on reducing differences in the socio-economic development level of Russian regions, decreasing the gap in key indicators of socio-economic development among the most developed and lagging regions.

Assets of the State Program "Reduction In differences in the Level of Socio-Economic Development of Russian Regions" should be accumulated in a specially created regional development fund (RDF) (a similar fund already existed in the 2000s). It is intended for equity financing of investment projects (programs) (new construction, expansion, reconstruction, technical re-equipment) for development of social and engineering

infrastructure in regions in order to align levels of their socio-economic security and the overall development level. We consider it expedient to form two parts of the program (Fund).

The *first part* (mandatory) will provide priority support for investment and social projects to RF subjects with a below average development level (the integral index of which is below 1) according to the following method. Subsidies from a RDF are allocated to co-finance expenses for measures of complex target programs of socio-economic development of RF subjects. The amount of Fund's assets distributed among regions is determined in the first half of each year. Up to September 1, a RF subject submits a project(s) in the field of healthcare, education, social protection, and public infrastructure development within the amount of allocations under the *first part of the Fund* to the corresponding authorized federal body of regional executive authorities. At the same time, it is necessary to determine a mandatory share of co-financing these projects on the part of the regional budget and extra-budgetary sources (from 10 to 40%) according to the overall socio-economic development level and state of the regional budget. The implemented project(s) should be aimed at solving a specific goal and objectives of the program and have a measurable result, expressed in increased availability of certain services, infrastructure, etc. A list of projects to be supported is determined by a special methodology and criteria. Any RF subject, not only the ones with a below average development level, can receive allocations from the *second part of the Fund*. The size of the second part of the Fund (program) may be equal to half of the size of the first part.

Thus, the proposed organizational and economic mechanism of the federal regional policy to reduce inter-regional differentiation and overcome its consequences includes both equalizing (presence of a RDF mandatory part for territories with a low development level in order to implement priority measures for reducing their backlog by social and infrastructure parameters) and stimulating components (a RDF competitive part in order to realize effective and priority projects). Such a structure of the mechanism will help solve key problems of regional development, improve living conditions of the population, and restrain a significant migration outflow from territories with a low socio-economic development level. This, in turn, will reduce differentiation of regions and its negative consequences; the specifics of territorial development will be taken into account and differentiated regional policy measures for different territories will be elaborated.

The results of the inter-regional differentiation analysis presented in the article, as well as the general conceptual scheme of the mechanism of its regulation can be used to solve problems, stated in the Strategy for Spatial Development of the Russian Federation 2025 (approved by the order of the RF Government as of February 13, 2019 No. 207-p), such as reduction in the level of inter-regional differentiation in RF subjects' socio-economic development and decrease in intra-regional socio-economic differences.

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ASSESSING THE STRUCTURAL CHANGES IN THE GREEK ECONOMY FOR THE PERIOD PRIOR TO ECONOMIC CRISIS

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Abstract

The process of economic growth is directly related to structural changes, the study of which has been the subject of research for many decades and it allowed detecting the dynamics affecting national and regional economies over time. Especially for the policy makers, the in-depth understanding of inter-sectorial linkages and of the structural changes existing in national or regional economics is increasingly important for the planning of effective economic policies leading to economic development and to the improvement of competitiveness and productivity. Within this context, this paper studies the inter-sectorial linkages in the Greek economy by using a combined approach based on input-output modeling and on causative matrix analysis. The purpose of the analysis is to detect the structural changes in Greece at the period prior to economic crisis (2000-2010), which is an important period because, at that time, the economic structure of the country have been proven deficient to successfully deal with the crisis that followed. The analysis shows that the majority of the productivity sectors (impressively) witnessed an increase in their gross output at that time, that the most significant changes induced in the tertiary sector, where technical changes were fewer than those captured due to change in final demand, and that the effects of final demand are increasingly individually internalized. The overall approach aspires to learn from a crucial period leading to an economic crisis, under a structural perspective of the Greek economy.

Keywords: structural changes, input-output analysis, multipliers, Greek economy.
JEL classification: Q33, Q40, Q41

1. Introduction

The ex-ante identification of the potentially high growth sectors, which might be suitable for economic development reinforcing in a country, is a continuous task of every economic planner. In the relevant literature this discussion is timeless but it's recent concern focuses on the definition and estimation of the key sectors. Traditionally, a key-sector is the one generating above-average input requirements than the other sectors and of whose the output is widely used by other sectors. The utility of input-output sectorial linkages has been the subject of many studies (Miller and Blair, 2009; Garcia-Muñiz and Ramos-Carvajal, 2015; Cassar, 2017).

Structural changes are changes in the structure and in the functionality of an economy, which have a significant impact on the development of a country, region, or generally place (Miller and Blair, 2009; Korres, 1996). The process of economic development in an economy results in distinct structural changes. As the gross domestic product (GDP) of a country increases (or decreases), a shift in economic activity arises among productive sectors. The process in turn leads to structural shifts, and consequent diminishing significance of some activities and growing dominance of others (Kaur et al., 2009). Investigation of structural relationships among the sectors becomes important from the policy perspective, since it helps at understanding the evolution of such relationships as well as the inter-sectoral adjustments over time.

Structural decomposition analysis can be used for historical analysis, but some recent work indicates how it might be used as a forecasting tool. Also, structural decomposition analysis enables the analyst to examine responses to price changes, which are only implicit in even value-based input-output tables (Bekhet, 2009). The Input-Output Analysis has been widely applied to study structural change in an economy over a particular period of time (Magtibay-Ramos et al., 2010; Trinh et al., 2012). Structural change, in the framework of Input - Output, refers to changes in input requirements, new products, and changes in the relative size of sectors within an economy.

In Greece, the recent economic crisis (Polyzos et al., 2013) seemed to have significantly affected the productive-web of the country. One of the key-methodologies for assessing and evaluating structural changes in an economy over time is the so-called Input-Output Analysis, which models interactions among the sectors of the economy concerned (Polyzos and Sofios, 2008; Polyzos, 2009; Pnevmatikos, 2017; Polyzos, 2019). Input-Output Analysis describes the operability of an economic system and explores the relationships among the productive sectors of an economy. It provides tools to assess structural changes in the economy, in terms of linkages among these sectors (Miller and Blair, 2009). Input–Output Tables give insights on the status-quo of a particular economy, on an annual basis, through an analysis of inter-sectorial transactions in goods and services.

The Input-Output analysis is used in this paper to study the structural changes in the sectors of the Greek economy at the period 2000-2010, focusing on the corresponding Input-Output Tables. The analysis focuses on structural changes that have taken place in the Greek economy using input-output data. The purpose of the analysis is to detect the structural changes in Greece at the period prior to economic crisis (2000-2010), which is an important period that marked the economic performance of the country the years that followed the crisis (Polyzos et al., 2013).

The remainder of this paper is organized as follows: Section 2 discusses the methods used to detect structural changes. Section 3 shows the results of the analysis and discusses them in order to identify the structural changes and the leading sectors of the Greek economy at the period 2000-2010. Finally, in section 4, the main conclusions that are drawn from the above research and analysis, as well as proposals are formulated for the growth of the Greek economy.

2. Methods of analyzing structural changes

In this section, key-methods, which are used to examine structural changes in an economy, are described and evaluated.

2.1. Structural Decomposition Analysis (SDA)

The Structural Decomposition Analysis (SDA) enables the main sources of change to be examined and distinguished in an economy. This is done by identifying changes to basic parameters in the framework of input-output analysis (Rose and Casler, 1996; Rose and Chen, 1991; Pnevmatikos, 2017). Specifically, in the Input-Output system, the gross production value (X), for two successive years (t-1, t), is defined as follows:

$$\mathsf{X}^{t-1} = (\mathsf{I} - \mathsf{A}^{t-1})\mathsf{Y}^{t-1} \text{ and } \mathsf{X}^{t} = (\mathsf{I} - \mathsf{A})^{t}\mathsf{Y}^{t} \quad (1),$$

where Y is the vector of final demand and $(I\text{-}A)^{-1}$ is the Leontief's inverse matrix. According to Skolka (1989), the differences in gross output between two years can be determined by two general categories of structural changes in final demand (Y) and the changes in the input coefficients of matrix A. Particularly:

$$\Delta\mathsf{X} = \mathsf{X}^{t} - \mathsf{X}^{t-1} = (\mathsf{I} - \mathsf{A}^{t})^{-1}\mathsf{Y}^{t} - (\mathsf{I} - \mathsf{A}^{t-1})^{-1}\mathsf{Y}^{t-1} \quad (2),$$

$$\Delta\mathsf{X} = \left[(\mathsf{I} - \mathsf{A}^{t})^{-1} - (\mathsf{I} - \mathsf{A}^{t-1})^{-1}\right]\mathsf{Y}^{t-1} + (\mathsf{I} - \mathsf{A}^{t})^{-1}(\mathsf{Y}^{t} - \mathsf{Y}^{t-1}) \quad (3),$$

$$\Delta\mathsf{X} = \left[(\mathsf{I} - \mathsf{A}^{t})^{-1} - (\mathsf{I} - \mathsf{A}^{t-1})^{-1}\right]\mathsf{Y}^{t} + (\mathsf{I} - \mathsf{A}^{t-1})^{-1}(\mathsf{Y}^{t} - \mathsf{Y}^{t-1}) \quad (4).$$

In equation (3), the changes in the inverse matrices (technical changes) are multiplied by final demand of base year t-1, while the changes in final demand are multiplied by the inverse

matrix of current year t (Chenery et al., 1962; Syrquin, 1976; Kubo and Robinson, 1984). In equation (4), changes in the inverse matrices are multiplied by final demand of this year, while the changes of final demand with the inverse matrix of the base year (Nijhowne et al., 1984; Rose and Chen, 1991).

Generally, equations (3) and (4) are equivalent, in mathematical terms. However, their results are different because changes in technology and in final demand are different in these two cases. These approaches have been discussed by several researchers (Skolka, 1989; Rose and Chen, 1991; Vaccara and Simon, 1968; Feldman et al., 1987; Miller and Shao, 1994; Dietzenbacher and Los, 1998). According to Dietzenbacher and Los (1998), summing equations (3) and (4) and averaging their results, gives the following alternative approach:

$$\Delta x = (1/2)(\Delta L)(f^{t-1} + f^{t}) + (1/2)(L^{t-1} + L^{t})(\Delta f) \quad (5),$$

where $(\Delta L)(f^{t-1}+f^{t})$ expresses the technological changes, while $(L^{t-1}+L^{t})(\Delta f)$ depicts the changes in final demand. This approach is considered satisfactory as mid-point weights are used.

2.2. The causative matrix method

The causative matrix method is used to detect changes in an economy at two different time points and it is based on the rationale of the Markov-chain analysis. A set of random variables $\{X_n\}$ is a Markov chain when the probability of the future value x_{n+1} depends only on the present x_n value and not on previous past value. In general, for two matrices A_t and A_{t+1} defined at two different times, the causative matrix formula is defined by the relation $A^{t+1}=CA^{t}$, where C is the causative matrix and models the changes between matrices A^{t} and A^{t+1} (Lipstein, 1968; Rogerson and Plane, 1984; Plane and Rogerson, 1986; Jackson et al., 1990). In the context of Input-Output analysis, by assuming that A is the matrix of technical coefficients and S is the output matrix, causative matrix (C) is easier be explained when the sums of the columns or rows are equal to 1. However, since $\sum_i \alpha_{ij} < 1$ and $\sum_j s_{ij} < 1$, this can be achieved in two ways. The first is by the introduction of the added value, etc., and the elements of final demand into matrices A and S, respectively. With respect to the second way, elements of matrix A should be expressed as a proportion of inputs that come from sector i and end up in sector j, while the elements of matrix S should reflect the proportion of the product sold by sector i to the rest sectors.

The causative matrix can be distinguished in two categories: (a) In the Right causative matrix (C_R) used to determine horizontal linkages, and (b) in the Left Causative Matrix (C_L) used to examine vertical linkages. According to Jackson et al. (1990), one of the limitations associated with the causative matrix relates to the fact that the interpretation of its elements becomes difficult when the original matrices do not have the dominant diagonals. When the elements of the diagonal are smaller than the sum of the elements in a column or a raw, then the matrix does not have a dominant diagonal. This difficulty is due to the fact that both the determinant of the normalized matrix (A or S) and the relative co-factors may have different indications with respect to the case of a dominant diagonal matrix. In addition, in matrices with non-dominant diagonals, indirect sectorial impacts contribute to a larger extent to sectorial changes as compared to direct effects. Consequently, a small (positive) direct change in an input or output coefficient can cause a large (negative) indirect effect, leading to a misinterpretation of the content (elements) of columns and rows of a matrix.

For a better interpretation of the causative matrix, Jackson et al. (1990) used the Leontief's inverse matrix to investigate changes in output multipliers. In particular, the elements of each column of the inverse matrix are normalized with respect to the sum of the elements of the corresponding column, as the sums of the columns of normalized matrices must be equal to 1. Therefore, every element of the normalized inverse matrix (r_{ij}) expresses the ratio of the output multiplier of sector j transferred to sector i. The normalized Leontief inverse matrix is more likely to have a dominant diagonal than matrix of technical coefficients. In particular, if $B=(I-A)-1$ is the Leontief's inverse matrix and M is a diagonal matrix for which each element (m_{jj}) is equal to the sum of the elements of column j of matrix B, then the normalized Leontief's inverse matrix can be written as $R=BM^{-1}$.

Within this context, the causative matrix is estimated from the formula $C = R_{t+1}R_t^{-1}$, while a typical element of matrix R_{t+1} is determined by the equation:

$$r_{ij(t+1)} = c_{i1}r_{1j} + c_{i2}r_{2j} + c_{i3}r_{3j} + ... \quad (6).$$

A negative value of c_{ik} indicates a decrease in the ability of sector i to affect the output multiplier of sector j due to the presence of sector k. Sectors can be considered competing with each other in terms of their impact on the output multiplier of sector j as well as other sectors.

2.3. Indices of inter-sectorial linkages

The indices of inter-sectorial linkages are a particularly useful for economic analysis because they contribute to the evaluation of the structure of an economy, to explore the importance of each sector in terms of the intensity of its inter-exchanges, and to point out the leading sectors of the economy. A number of studies, such as of Chenery and Watanabe (1958), Hirschman (1958), Rasmussen (1956) and Augustinovics (1970), suggested various vertical and horizontal inter-sectorial linkages indicators. However, these indicators do not reflect the intensity of the dispersion of indirect effect between the sectors of an economy. That is, any sector with a high horizontal or vertical linkages index does not necessarily lead to an increase in the gross product of all sectors of the economy under consideration. This implies the weakness of these indicators to serve the description of the structure of the economy and the dispersion that exists between the sectors. In an attempt to solve this problem, Rasmussen (1956) and Hirschman (1958) suggested the estimation of indices of power dispersion and sensitivity of dispersion through a normalization process. In particular, these indices are estimated as follows:

$$U_j = \frac{\sum_{i=1}^{n} b_{ij}}{n} \Bigg/ \frac{\sum_{j=1}^{n}\sum_{i=1}^{n} b_{ij}}{n^2} \quad \text{και} \quad U_i = \frac{\sum_{j=1}^{n} b_{ij}}{n} \Bigg/ \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}{n^2} \quad (7),$$

where U_j is the index of power dispersion, U_i is the index of sensitivity of dispersion, b_i express cases, and n is the number of productive sectors. In case when $U_j > 1$, an increase in final demand of sector j will cause an increase in the productive activity of economy above the average. In addition, if $U_i > 1$, then an increase in the final demand of the sectors by one unit, will cause an increase in sector i production above the average.

Unlike the indices of Rasmussen (1956) and Hirschman (1958), those of Allaudin (1986) are not sensitive to marginal values. Improving the methodological background, Allaudin (1986) suggested the variability index that can be used in addition to the dispersion index. The variability indicators are defined as follows:

$$V_j = \sqrt{\frac{\frac{1}{n-1}\left[\sum_{i=1}^{n}\left(b_{ij} - \frac{\sum_{i=1}^{n} b_{ij}}{n}\right)^2\right]}{\frac{\sum_{i=1}^{n} b_{ij}}{n}}} \quad \text{and} \quad V_i = \sqrt{\frac{\frac{1}{n-1}\left[\sum_{j=1}^{n}\left(b_{ij} - \frac{\sum_{j=1}^{n} b_{ij}}{n}\right)^2\right]}{\frac{\sum_{j=1}^{n} b_{ij}}{n}}} \quad (8),$$

where b_i are cases and n is the number of productive sectors. Low values of these indicators for a sector show that the indirect results of this sector are evenly distributed to other sectors, while the opposite is the case if the values of these indices are high. According to Allaudin (1986), a sector is considered to have a leading role in the economy when (a) the U_i and U_j indices have values greater than the unit, and (b) the indices V_i and V_j have relatively low values.

2.4. Output and employment multipliers

The multipliers of Input - Output Analysis are particularly important indicators used to estimate the impact of changes in final demand on output of an economy, income,

employment, etc. (Polyzos, 2006, Polyzos and Sofios, 2008; Polyzos, 2009; Miller and Blair, 2009). The output multiplier of sector *j* is defined as the total value of production in all sectors of the economy that satisfy the final demand of a unit for the output of sector *j*. The output multiplier for each sector is estimated by the sum of the corresponding column of the Leontief's inverse matrix. Specifically it is defined by the equation (Polyzos, 2006; Pnevmatikos et al., 2013; Pnevmatikos, 2017):

$$OM_j = \sum_{i=1}^{n} b_{ij} \quad (9),$$

where OM_i is the output multiplier of sector *j* and b_{ij} is the element of the Leontief's inverse matrix.

Next, the employment multiplier of sector *j* illustrates the overall change in employment that is induced in the economy by a change in final demand of each sector separately. In particular, for the estimation of employment multiplier, the direct employment coefficients vector is first estimated as follows (Miller and Blair, 2009):

$$DE_j = E_j / X_j \quad (10),$$

where E_j is the number of employees in each sector and X_j is the total output of each sector. Then, total employment multipliers are estimated from the following formula:

$$EM_j = DE_j (I - A)^{-1} \quad (11).$$

3. Assessing structural changes in the Greek Economy

In this section, structural changes of the productive sectors of the Greek economy (for the period 2000-2010) are estimated and evaluated by using the methods of Structural Decomposition Analysis and Causative Matrix. Moreover, indices of Power Dispersion (U_j), Sensitivity of Dispersion (U_i), Vertical Variability (V_j) and Horizontal Variability (V_i) are estimated, as well as the Output and Employment Multipliers, in order to highlight the sectors that play an important role in the operation of the economic system. For this purpose, the Input-Output tables of the Greek economy, for the years 2000 and 2010, which have an initial dimension of 65×65 (sectors) and are extracted from the Greek Statistical Service (ELSTAT), are used. In order to match the Input-Output Tables of two periods, further editing took place in some sectors and the final tables concluded having 49 sectors (49×49). Table 1 shows the sectors included in the Input - Output tables.

Table 1. Codes and descriptions of productive sectors of the Greek economy

Sector No.	Sector code	Sector description
1	R01	Products of agriculture, hunting and related services
2	R02	Products of forestry, logging and related services
3	R03	Fish and other fishing products; aquaculture products; support services to fishing
4	RB	Mining and quarrying
5	R10_12	Food products, beverages and tobacco products
6	R13_15	Textiles, wearing apparel and leather products
7	R16	Wood and products of wood and cork, except furniture; articles of straw and plaiting materials
8	R17	Paper and paper products
9	R18-R58	Printing, recording and publishing services
10	R19	Coke and refined petroleum products
11	R20-R21	Chemicals and chemical products (includes pharmaceutical products
12	R22	Rubber and plastics products
13	R23	Other non-metallic mineral products
14	R24	Basic metals
15	R25	Fabricated metal products, except machinery and equipment
16	R26	Computer, electronic and optical products

Sector No.	Sector code	Sector description
17	R27	Electrical equipment
18	R28	Machinery and equipment n.e.c.
19	R29	Motor vehicles, trailers and semi-trailers
20	R30-R33	Other transport equipment - Repair and installation services of machinery and equipment
21	R31_32	Furniture; other manufactured goods
22	RD	Electricity, gas, steam and air-conditioning
23	R36	Natural water; water treatment and supply services
24	R37_39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
25	RF	Constructions and construction works
26	R45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
27	R46	Wholesale trade services, except of motor vehicles and motorcycles
28	R47-R95	Retail trade services, except of motor vehicles and motorcycles - Repair services of computers and personal and household goods
29	R49	Land transport services and transport services via pipelines
30	R50	Water transport services
31	R51	Air transport services
32	R52-R79	Warehousing and support services for transportation- Travel agency, tour operator and other reservation services
33	R53-R61	Postal and telecommunication services
34	RI	Accommodation and food services
35	R59_60-R90_92-R93	Cultural, sport, entertainment services
36	R62_63	Computer programming, consultancy and related services; information services
37	R64	Financial services, except insurance and pension funding
38	R65	Insurance, reinsurance and pension funding services, except compulsory social security
39	R66	Services auxiliary to financial services and insurance services
40	RL	Real estate services
41	R69_70-R71-R73-R74_75-R78-RR80_82	Professional, scientific and technical services;
42	R72	Scientific research and development services
43	R77	Rental and leasing services
44	R84	Public administration and defence services; compulsory social security services
45	RP	Education services
46	R86-R87_88	Health and Social work services
47	R94	Services furnished by membership organisations
48	R96	Other personal services
49	RT	Services of households as employers

Next, Table 2 shows the results of the structural decomposition analysis (SDA) and of the left causative matrix method, computed for each sector. In particular, based on Structural Decomposition Analysis, the factors being responsible for the change in Gross Product between the years 2000 and 2010 are determined. The results show that most of the productive sectors of the economy show an increase in their Total Gross Production, with the effect of final demand generally affecting to a greater extent than the technical coefficients.

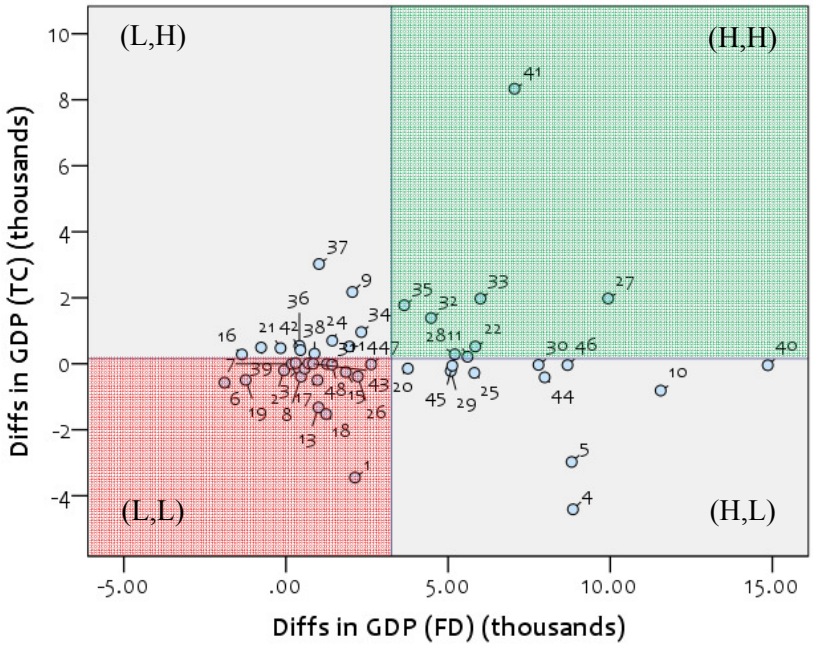
The change in the technical coefficients leads to an increase in the product for the 44.89% of the sectors. The greatest positive effect on Gross Product by the change in technical

coefficients is observed for the "Professional, scientific and technical services" (RR80_82) and "Services auxiliary to financial services and insurance services" (R66) sectors. On the contrary, the most significant reductions in Gross Product due to the change in technical coefficients are observed in the "Mining and quarrying" (RB), "Agriculture, hunting and related services" (R01), and "Food products, beverages and tobacco products" (R10_12) sectors.

According to the change of Gross Product due to the change in final demand, in most (43) sectors, the change in the final demand leads to a positive change in output. The biggest positive effect on Gross Product is observed in the "Real estate services" (RL), "Coke and refined petroleum products" (R19) and "Wholesale trade services" (R46) sectors, while the most negative effect takes place in the sectors "Textiles, wearing apparel and leather products" (R13_15), "Motor vehicles, trailers and semi-trailers" (R29) and "Computer, electronic and optical products" (R26).

To illustrate the results of the SDA, we create the scatter plot of Figure 1, where the plan is divided into four quadrants defined by the mean values of the differences in GDP due to technical coefficients (TC) and due to final demand (FD). This classification produces four performance groups of sectors, namely (H,H), (H,L), (L,H), and (L,L), which include sectors with scores higher than (H=high | > mean value) or lower than (L=low | < mean value) the mean value, for the paired variables (*X*,*Y*).

Figure 1. Scatter plot based on the Structural Decomposition Analysis of Table 2. The plan is divided into four quadrants defined by the mean values of the differences (diffs) in GDP due to technical coefficients (TC) and due to final demand (FD). Each sector belongs to a quadrant according to its scores in variables *X*="diffs in GDP due FD" and *Y*="diffs in GDP due TC", where H=high (>mean value), L=low (<mean value). Case labels are sector numbers shown in Table



According to Figure 1, 8 out of 49 sectors (~16% of the total) shown in Table 1, with reference numbers (codes shown in brackets) 11 (R20-R21), 22 (RD), 27 (R46), 28 (R47-R95), 32 (R52-R79), 33 (R53-R61), 35 (R59_60-R90_92-R93), and 41 (R69_70-R71-R73-R74_75-R78-RR80_82) have a dominance "High-High" (H,H) performance, according to the SDA. The density of the other groups in Figure 1 are almost 22% (11/49) for the intermediate performance (H,L) and (L,H) groups, and almost 39% (19/49) for the lowest performance (L,L) group.

At next, according to the left Causative Matrix method (Table 2), it is observed that in 36.73% of the sectors, the diagonal elements are greater than 1. This shows that the effects of final demand on each of these sectors, in relation to the other sectors, are increasingly internalized within the sector. The sectors with the greater diagonal elements are "Natural

water; water treatment and supply services" (R36), "Accommodation and food services" (RI), "Rental and leasing services" (R77), "Wood and products of wood and cork" (R16).

Table 2. Results of Structural Decomposition Analysis and of Left Causative Matrix Method

	Structural Decomposition Analysis – SDA			Causative Matrix Method		
Sector code	Change in Gross Product due to change in technical coefficients (in € million)	Change in Gross Product due to change in final demand (in € million)	Total change in Gross Product (in € million)	Diagonal data	Total line sums	Line sums except the data of main diagonal
R01	-3446.97	2126.17	-1320.81	0.90	0.83	-0.07
R02	-199.00	-61.27	-260.27	0.79	0.70	-0.08
R03	-156.02	402.28	246.25	0.93	0.92	-0.01
RB	-4411.34	8851.75	4440.41	0.99	0.52	-0.47
R10_12	-2974.00	8808.42	5834.42	1.03	0.94	-0.08
R13_15	-573.31	-1897.32	-2470.63	1.07	1.07	0.01
R16	-2.85	179.12	176.27	1.15	1.14	-0.01
R17	-393.10	464.33	71.23	0.94	0.89	-0.05
R18-R58	2175.62	2047.45	4223.07	1.12	1.34	0.22
R19	-810.67	11556.56	10745.89	1.03	0.77	-0.26
R20-R21	210.00	5599.68	5809.68	0.98	1.11	0.13
R22	-144.49	580.34	435.85	0.93	0.95	0.02
R23	-1324.69	1000.19	-324.51	1.01	0.93	-0.08
R24	521.46	1960.05	2481.51	0.96	1.03	0.08
R25	-249.25	1843.96	1594.71	0.73	0.74	0.01
R26	281.34	-1361.97	-1080.63	1.06	1.10	0.04
R27	-495.62	970.59	474.97	0.97	0.94	-0.03
R28	-1526.90	1238.43	-288.48	0.86	0.77	-0.09
R29	-490.64	-1241.41	-1732.05	0.99	0.94	-0.05
R30-R33	-145.51	3759.95	3614.44	1.06	1.05	-0.01
R31_32	471.31	-166.03	305.28	1.07	1.10	0.03
RD	521.16	5837.64	6358.80	1.01	0.94	-0.07
R36	20.24	294.94	315.18	1.18	1.17	-0.01
R37_39	698.11	1424.71	2122.82	1.04	1.08	0.04
RF	-277.38	5809.19	5531.81	0.94	0.83	-0.11
R45	-385.04	2214.28	1829.24	0.96	0.89	-0.07
R46	1976.98	9934.71	11911.69	0.85	1.21	0.35
R47-R95	286.89	5203.13	5490.01	0.93	0.96	0.04
R49	-220.76	5084.36	4863.60	0.94	0.93	0.00
R50	-35.70	7789.34	7753.65	0.95	0.96	0.01
R51	-9.78	1263.16	1253.39	0.78	0.80	0.02
R52-R79	1388.02	4474.56	5862.58	0.93	1.04	0.11
R53-R61	1973.32	5997.16	7970.48	0.88	1.15	0.27
RI	960.97	2320.51	3281.48	1.16	1.27	0.11
R59_60-R90_92-R93	1770.46	3647.95	5418.41	0.99	1.15	0.16
R62_63	543.86	414.60	958.46	0.99	1.06	0.07
R64	3023.77	1018.64	4042.41	0.90	1.35	0.45
R65	307.37	881.58	1188.95	1.00	1.06	0.06
R66	494.58	-766.04	-271.45	1.03	1.17	0.14
RL	-44.71	14857.46	14812.74	1.00	0.68	-0.32
R69_70-R71-R73-R74_75-R78-RR80_82	8334.08	7046.41	15380.49	0.85	1.60	0.76
R72	410.21	447.69	857.91	0.85	0.89	0.05
R77	13.11	695.00	708.12	1.14	1.05	-0.09
R84	-413.52	7978.99	7565.47	1.03	1.03	0.00
RP	-61.69	5130.11	5068.42	0.97	0.96	0.00
R86-R87_88	-39.56	8683.87	8644.31	0.96	0.98	0.01
R94	-18.05	2621.79	2603.74	0.87	0.87	0.00
R96	-24.78	1422.34	1397.56	1.11	1.10	0.00
RT	0.79	837.05	837.84	1.00	1.00	0.00

Subsequently, the off-diagonal elements reflecting the changes in the relationships between the sectors are examined. The negative (positive) elements (cik) show that sector k influences negatively (positively) the contribution of sector i to the output multipliers of the other sectors of the economy. The largest negative values are found among the sectors "Real estate services" (RL), "Services furnished by membership organisations" (R94), "Mining and quarrying" (RB) and "Coke and refined petroleum products" (R19). On the other hand, the highest positive values are observed among the sectors "Air transport services" (R51), "Accommodation and food services" (RI) and "Services furnished by membership organisations" (R94).

From the sums of the causative matrix rows (except the diagonal elements), it is observed that for 26 out of 49 sectors sum above zero, indicating the increased effects on the output of each sector caused by final demand in other sectors. Highest sums are observed in the sectors "Professional, scientific and technical services" (R69_70-R71-R73-R74_75-R78-RR80_82), "Services auxiliary to financial services and insurance services" (R66) and " Wholesale trade" (R46). In contrast, for 23 sectors, the rows sum (excluding diagonal) is less than zero, with the lowest being observed in the sectors "Real estate services" (RL), and "Mining and quarrying" (RB). In these sectors, there is a reduced impact on their output from final demand in other sectors.

From the investigation of sectorial linkages, it is observed that, in Greece, for the year 2000, the sectors with the strongest vertical linkages, as they are estimated through the Index of power dispersion, are "Food products, beverages and tobacco products" (R10_12), "Wood and of products of wood and cork" (R16), "Basic metals" (R24), and "Constructions and construction works" (RF). The last two sectors maintain particularly strong vertical linkages in 2010, while higher index values are observed in the sectors "Services furnished by membership organisations" (R94), "Fabricated metal products, except machinery and equipment" (R25) and "Air transport services" (R51). These sectors play a key-role in the economy as growth in these sectors produces an increase in final demand for inputs from other sectors of the economic system.

The examination of the horizontal sectorial linkages, based on Sensitivity of Dispersion index, reveals that sectors such as "Professional, Scientific and Technical Services" (R69_70-R71-R73-R74_75-R78-RR80_82), "Mining and Quarrying" (RB), "Real Estate Services" (RL), "Basic Metal" (R24) services, and "Financial services" (R64) show high values for both reference years (2000 and 2010). These sectors can be boost for the growth of the Greek economy, as an increase in the final demand of the other sectors causes an increase in the production activity of these sectors above the average.

The previously approach was adopted to identify the leading manufacturing sectors of the Greek economy. According to this, a sector is considered as dominant in the operation of an economy when the indices of sensitivity of dispersion and power dispersion (U_i and U_j) have values greater than the unit, and when the indices of horizontal and vertical variability (V_i and V_j) have relatively low values Table 3).

Table 3. Indicators of Dispersion, Variability and Product and Employment multipliers

Sector No.	Sector code	Index of power dispersion (U_j)		Index of sensitivity of dispersion (U_i)		Index of vertical variability (V_j)		Index of horizontal variability (V_i)		Product multiplier		Employment multiplier	
		2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
1	R01	1.05	1.08	1.25	1.05	0.78	0.82	0.73	0.84	1.53	1.64	71.58	59.94
2	R02	0.75	0.97	0.81	0.72	0.98	0.89	0.95	1.04	1.09	1.47	21.14	43.09
3	R03	0.92	0.95	0.72	0.68	0.90	0.86	1.02	1.02	1.35	1.44	18.06	17.42
4	RB	0.75	0.73	1.98	1.39	0.97	0.96	0.68	0.74	1.10	1.10	4.56	2.15
5	R10_12	1.31	1.14	1.02	0.86	0.84	0.79	0.82	0.90	1.92	1.73	34.82	19.88
6	R13_15	1.00	0.83	0.87	0.80	0.94	0.94	1.01	0.96	1.46	1.27	22.10	10.30
7	R16	1.31	1.11	0.95	0.92	0.89	0.96	1.05	1.05	1.91	1.68	45.80	27.93
8	R17	1.06	1.02	1.12	0.97	0.98	0.92	0.96	0.94	1.54	1.55	9.84	7.15
9	R18-R58	1.19	0.90	0.86	1.10	0.78	0.82	0.91	0.78	1.74	1.52	30.28	10.86
10	R19	1.20	1.16	1.50	1.32	0.89	0.86	0.70	0.75	1.76	1.76	5.39	3.85
11	R20-R21	0.91	0.87	1.25	1.29	0.95	0.93	0.82	0.77	1.34	1.33	7.76	4.70
12	R22	1.02	1.06	0.84	0.83	0.84	0.82	0.93	0.92	1.49	1.62	11.95	10.49
13	R23	1.15	1.06	0.96	0.83	0.87	0.86	0.96	0.98	1.68	1.62	15.99	12.77
14	R24	1.27	1.25	1.53	1.59	0.86	0.82	0.87	0.82	1.86	1.90	8.96	7.91
15	R25	0.90	1.32	1.06	0.95	0.89	0.82	0.81	0.89	1.32	2.01	13.07	15.10
16	R26	0.77	0.68	0.79	0.82	0.97	0.99	0.95	0.89	1.12	1.04	4.02	1.50
17	R27	0.99	0.97	0.82	0.74	0.86	0.84	0.94	0.95	1.45	1.47	8.04	7.34
18	R28	0.82	0.92	0.89	0.76	0.92	0.85	0.88	0.93	1.20	1.39	7.85	8.40
19	R29	0.75	0.72	0.77	0.70	0.97	0.96	0.95	0.98	1.09	1.10	2.12	2.04
20	R30-R33	0.74	0.67	0.72	0.69	0.96	0.99	0.98	0.98	1.09	1.02	8.44	2.08
21	R31_32	0.96	0.87	0.79	0.79	0.85	0.87	0.94	0.92	1.41	1.32	22.41	16.57
22	RD	0.89	1.11	1.22	1.27	0.87	0.84	0.77	0.86	1.45	1.69	11.39	5.20
23	R36	1.10	0.91	0.73	0.72	0.79	0.86	0.97	0.97	1.61	1.38	20.84	12.55
24	R37_39	1.00	0.92	0.77	0.79	0.84	0.85	0.95	0.92	1.46	1.39	30.51	11.31
25	RF	1.22	1.31	1.18	1.03	0.76	0.76	0.76	0.84	1.78	2.00	23.01	20.49
26	R45	0.93	0.94	1.00	0.91	0.87	0.85	0.82	0.85	1.36	1.42	28.97	18.62
27	R46	1.10	1.15	1.46	1.75	0.85	0.81	0.69	0.64	1.43	1.75	16.19	12.30
28	R47-R95	1.12	1.03	1.25	1.24	0.84	0.81	0.74	0.73	1.46	1.57	53.43	40.97
29	R49	1.11	1.16	0.89	0.84	0.79	0.77	0.88	0.90	1.63	1.76	40.89	19.15
30	R50	1.13	1.14	0.72	0.70	0.81	0.79	0.98	0.97	1.65	1.73	10.15	6.79
31	R51	1.02	1.27	0.76	0.74	0.82	0.74	0.95	0.95	1.49	1.93	12.95	9.57
32	R52-R79	0.89	0.92	1.21	1.32	0.93	0.89	0.83	0.77	1.30	1.40	15.25	8.35
33	R53-R61	0.93	1.08	1.28	1.58	0.96	0.73	0.82	0.77	1.36	1.64	15.17	8.26
34	RI	1.14	0.94	0.89	1.01	0.78	0.84	0.88	0.81	1.66	1.43	27.94	21.22
35	R59_60-R90_92-R93	0.96	1.02	0.78	0.95	0.89	0.92	0.99	0.93	1.41	1.55	24.87	12.29
36	R62_63	0.99	0.95	0.80	0.84	0.86	0.86	0.96	0.91	1.44	1.45	23.08	18.10
37	R64	0.86	0.92	1.29	1.68	0.93	0.88	0.75	0.65	1.25	1.40	12.70	10.23
38	R65	1.14	1.04	0.77	0.78	0.83	0.82	1.00	0.92	1.67	1.59	29.65	12.56
39	R66	1.00	1.03	0.88	0.95	0.86	0.92	0.93	0.94	1.47	1.56	12.19	18.54
40	RL	0.84	0.81	1.70	1.46	0.91	0.91	0.64	0.67	1.23	1.23	3.09	2.31
41	R69_70-R71-R73-R74_75-R78-RR80_82	1.03	1.21	2.11	2.74	0.72	0.87	0.64	0.57	1.51	1.84	29.65	17.66
42	R72	1.00	1.17	0.73	0.78	0.87	0.82	1.03	1.01	1.46	1.78	29.04	13.95
43	R77	1.20	0.99	0.90	0.82	0.79	0.84	0.91	0.92	1.75	1.51	14.59	8.64
44	R84	1.03	0.94	0.70	0.66	0.83	0.83	1.01	1.00	1.50	1.42	24.00	19.65
45	RP	0.77	0.76	0.71	0.68	0.95	0.93	0.98	0.98	1.12	1.16	36.36	27.61
46	R86-R87_88	1.10	1.08	0.71	0.68	0.80	0.79	1.00	0.98	1.61	1.64	37.78	22.04
47	R94	1.21	1.36	0.72	0.69	0.76	0.71	0.98	0.99	1.77	2.06	20.82	15.27
48	R96	0.93	0.81	0.69	0.66	0.86	0.90	1.00	1.00	1.36	1.23	23.60	18.34
49	RT	0.68	0.66	0.68	0.66	1.00	1.00	1.00	1.00	1.00	1.00	67.71	56.81

In particular, the examination of the values of the above indices shows that, during the period 2000-2010, the Greek economy has a significant number of sectors that are strongly interconnected, both on a horizontal and a vertical level. These sectors, that can be characterized as leadership, have a particular weight in product formation and can be key determinants for the growth of the economy and the improvement of its competitiveness.

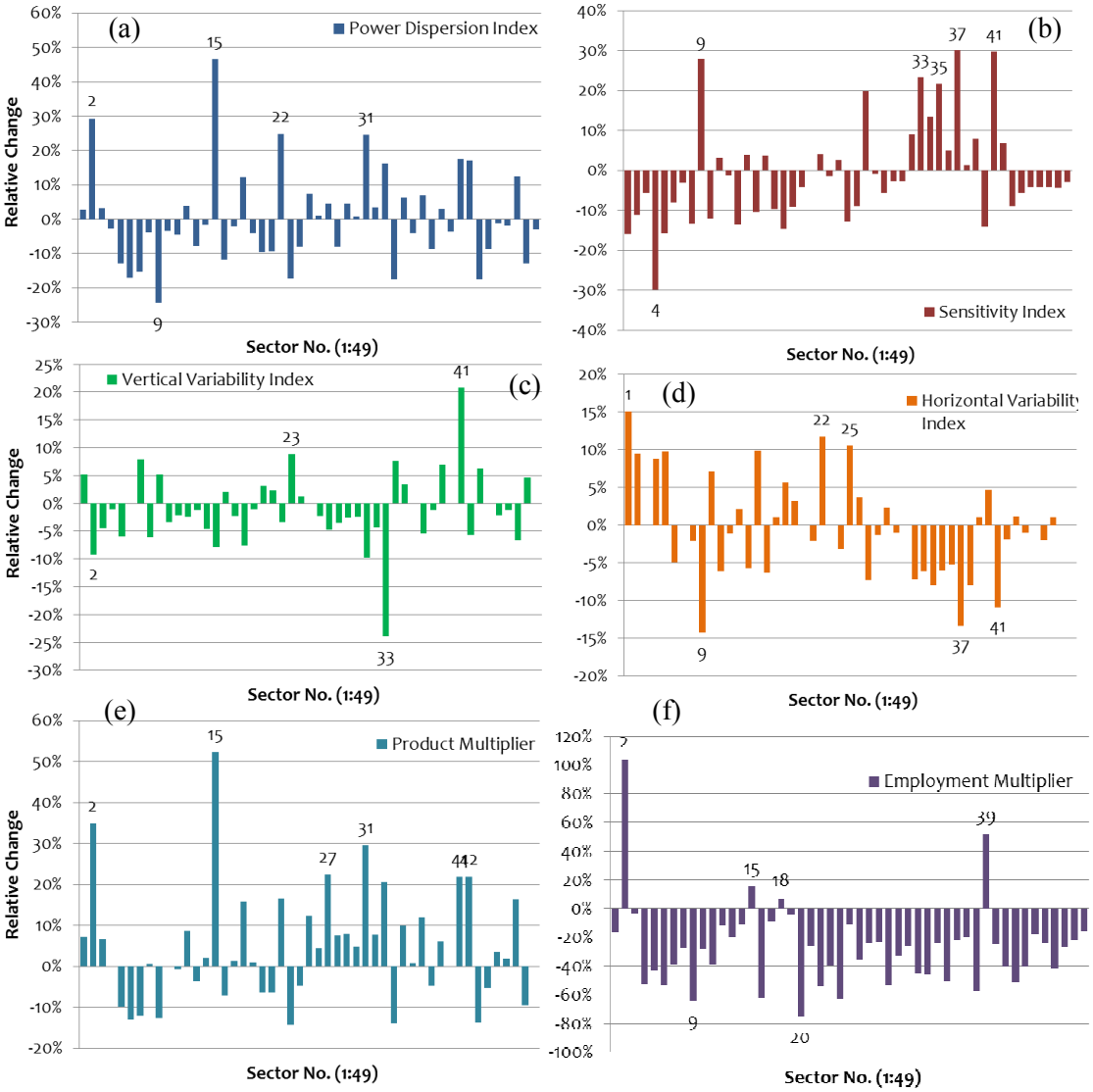
Specifically, between the years 2000 and 2010, there are 7 common sectors that have leading characteristics and are: "Products of agriculture, hunting and related services" (R01), "Coke and refined petroleum products" (R19), "Basic metals" (R24), "Wholesale and retail trade" (R45), and "Professional, scientific and technical services" (R69_70-R71-R73-R74_75-R78-RR80_82). Moreover, for the year 2000, as key-sectors is considered "Food products, beverages and tobacco products" (R10_12), while for the year 2010 the sectors "Electricity, gas, steam and air-conditioning" (RD) and "Postal and telecommunication services" (R53-R61).

From the survey of output multipliers, it is noted that, for the year 2000, the sectors with the largest output multipliers are "Food and beverages and tobacco products" (R10_12), "Wood and products of wood and cork" (R16), "Basic metals" (R24) and "Construction and construction works" (RF. The last two sectors maintained high values in output multipliers in year 2010, showing an increase compared to 2000. In general, in the year 2010, 30 sectors show an increase in output multipliers, with the most significant increases being observed in the sectors "Air transport services" (R51), "Fabricated metal products" (R25), "Products of forestry, logging and related services" (R02), "Professional, scientific and technical services" (R69_70-R71-R73-R74_75-R78-RR80_82) and "Scientific research and development services" (R72). On the contrary, the largest decreases were observed in the sectors "Rental and leasing services" (R77), "Accommodation and food services" (RI), "Natural water; water treatment and supply services" (R36) and "Wood and of products of wood and cork" (R16).

Concerning employment multipliers, the highest values for 2000 are observed in the sectors "Products of agriculture, hunting and related services" (R01), "Services of households as employers" (RT), "Wholesale and retail trade" (R45) and "Wood and of products of wood and cork" (R16). These sectors maintain high values in 2010, while the top of the list is the "Products of forestry, logging and related services" (R02) sector, showing a significant increase in the period 2000-2010. It is noteworthy that in the period 2000-2010 only 4 sectors ("Products of forestry, logging and related services" (R02) , "Machinery and equipment nec" (R28), "Services auxiliary to financial services and insurance services" (R66)) show an increase in employment multiplier values.

Finally, Figure 2 shows the distribution (along the 49 examined sectors) of the relative changes, for the power dispersion index (a), the sensitivity index (b), the vertical variability index (c), the horizontal variability index (d), the product multiplier (e), and the employment multiplier (f). Relative changes were computed for the years 2000 and 2010 on data shown in Table 3. In the diagrams of figure 2, outlier values are labeled separately for positive and negative cases.

Figure 2. Relative changes [(xβ-xα)/xα] distribution of the (a) power dispersion index, (b) sensitivity index, (c) vertical variability index, (d) horizontal variability index, (e) product multiplier, and (f) employment multiplier, computed on data of Table 3 for the years α=2000 and β=2010. Case labels are sector numbers shown in Table 1.



The results of Figure 2 show that outlier values that are counted more than once in these 6 (a-f) available diagrams are sectors with numbers (codes are shown in brackets) 2 (R02), 9 (R18-R58), 15 (R25), 22 (RD), 31 (R51), 33 (R53-R61), 37 (R64), and 41 (R69_70-R71-R73-R74_75-R78-RR80_82). These sectors appear more sensitive than the others to the relative changes captured for the years 2000 and 2010, indicating possible sectors where planning of appropriate policies should focus on.

4. Conclusions

Economic development is essentially a process of activities re-organizing themselves in such a way that they will grow and lead to an increase of total output. Structural changes should be considered as a necessary condition for further growth and therefore it is a cause of economic growth and not an outcome.

This article examined the structural changes of the Greek economy at the period prior to economic crisis (2000-2010), with techniques based on input-output analysis, which is an important methodological tool interpreting, inter alia, the functionality of an economic system. According to the structural decomposition analysis (SDA), at that period, an amount of 83.67% of the Greek economy's productive sectors witnessed an increase in their gross output. The most significant increases occurred in the tertiary sector, an particularly in the "Professional, scientific and technical services" (R69_70-R71-R73-R74_75-R78-RR80_82),

"Real estate services" (RL), and "Wholesale and retail trade" (R45) sectors. Based on the examination of the influence of final demand and of technical coefficients on the output, it is noted that the effect of the technical coefficients on the growth of Total Gross Product is weaker in comparison with the effect of final demand. Sectors that have a positive effect on the change in total production due to the change in technical coefficients are fewer in number than the sectors that contribute to the increase in total gross product due to the change in final demand.

The results of the Left Causative Matrix analysis showed that for a significant number of sectors (18 out of 49 sectors), the effects of final demand are increasingly individually internalized. In addition, for nearly half of the sectors, an increased impact on their product was observed, which was caused by the change of the final demand in the other sectors.

The analysis overall showed that in the last few years there have been emerging new sectors with a leading role in the tertiary sector (e.g. the "Postal and telecommunication services" (R53-R61)), whereas the secondary sector (e.g. textiles, wearing apparel and leather products) appeared to lose the momentum developed in the past years.

Overall, the analysis revealed that, at the period 2000-2010, some of the productive sectors of the Greek economy have (to some extent) undergone changes in their structure. Based on the current circumstances and on the economic crisis recently affected Greece, the ultimate goal of policymakers should focus on the productive reconstruction of the Greek economy through the structural and technological transformation of the productive system of the country, in order to create a strong, competitive, and sustainable economy. The resources allocation should focus on the development of the leading sectors and on the sectors producing the highest multiplier effects. These sectors should formulate the decision variables in the planning of appropriate policies. By strengthening the interdependencies of the dominant sectors, in the first instance lay the foundations for creating and maintaining a strong productive web with the ultimate goal of development of the Greek economy and exit from the crisis.

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ANALYSIS ON TRAVEL EXPENDITURE BY OCCUPATION FOR JAPAN DOMESTIC TRAVEL

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Abstract

There is growing interest in the travel market with its significant impact on the economy and society. This paper attempts to provide some insight to the Japan domestic travel market by analysing the travel related purchasing behaviour by occupation. It examines travel related expenditure covering five consumption items for domestic travel with and without overnight stays by Japan residents. The occupations examined are management; professionals and engineers; administration; retail, service and security; agriculture, lumbering, fishing; manufacturing, transport, construction, field work; housewives; students; retired and unemployed. The results find that the greatest difference by occupation is the partiality agriculture, lumbering and fishing and housewives have towards package tours, holidays and vacation for travel with and without overnight stays. Concerning travel with overnight stays, management, professionals and engineers exhibited similar purchasing behaviours and for travel without overnight stays, professionals, engineers, administration retail, service and security displayed similar preferences. Students showed an exceptionally strong partiality towards entrance and attraction expenditure when travelling without overnight stays. Another significant result is the weak preference by management for travel gifts and shopping. The purchasing behaviour of manufacturing, transport, construction and field work were the closest to the average traveller.

Keywords: occupation, travel expenditure, consumption item, Japan domestic overnight travel

JEL classification: J10, Z30, Z33

1. Introduction

There is growing interest in the travel market with its significant impact on the economy and society. In Japan, with travel listed as a focus market for development according to the Tourism-based Country Promotion Basic Act (Japan Tourism Agency, 2017), there is growing need to understand the trend of the travel industry.

In order to understand the market of an industry, demographic variables are often applied in the analysis since it is straightforward to measure the variables and they reflect the preference and behaviours of the consumers (Kotler and Keller, 2006). There are numerous past studies using demographic variables (e.g. Rendon, 2003; Kuris and Bortoleto, 2011). They have also been examined in past studies on travel and tourism to understand motivation, preference and behaviour patterns (e.g. Crask, 1981; Merci and Hunt, 1998; Heung et al., 2001; Johns and Gyimóthy, 2002; Tsiotsou and Vasioti, 2006; Jönsson and Devonish, 2008; Katsoni et al., 2011; Hasanagas et al., 2018)

This paper examines occupation as the demographic variable considering the impact it may have on leisure time, income and social status which may affect travel. Occupation is often included as a demographic variable to study travel. Woodside and Pitts (1976) include occupation in their study on predicting travel behaviour. Occupation is often seen in studies that focus on specific type of travel such as sport tourism and mountain tourism (Daniels, 2004; Daniels et al., 2004; Fredman, 2008). Jang et al. (2004) examine socio-demographic and trip-related variables which find occupations as having a significant effect on travel expenditures by Japanese travellers to the United States. However, research on Japan domestic tourism which examines occupation is limited. There is the study by Furuya et al. (2008) which focuses on Chinese, Korean and Japanese businessmen and public servants and examines the media that the tourist information was obtained, the frequency of domestic travel and overseas travel based on type of travel. Study by JTB (2015) examines occupation to analyse the motivation of domestic and international travel, which find businessmen the

most eager and housewives the least motivated towards domestic travel in Japan. Development Bank of Japan and Japan Economic Research Institute (2017) study by occupation, the length of stay for domestic business travel; the size of share of business travel within all domestic travel; and the business travel expenditure per night of travel. They find that managerial positions and manufacturing have the longest stay as well as the largest share of business travel and agriculture and management were found to have the highest expenditure per night of travel. However, past studies have not comprehensively covered the preference for type of travel expenditure by occupation. This paper will cover the total number of purchases per consumption item by occupation for domestic travel with and without overnight stays. The paper aims to supplement past research by focusing on the following areas. First, it will study each consumption item to examine the occupations that have a partiality towards the consumption item and compare the differences. It will then focus on each occupation to compare the strength of the partiality towards each consumption item. This will be conducted for both travel with and without overnight stays. Secondly, it will examine partialities towards each consumption item for travel with and without overnight stays to identify occupations with similar results. It will then categorize each occupation depending on the difference in partiality compared to the average of all travellers. Next, each occupation will be studied to understand which consumption items have similar results for both travel with and without overnight stays. The consumption items will be categorized based on the strength of the preference compared to the overall average. Finally, for each occupation, it will examine whether the partiality towards each consumption item is stronger for travel with or without overnight travel.

The next section will cover the methodology and data and the third section will provide the results. The fourth section will discuss the main findings from the results, followed by the conclusion which will provide some policy implications and future research questions.

2. Methodology and Data

This paper studies the Japan domestic travel market by looking at the share of all travellers' purchases of each consumption item to identify any differences by occupation of the traveller. This paper applies the data from the Tourist Consumption Trend Report from 2012 to 2017 made available from the Japan Tourism Agency (2018) concerning the total number of purchases during travel per consumption item and by occupation. The data is used to examine the cases of travel with and without overnight stays for the domestic travel market by Japan residents. There are nine occupations covered by the data, which are *management*; professionals and engineers (*professionals*); *administration*; retail, service and security (*retail*); agriculture, lumbering, fishing (*agriculture*); manufacturing, transport, construction, field work (*manufacturing*); *housewives*; *students;* retired and unemployed (*retirees*). Concerning the travel related consumption items, they are categorized into the following six. Consumption items for travel with overnight stays are, package tours, holidays and vacation expense (*package*); transportation (*transportation*); *accommodation*; food and drink (*food&drink*); 'omiyage - travel gifts' and shopping expense (*souvenir*); and entrance and attraction expense (*attraction*). The consumption items for the case without overnight stays will be the same five items excluding the *accommodation*.

The analysis is conducted as follows. First, we will calculate the share of the number of total purchases for each consumption item for all travellers.

$$D_{Ji}^{c} = \frac{X_{Ji}^{c}}{X_{JI}^{c}} \quad (1)$$

Here, X represents the total number of purchases of the consumption item during domestic travel. i represents the consumption item, I refers to the total consumption items and J is total occupations. c represents the cases (o) with overnight stays or (d) without.

Next, the share of consumption item by occupation will be determined.

$$D_{ji}^{c} = \frac{X_{ji}^{c}}{X_{jI}^{c}} \quad (2)$$

Here, occupation is depicted by *j*. By dividing (2) by (1), the size of the share of consumption item by occupation relative to the total travellers' share by (relative share of consumption item by occupation) can be compared. Hence, in (3) below, the relative share of consumption item by occupation is represented.

$$P_{ji}^{c} = \frac{D_{ji}^{c}}{D_{jt}^{c}} \quad (3)$$

If the partiality is calculated based on only one fiscal year, there is the risk of an impact specific to that fiscal year and the value becomes unreliable. In order to address this possibility, this study adopts the mean for 2012 to 2017. When P_{ji}^{c} is larger than 1, then the share for that consumption item by the occupation is greater than the average share; when it is less than 1, then the share by the occupation is less than the average; and when it is 1, then the share by the occupation is equivalent to the average. Here, we will define $P_{ji}^{c} < 0.667$ as 'very weak', $0.667 \leqq P_{ji}^{c} \leqq 0.909$ as 'weak', $0.909 < P_{ji}^{c} < 1$ as 'slightly weak', $1 < P_{ji}^{c} < 1.1$ as 'slightly strong', $1.1 \leqq P_{ji}^{c} < 1.5$ as 'strong' and $1.5 \leqq P_{ji}^{c}$ as 'very strong'. Since $P_{ji}^{c} = 1$ is not found in any of the results, it will be omitted. In the annotations of Table 3, and 4, the P_{ji}^{c} is represented as *PF*.

The partiality value provided above will first be compared amongst the occupations for each consumption item. In order to analyse the dispersity of the partiality for each consumption item amongst the occupations, we will measure the standard deviation of the partiality amongst the occupations. Such comparison would help marketers with their strategy when considering their target audience. In order to understand the largest difference in preference amongst occupations, a comparison was made between the occupation that shows the greatest preference with the one that shows the least. Since the results were consistent with the standard deviation analysis, taking into consideration of space, they have been omitted from this paper. Next, for each occupation, the partiality value will be compared amongst the consumption items. The dispersity concerning partiality amongst consumption items by an occupation will be analysed by measuring the standard deviation of the partiality between consumption items. The aim of the analysis is to provide opportunities for the various travel related providers to cooperate and gain synergy. The analysis is applied to cases with and without overnight stays, which will enable the examination of any differences or similarities between occupations concerning the partiality of each consumption item for travel with and without overnight stays. As well as study any differences and similarities between the consumption items for each occupation for travel with and without overnight stays, it will further focus on each consumption item to identify occupations where the strength of the partiality changes depending on whether the travel includes overnight stays or not. This is depicted in the following equation.

$$R^{c} = \frac{P_{ji}^{o}}{P_{jt}^{a}} \quad (4)$$

If the value is greater than 1, then partiality is stronger for travel with overnight stays and if it is less than 1, it is stronger for travel without overnight stays. From equation (4) which depicts the partiality value for travel with and without overnight stays, if $R^{c} < 0.667$ is defined as 'very weak', then $0.667 \leqq R^{c} \leqq 0.909$ will be 'weak', $0.909 < R^{c} < 1$ will be 'slightly weak', $1 < R^{c} < 1.1$ will be 'slightly strong', $1.1 \leqq R^{c} < 1.5$ will be 'strong' and $1.5 \leqq R^{c}$ will be 'very strong'. Since $R^{c} = 1$ is not found in any of the results, it will be omitted.

3. Results

In this section, we will analyse the purchasing behaviour for each domestic travel related consumption item by occupation.

Table 1. Travel purchase partiality with overnight travel

	Pk	Tp	Ac	FD	Sv	At	S.D. among Consumption Items	
Management	0.887	1.018	1.177	1.051	0.899	0.816	0.132	(3)
Professionals	0.749	1.006	1.115	1.078	0.992	0.964	0.128	(4)
Administration	0.900	1.016	1.094	1.093	1.051	1.069	0.073	(8)
Retail	0.833	0.987	1.046	1.050	1.009	0.984	0.079	(6)
Agriculture	2.194	1.002	0.819	0.769	1.032	1.020	0.529	(1)
Manufacturing	0.856	1.012	0.957	0.981	0.998	0.967	0.055	(9)
Housewives	1.125	1.034	0.943	0.976	1.084	1.121	0.076	(7)
Students	1.306	0.969	0.834	0.921	0.965	1.063	0.163	(2)
Retirees	1.155	0.972	0.889	0.884	0.981	0.984	0.098	(5)
S.D. among Occupations	0.445 (1)	0.022 (6)	0.128 (2)	0.106 (3)	0.053 (5)	0.087 (4)		

Pk: Package, Tp: Transportation, Ac: Accommodation, FD: Food&Drink, Sv: Souvenir, At: Attraction.
Number in parentheses represent the rank order
S.D. represents Standard Deviation

First, domestic travel for the case with overnight stays will be observed. We will investigate the partiality for each consumption item by occupation relative to the average of all travellers. In Table 1, concerning partiality towards *package*, *agriculture* shows a value of 2.194 which is the largest amongst all occupations by far and *professionals* shows the least partiality at 0.749. The dispersity of the partiality towards *package* is the largest amongst all consumption items at 0.445. Next, concerning *transportation*, *housewives* have the strongest partiality at 1.034 and the *students* the least at 0.969. The dispersity amongst occupations is smallest amongst the consumption items at 0.022. Concerning *accommodation*, *management* shows the strongest partiality at 1.177 and *agriculture* the weakest at 0.819. The dispersity concerning the partiality towards *accommodation* is the second largest amongst the consumption items at 0.128. *Food&drink* partiality by *administration* is the strongest at 1.093 and *agriculture* the weakest at 0.769. The dispersity of partiality for *food&drink* is the third largest amongst the six items at 0.106. For *souvenir*, *housewives* show the strongest partiality at 1.084 and *management* the weakest at 0.899. The dispersity amongst the occupations for *souvenir* is the second smallest amongst the items at 0.053. Finally, the partiality towards *attraction* is strongest amongst *housewives* at 1.121 and the weakest with *management* at 0.816. The dispersity of the partiality amongst occupations for *attraction* is the fourth largest at 0.087.

Next, we will examine each occupation and compare the partiality towards each consumption item with the average of all travellers. From Table 1, *management* and *professionals* show weaker partiality than the total average towards *package, souvenir* and *attraction*. However, they show stronger partiality than the total average for *transportation*, *accommodation* and *food&drink*. The partiality towards *accommodation* are especially strong. *Administrators* have a slightly weaker than average partiality towards *package*, but a slightly stronger than average towards the other five consumption items. *Retail* show weak partiality towards *package*, *transportation* and *attraction* with *package* being very weak. However, it shows slightly stronger than the average partiality towards *accommodation*, *food&drink* and *souvenir*. The partiality towards *package* by *agriculture* is very strong and it shows a slightly higher than average partiality towards *transportation*, *souvenir* and *attraction*. However, less than average partiality towards *accommodation* and *food&drink* are identified. *Manufacturing* shows a much weaker than average partiality towards *package* and a slightly less than average towards *accommodation*, *food&drink*, *souvenir* and *attraction*. However, the partiality towards *transportation* is slightly stronger than the average. The partiality towards *package*

and *attraction* by *housewives* are stronger than the average and slightly stronger for *souvenir* and *transportation*, though slightly weaker than average for *accommodation* and *food&drink*. *Students* show a strong partiality towards *package* and slightly stronger partiality for *attraction*, but a weaker than average towards *transportation*, *accommodation*, *food&drink* and *souvenir*. The partiality towards *accommodation* is especially weak. *Retirees* show a strong partiality towards *package*, but less than average for all other consumption items, especially *accommodation* and *food&drink*. The dispersity of partiality amongst the consumption items in order of size is *agriculture*, which is very large, followed by *students.* The third largest is *management*, followed closely by *professionals* and then *retirees*. *Retail*, *housewives* and *administration* show very little difference. The least is *manufacturing*.

The next section will examine the case without overnight stays for domestic travel in Japan. We will first observe the partiality for each consumption item by occupation relative to the average of all travellers.

Table 2. Travel purchase partiality without overnight travel

	Pk	**Tp**	**FD**	**Sv**	**At**	S.D. among Consumption Items	
Management	0.497	1.070	0.995	0.805	0.648	0.238	(4)
Professionals	0.510	1.071	1.069	0.930	0.911	0.230	(6)
Administration	0.660	1.038	1.102	0.971	0.999	0.171	(7)
Retail	0.779	1.041	1.047	0.981	1.003	0.110	(8)
Agriculture	2.175	0.832	0.855	1.113	0.928	0.567	(1)
Manufacturing	0.794	1.026	1.016	1.050	1.043	0.108	(9)
Housewives	1.799	0.922	0.924	1.148	1.032	0.367	(2)
Students	0.774	0.979	1.065	1.018	1.410	0.230	(5)
Retirees	1.592	0.913	0.856	1.047	1.012	0.294	(3)
S.D. among Occupations	0.621 (1)	0.083 (5)	0.093 (4)	0.102 (3)	0.196 (2)		

Pk: Package, Tp: Transportation, Ac: Accommodation, FD: Food&Drink, Sv: Souvenir, At: Attraction.
Number in parentheses represent the rank order
S.D. represents Standard Deviation

From Table 2, the partiality towards *package* by *agriculture* is the strongest amongst all occupations by far at 2.175 and the weakest partiality is at 0.497, by *management,* which is very low. The largest dispersity concerning partiality of consumption item by occupation is also seen in *package* at 0.621. There is a partiality towards *transportation* by *professionals* at 1.071 which is the strongest amongst all occupations and the weakest partiality is seen by *agriculture* at 0.832. However, the dispersity concerning the partiality towards *transportation* is the smallest amongst all consumption items at 0.083. Concerning *food&drink*, *administration* shows the strongest partiality at 1.102 and *agriculture* the weakest at 0.855. The dispersity concerning partiality amongst occupations for *food&drink* is 0.093 which is the second smallest amongst the five consumption items. *Housewives* shows the strongest partiality towards *souvenir* at 1.148 and *management* the weakest at 0.805. The dispersity amongst occupations is 0.102, which is the third largest amongst the five consumption items. Finally, concerning *attraction*, *students* show the strongest partiality at 1.410 and *management* the least at 0.648 which is very low. The dispersity amongst occupations for *attraction* is the second largest amongst all the consumption items at 0.196.

Next, we will observe each occupation and compare the partiality towards each consumption items with the average of all travellers. Table 2 shows that the *managements*' partiality towards *package*, *food&drink*, *souvenir* and *attraction* is lower than the total average, with very weak partiality towards *package* and *attraction*. Results for *souvenir* is also weak. However, the results for *transportation* is slightly higher than the total average. *Professionals* and *administration* show a lower than average partiality towards *package, souvenir* and *attraction*, with very weak partiality towards *package*. They have a slightly

higher than average partiality towards *transportation* and *food&drink*. *Retail* also has a weak partiality towards *package* and slightly lower than average for *souvenir*. However, *retail* show a slightly higher than average towards *transportation*, *food&drink* and *attraction*. *Agriculture* partiality towards *package* is very high compared to the average and partiality for *souvenir* is strong. On the other hand, the partiality for *transportation* and *food&drink* by *agriculture* is particularly weak and partiality towards *attraction* is slightly lower than the average. *Manufacturing* shows a lower than average partiality for *package* and a slightly higher than average for all other consumption items but no noticeable difference amongst them. *Housewives* show a particularly strong partiality towards *package*, higher than average for *souvenir* and slightly higher for *attraction*. However, they show a slightly lower than average partiality for *transportation* and *food&drink*. *Students* have a strong partiality for *attraction* and slightly higher than average for *food&drink* and *souvenir*. The partiality towards *package* is lower than the average and a slightly lower than average for *transportation*. The partiality of *retirees* shows a similar trend to *housewives* with a very strong partiality for *package* and slightly higher than average for *souvenir* and *attraction*. The weak partiality for *food&drink* and slightly lower than average partiality for *transportation* is also similar. The largest dispersity in partiality for consumption items by far is seen by *agriculture*, with *housewives* in second, *retirees* in third. There were no significant differences amongst the fourth to the sixth, which were *management*, *students* and *professionals*. This was followed by *administration.* The difference between the eighth, *retail* and the last, *manufacturing*, was minimal.

In order to observe similarities amongst occupations concerning their preferences for consumption items based on travel with and without overnight stays, the results from Table 1 and 2 have been classified in Table 3 based on the strength of the partiality by the occupation against the average of all travellers. The aim of this analysis is to identify occupations with similar spending behaviour.

Table 3. Partiality of consumption items by occupation compared to the overall average

		Higher than Total Average			Lower than Total Average		
		Slightly High	High	Significantly High	Slightly Low	Low	Significantly Low
Management	With	**Tp**, FD	Ac			***Pk***, Sv, ***At***	
	Without	**Tp**			FD	**Sv**	***Pk***, ***At***
Professionals	With	**Tp**, **FD**	Ac		**Sv**, **At**		**Pk**
	Without	**Tp**, **FD**			**Sv**, **At**		**Pk**
Administration	With	**Tp**, Ac ***FD***, Sv, At			***Pk***		
	Without	**Tp**	***FD***		Sv, At		***Pk***
Retail	With	Ac, **FD**, Sv			Tp、At	**Pk**	
	Without	Tp, **FD**, At			Sv	**Pk**	
Agriculture	With	Tp, ***Sv***, At		**Pk**		Ac, **FD**	
	Without		***Sv***	**Pk**	At	Tp, **FD**	
Manufacturing	With	**Tp**			Ac, FD, Sv, At	**Pk**	
	Without	**Tp**, FD, Sv, At				**Pk**	
Housewives	With	Tp, ***Sv***	***Pk***, ***At***		Ac, **FD**		
	Without	***At***	***Sv***	***Pk***	Tp, **FD**		
Students	With	***At***	Pk		**Tp**, FD, Sv	Ac	
	Without	FD, Sv	***At***		**Tp**	Pk	
Retiree	With		***Pk***		**Tp**, Sv, At	Ac, **FD**	
	Without	Sv, At		***Pk***	**Tp**	**FD**	

* Pk: *Package*, Tp: *Transportation*, Ac: *Accommodation*, FD: *Food&Drink*, Sv: *Souvenir*, At: *Attraction.*

** Slightly High: 1.0<PF<1.1, High: 1.1≦PF<1.5, Significantly High: 1.5≦PF, Slightly Low: 0.9<PF<1.0, Low: 0.667≦PF≦0.9, Significantly Low: PF<0.667.

*** Bold: represents that the results for travel with and without overnight stays are the same.

Bold & Italic: represents that the results for travel with and without overnight stays are in the similar range.

Table 3 shows that for *package*, *agriculture*, *housewives* and *retirees* have higher than average partiality and *management*, *professionals*, *administration*, *retail* and *manufacturing* are all below the total average for travel with and without overnight stays. Concerning *transportation*, for both travel with and without overnight stays, *management*, *professional*, *administration* and *manufacturing* are all in the 'slightly high' category and *students* and *retirees* in the 'slightly low'. *Retail* are in the 'slightly high' category for travel without overnight stays, but 'slightly low' with overnight travel. *Agriculture* and *housewives* have a 'slightly high' result for travel with overnight stays, but a lower than average for travel without. Concerning *food&drink*, for both travel with and without overnight stays, *professionals* and *retail* are in the 'slightly high' category and *administration* also shows a higher than average result. *Agriculture* and *retirees* are in the 'low' category and *housewives* display 'slightly low' results. *Management* shows a 'slightly high' result with overnight travel, but a 'slightly low' without. *Manufacturing* and *students* display opposite results with 'slightly low' for travel with overnight stays and 'slightly high' without overnight stays. Concerning *souvenir*, for both travel with and without overnight stays, *agriculture* and *housewives* have higher than average results. *Management* are in the 'low' category and *professionals* in the 'slightly low'. *Administration* and *retail* show 'slightly high' results for travel with overnight stays, but 'slightly low' for without. On the other hand, *manufacturing*, *students* and *retirees*, are in the 'slightly low' category for travel with overnight stays, but 'slightly high' without. For *attraction*, for both travel with and without overnight stays, both *housewives* and *students* show higher than average results, but *management* are below the average. *Professionals* show a 'slightly low' result. *Administration* and *agriculture* are in the 'slightly high' category for travel with overnight stays, but 'slightly low' without. *Retail,*

manufacturing and *retirees* show the opposite results, with 'slightly low' for travel with overnight stays and 'slightly high' for travel without.

Results from Table 1 and 2 have been classified in Table 4 based on the partiality of each consumption item against the average of all travellers. The aim of this analysis is to identify consumption items that can be marketed together.

Table 4. Comparison of partiality between occupations for each consumption item

		Higher than Total Average			Lower than Total Average		
		Slightly High	**High**	**Significantly High**	**Slightly Low**	**Low**	**Significantly Low**
Package	With		***Hw*** , St, ***Rt***	**Ag**	***Adm***	***Mgr*** , ***Pr*** , **Re**, ***Ma***	
	Without			**Ag**, ***Hw*** , ***Rt***		***Re*** , ***Ma*** , St	***Mgr*** , ***Pr*** , ***Adm***
Transportation	With	**Mgr**, **Pr**, **Adm**, Ag, **Ma**, Hw			Re, **St, Rt**		
	Without	**Mgr**, **Pr**, **Adm**, Re, **Ma**			Hw, **St, Rt**	Ag	
Accommodation	With	Adm, Re	Mgr, Pr		Ma, Hw	Ag, St, Rt	
	Without						
Food & Drink	With	Mgr, **Pr**, ***Adm*** , **Re**			Ma, **Hw**, St	**Ag**, **Rt**	
	Without	**Pr**, **Re**, Ma, St	***Adm***		Mgr, **Hw**	**Ag**, **Rt**	
Souvenir	With	Adm, Re, ***Ag*** , ***Hw***			**Pr**, Ma, St, Rt	**Mgr**	
	Without	Ma, St, Rt	***Ag*** , ***Hw***		**Pr**, Adm, Re	**Mgr**	
Attraction	With	Adm, Ag, ***St***	***Hw***		**Pr**、Re、Ma、Rt	***Mgr***	
	Without	Re, Ma, ***Hw*** , Rt	***St***		**Pr**、Adm、Ag		***Mgr***

* Mgr: *Management* , Pr: *Professional* , Adm: *Administration* , Re: *Retail* , Ag: *Agriculture* , Ma: *Manufacturing* , Hw, *Housewives* , St: *Students* , Rt: *Retiree.*

** Slightly High: 1.0<PF<1.1, High: 1.1≦PF<1.5, Significantly High: 1.5≦PF, Slightly Low: 0.9<PF<1.0, Low: 0.667≦PF≦0.9, Significantly Low: PF<0.667.

*** Bold: represents that the results for travel with and without overnight stays are the same.

Bold & Italic: represents that the results for travel with and without overnight stays are in the similar range.

From Table 4, we can observe *management* in the 'slightly high' category for partiality towards *transportation* but in the 'low' for *souvenir* for both travel with and without overnight stays. The partiality for *package* and *attraction* are also lower than the average, with very weak partiality when the travel does not include overnight stays. *Professional* was found to have consistent results for travel with and without overnight stays. The results are *transportation* and *food&drink* in the 'slightly high' category, *souvenir* and *attraction* in the 'slightly low' category and *package* in the 'very low'. *Administration* shows for both travel with and without overnight stays higher than average partiality for *transportation* and *food&drink*, but a lower than average for *package. Souvenir* and *attraction* show slightly higher than average partiality for overnight stays but slightly lower than average for travel without overnight stays. Results for *retail* for both travel with and without overnight stays indicate *food&drink* in the 'slightly higher' category and *package* in the 'low'. *Transportation* and *attraction* indicate slightly higher than average partiality for travel without overnight stays, but slightly lower than average with overnight stays. *Souvenir* shows a slightly higher than average partiality for travel with overnight stays but a slightly lower partiality without. *Agriculture* shows a very strong partiality towards *package* for both travel with and without overnight stays as well as a higher than average for *souvenir*. However, *food&drink* is identified as lower than average partiality for both travel with and without overnight stays. *Transportation* and *attraction* show a higher than average partiality for travel without overnight stays but a slightly lower than average with overnight stays. For *manufacturing*, *transportation* shows a slightly higher than average partiality for both travel with and without overnight stays and a lower partiality for *package*. *Food&drink*, *souvenir* and *attraction* show a slightly higher than average partiality for travel without overnight stays but a slightly lower than average for travel with overnight stays. *Housewives* can be observed to have a higher

than average partiality for *package, souvenir* and *attraction* with a slightly lower than average for *food&drink* for both travel with and without overnight stays. *Transportation* partiality is slightly higher for travel with overnight stays but slightly lower for travel without. *Students* appear to prefer *attraction* with a higher than average for both travel with and without overnight stays, while *transportation* shows a slightly lower than average. *Package* shows a strong partiality with overnight stays but weak partiality without. *Food&drink* and *souvenir* are slightly higher than average without overnight stays but slightly lower than average with overnight stays. *Retirees* results show a higher than average partiality for *package* regardless of overnight stays, but a 'low' partiality for *food&drink*. *Transportation* is in the 'slightly low' category. *Souvenir* and *attraction* partiality are slightly higher than average without overnight stays and slightly lower with overnight stays.

Finally, we will examine whether the partiality towards each consumption item is stronger for travel with or without overnight travel.

Table 5. Ratio of with/without overnight travel

	Pk	**Tp**	**FD**	**Sv**	**At**
Management	1.787	0.951	1.057	1.117	1.259
Professionals	1.467	0.939	1.008	1.068	1.058
Administration	1.363	0.979	0.992	1.082	1.071
Retail	1.069	0.948	1.003	1.028	0.980
Agriculture	1.009	1.204	0.899	0.927	1.100
Manufacturing	1.078	0.986	0.965	0.951	0.927
Housewives	0.625	1.121	1.057	0.944	1.086
Students	1.687	0.990	0.865	0.948	0.754
Retiree	0.725	1.065	1.033	0.937	0.972

Pk: *Package* , Tp: *Transportation* , Ac: *Accommodation* , FD: *Food&Drink* , *Sv: Souvenir, At: Attraction* .

First, we will examine each consumption for occupations where there is a difference in partiality depending on travel with or without overnight stays. The results in Table 5 indicate that for *package*, *management* and *students* have a much stronger partiality when the travel includes overnight stays as well as *professionals* and *administration* showing a stronger partiality. *Retail*, *agriculture* and *manufacturing* also show a slightly stronger partiality with overnight stays. However, *housewives* show a very strong partiality for *package* when the travel does not include overnight stays and *retirees* show a strong partiality. For *transportation*, *agriculture* and *housewives* show a stronger partiality when the travel includes overnight stays and *retirees* also show a slightly stronger partiality. The results differ for *management*, *professionals*, *administration*, *retail*, *manufacturing* and *students*, where they all show a slightly stronger partiality for *transportation* for travel without overnight stays. Slightly stronger partiality for *food&drink* can be observed for travel with overnight stays by *management*, *professionals*, *retail*, *housewives* and *retirees*. On the other hand, results indicated a stronger partiality for *food&drink* by *agriculture* and *students* for travel without overnight stays and a slightly stronger partiality by *administration* and *manufacturing*. For *souvenir*, partiality by *management* for travel with overnight stays is stronger and slightly stronger for *professionals*, *administration* and *retail*. Concerning *souvenir* for travel without overnight stays, *agriculture*, *manufacturing*, *housewives*, *students* and *retirees* all show a slightly stronger partiality. *Attraction* partiality is stronger for travel with overnight stays for *management* and *agriculture* and slightly stronger for *professionals*, *administration* and *housewives*. *Students* show a stronger partiality for *attraction* when travel does not include overnight stays and a slightly stronger partiality by *retail*, *manufacturing* and *retirees*.

Next, we will identify for each occupation the consumption items that show a stronger partiality depending on whether the travel includes overnight stays. Results from Table 5 shows that for travel with overnight stays *management* and *professionals* show a stronger partiality for *package*, *food&drink*, *souvenir* and *attraction*, with very stronger partiality for *package*. For travel without overnight stays, results for *transportation* show slightly stronger

partiality. The consumption items with stronger partiality for travel with overnight stays for *administration* are *package, souvenir* and *attraction*, in particular *package*. For travel without overnight stays, *administration* shows a slightly stronger partiality for *transportation* and *food&drink*. *Retail* shows a slightly stronger partiality for *package*, *food&drink* and *souvenir* with overnight stays and slightly stronger partiality for *transportation* and *attraction* without. The results for *agriculture* show a stronger partiality for *transportation* and *attraction* with overnight stays and a slightly stronger partiality towards *package*. For travel without overnight stays, *agriculture* shows a stronger partiality for *food&drink* and slightly stronger partiality for *souvenir*. For travel with overnight stays, *manufacturing* only shows a slightly stronger partiality for *package*. All other consumption items display a slightly stronger partiality for travel without overnight stays. *Housewives'* results show a stronger partiality for *transportation* and slightly stronger partiality for *food&drink* and *attraction* with overnight stays, while displaying a very strong partiality for *package* and slightly stronger partiality for *souvenir* when there is no overnight stays. Results for *students* are similar to *manufacturing* with very strong partiality towards *package* for travel with overnight stays, as well as stronger partiality for *food&drink* and *attraction* and slightly stronger partiality towards *transportation* and *souvenir* without overnight stays. *Retirees* results indicate slightly stronger partiality for *transportation* and *food&drink* for travel with overnight stays. For travel without overnight stays, strong partiality for *package* and a slightly stronger partiality for *souvenir* and *attraction* can be observed for *retirees*.

4. Discussions

From the results obtained above, the main findings concerning Japan domestic travel from the analysis are as follows.

- The dispersity of the partiality towards *package* is the greatest and most significant, which suggest that multiple strategies may be required to appropriately cover all occupations. Strong partiality can be observed for *agriculture* and *housewives* for both travel with and without overnight stays. This may represent partiality towards travelling in larger groups and a preference for ease of travel and safety. Women have been identified to spend longer hours interacting with others and spend a larger share of their time worrying about safety (Ministry of Internal Affairs and Communications, 2016; Cabinet Office, 2017). For agriculture, this could be influence from rural living where they have stronger ties with their community (Schady, 2001; Ministry of Health, Labour and Welfare, 2006). The aging population of *agriculture* could also be an influential factor, preferring the ease of travel and security provided by package travel (Kaneko, 2013; Cabinet Office, 2017; Ministry of Internal Affairs and Communications, 2017). Weak partiality for *package* was observed by *management*, *professionals, retail and manufacturing*.
- The consumption item with the least dispersity by occupation was *transportation*. This implies that a targeted strategy by occupation may not be necessary for this market.
- The dispersity of the partiality towards *accommodation* was the second greatest. Strong partiality by *management* and *professionals* but weak partiality by *agriculture*, *students* and *retirees*. This may be driven by difference in income level, which would suggest further potential in this market with appropriate products based on different price ranges.
- Partiality towards *food&drink* was lowest amongst *agriculture* and *retirees*.
- The dispersity in partiality of *souvenir* was the least significant after *transportation*. *Souvenir* partiality was weak for both travel with and without overnight stays by *management*, which may suggest that they have a tendency of not purchasing travel gifts.
- Weak partiality was also seen by *management* concerning *attraction* for both travel with and without overnight stays. *Management* will likely have a higher age range and may prefer a different type of leisure activity.
- The occupation that showed the least amount of dispersity amongst the consumption items for both travel with and without overnight stays was *manufacturing*. In other

words, the preference by *manufacturing* is the closest to the average traveller. On the other hand, *agriculture* had the largest dispersity amongst consumption items for both travel with and without overnight stays, which suggests that a specific marketing plan may be required for this occupation.

- Concerning travel with overnight stays, *management* and *professionals* exhibited the most similar partiality towards the consumption items. One reason may be due to similar range in income level. *Agriculture* and *housewives* also showed similar partiality, which may again be due to preference concerning group participation and preference for ease of travel and safety.
- For travel without overnight stays, *professionals*, *administration* and *retail* displayed similar partialities toward the consumption items. *Housewives* and *retirees* also showed similar partialities, which may be due to restraints they have on spending.
- *Management*, *professionals, administration* and *students* all showed stronger partiality towards *package* when the travel included overnight stays compared to without. However, *housewives* and *retirees* exhibited stronger partiality towards *package* when the travel did not include overnight stays.
- *Students* showed an exceptionally strong partiality towards *attraction* when travelling without overnight stays. This suggests that *students* are able to spend on *attraction* when there is no overnight travel expense.

5. Conclusion

This paper attempts to provide some insight to the Japan domestic travel market by analysing the travel related purchasing behaviour for each consumption item by occupation. Policy implications can be obtained from these results. First, the travel industry can benefit from not only the supply side focus of 4P (price, products, place, promotion), but also by focusing on the 4C (consumer value, cost to consumer, convenience, communication), utilizing the results of each occupation and consumption item in its marketing strategies. For example, in order to capitalize on the partiality towards *package* by *agriculture*, marketing communication to this audience with consideration to the type of travel products and services that would be of interest, convenient and affordable would be beneficial. These results could also provide useful insight for marketing and destination marketing/management organizations when they consider the type of traveller, they are interested in attracting. Data based information like this makes it easier to gain cooperation amongst the different stakeholders such as hotels, public transport, restaurants and the local government, since it will help guide strategies for products and services and provide indicators to monitor performance. With the advancement in social media, increasing amount of data to support the tailoring of marketing communication to specific audiences will become more valued. The ability for the travel related industry to strategize and plan based on preference in purchasing behaviour of each occupation and their trends in this way could support them in the demanding need to provide frequently tailored marketing communication through the various media channels now available, which in turn could support the sustainable development of the industry.

Concerning future research, it would be beneficial for similar studies to be conducted in other regions to compare with the results of Japan. For example, are the travel related purchasing behaviour for the occupations of farming, lumbering, fishing and housewives also similar? Other research questions would include analysis on the factors that influence these purchasing behaviours for each occupation and to understand whether different results could be obtained if the travel was broken down into different types of travel such as holiday, business or visiting friends and relatives.

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IS THERE A CAUSALITY RELATIONSHIP BETWEEN LAW ENFORCEMENT, CRIME RATES, AND ECONOMIC GROWTH? AN EMPIRICAL EVIDENCE FROM WESTERN INDONESIA

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Abstract

The economic impact of law enforcement and crime rates empirically has not been widely revealed by researchers. In fact, in general, economic activities can be related to security factors. This study analyzes the influence of law enforcement and crime on economic growth. Using a panel data set of 8 provinces from western Indonesia during the period 2006-2017, the study found that there were no long-run relationships between the three variables. In the short-run, law enforcement and crime rates have a positive and significant effect on economic growth. Law enforcement has a significant and negative effect on crime rates, and vice versa crime rates have a positive and significant effect on law enforcement. The results of the Granger causality test indicate the existence of bidirectional causality between crime rates and law enforcement and between law enforcement and economic growth. Furthermore, unidirectional causality exists running from crime to economic growth.

Keywords: Economic Growth, Law Enforcement, Crime Rates, Panel Vector Autoregressive, and Granger Causality Test.

JEL classification: K14, K42, O47

1. Introduction

Law enforcement is one of the determinants of the success of economic activities. Even it has been essential in assuring long-term economic development (Chen, 1999; Allen et al., 2005). When law enforcement decreases, the condition has an adverse impact on economic activity. In the regions suffering from higher criminal rate, economic actors require the certainty of ownership and business security in order that their asset is secure from criminal acts such as robbery, fraud, and so on. The existence of law enforcement in supporting economic activities as stated by Porath (2006) that the legal aspects of economic activity are an important thing to ensure the activities will be going on night and day properly. Conversely, when law enforcement is low and the criminal level is high, these conditions have a negative impact on economic activity and in turn, can reduce economic growth. A number of research studies have found that the higher law-enforced regions, on average, have higher per capita income than lower law-enforced regions (Bolaky, 2013).

In the context of the regional economy in Indonesia, a study of the relationship between law enforcement, crime rates, and economic growth is interesting to analyze. Based on the report of the Indonesian Central Bureau of Statistics in 2012-2016, a number of regions in Indonesia are suffering from high crime rates, especially in western Indonesia. The law enforcement in the area is also relatively different between one province and another. In this study, law enforcement is proxied from the level of the settlement of criminal cases (crime clearance), namely the ratio of criminal cases resolved by the court in a certain period of time

with a total of criminal cases that occurred in the area at the same time. Furthermore, the level of economic growth in each province in western Indonesia is also relatively different from one and another (Amri, 2018). This is indicated by the annual per capita income of the respective province. In 2006, the highest per capita income province is Sumatera Utara of IDR7,427.09 million per year, then followed by Riau province in the second with per capita income of IDR7,512.51 thousand per year. Conversely, the lowest per capita income province is Bengkulu of Rp.4,496.06 thousand. Until 2015 both Sumatera Utara and Riau provinces are still be first and second highest per capita income province in western Indonesia, respectively. If the economic growth of the region can be associated with non-economic aspects such as crime and law enforcement, it is important to analyze the causal relationship between the three variables.

The study on the relationship between law enforcement, crime, and economic growth has been carried out by many economic researchers. However, the empirical evidence they found is still a contradiction between one study and another. Empirical evidence regarding the relationship between crime and economic growth, for example, the results of research by Goulas & Zervoyianni (2013) concludes that crime has an ambiguous effect on economic growth. In term of the macroeconomic uncertainty, the findings of their study point out that the high crime rates can reduce annual output growth by between 0.49% and 0.62%. Unlike Goulas & Zervoyianni, empirical research conducted by Kizilgol & Selim (2017) concluded that economic growth has a positive effect on crime. Previously, the study of Mulok et al. (2016) also found an indication that the two variables were correlated with one another. The argument rationalizing the nature of the relations is that good economy tends to generate more crime, and the opposite occurs during bad economies.

Several research studies on the relationship between law enforcement and economic growth have not yet provided fix conclusions. For example, research findings of Pere (2015) for the case of the Western Balkan countries found a positive relationship between law enforcement and economic growth. The finding is in line with the results of the study of Lorenzani et al. (2014) which concluded that law enforcement is able to improve business security in the community and in turn lead to output growth. However, in contrast to the two researchers, the results of the study of Ozpolat et al. (2016) for the case of three countries groups (high income, middle income, and low-income countries) present inconclusive conclusions. Their findings inform that the relationship between law enforcement and economic growth is not relevant to explain the level of economic development of the middle income and low-income countries.

In contrast to previous research, our study reexamined the causal relationship between economic growth, law enforcement, and crime in the context of Indonesia. Especially so far, the study of the interrelationships between the three variables is still very little highlighted by economic researchers, especially for the western region of Indonesia. Whereas, predicting economic growth by using legal variables as predictor variables is very useful for policymakers in strengthening law enforcement to ensure business security for economic actors. In order to detail the analysis of the relationship between these variables, we employed the Panel-Vector Autoregressive (PVAR) as means of data analysis. The analysis accompanied by an analysis of impulse response function, variance decomposition, and Granger causality test. So that the results of the study not only detect the direction and significance of the relationship between variables but also reveal which of the one variable causing changes in the other two variables

Systematically, this paper arranged in five parts. The first part is an introduction highlighting a number of issues and the scientific arguments of the importance of the study. The second section contains a literature review complemented by a number of empirical findings regarding the relationship between variables. The third part is a research method that describes the source and measurements of the data as well as the econometric model used to analyze the relationships between variables. Then the fourth part is the result of research and discussion, and the last part is conclusions and suggestions..

2. LITERATURE REVIEW

2.1. The link between law enforcement and economic growth

A number of theories and empirical studies have explained the relationship between law enforcement and the economy. Law enforcement is an important requirement to ensure the certainty of economic activities in the community (Xu, 2011). The existence of legal certainty is essential for economic growth (Haggard & Tiede, 2011). The economic activities require legal certainty, especially regarding equality of rights for communities in carrying out economic activities (Lisitsyn-Svetlanov et al., 2018). When an area is categorized as an insecure area and has no legal certainty, the condition has an adverse impact on economic activity which in turn reducing output growth. Therefore, the relationship between economic activity and law enforcement is very close. For example, the empirical research conducted by Pere (2015) for the case of the Western Balkan countries has identified a close relationship between law enforcement practices and economic growth.

Empirical studies by a number of researchers regarding the relationship between law enforcement and economic growth provide unclear conclusions. The results of the research by Ozpolat et al. (2016) for the case of three countries groups (high income, middle income, and low-income countries) present inconclusive conclusions. Their findings inform that the relationship between law enforcement and economic growth is not relevant to explain the level of economic development of the middle income and low-income countries. While the results of the study by Adekoya & Raza (2016) in Nigeria discover that law enforcement reflected through punishment for criminals enable increase economic growth in the short run. Also, the crime dependence on punishment shows a negative value of 0.582 on economic growth. But the negativity of crime dependency on punishment shows that punishment is not efficient in promoting economic growth.

Unlike the results of the empirical research of the two researchers, the research study of by Lorenzani et al. (2014) regarding the relationship between the civil justice system and economic growth found that law enforcement increases entrepreneurial activity so that it affects investment and employment and in turn improve economic growth. The better law enforcement and better business security encourage productive economic activities.

2.2. The link between crime rates and economic growth

The study on the relations between crime and the economy has become the focus of interesting studies by a number of economic researchers. However, the empirical findings they found have not provided the same conclusion. The existence of a causal relationship between the two variables due to crime affecting production activities. The empirical study conducted by BenYishay & Pearlman (2014) for the case of Mexico has found out that higher rates of crime are associated with a significantly lower probability of enterprise plans to improve income growth. This thing explicitly indicates that criminal activities have a negative impact on economic growth. Unlike the findings of BenYishay & Pearlman, previously, Hemley & McPheters (1975) found that at the lower levels of income and production, crime tended to decreases. But when the economy increased, crime tends to increase. In other word, there is an inverse relationship between the two variables.

Sharma et al. (2011) in their research in India verified the existence of a negative relationship between crime and economic growth. Criminal activities in certain areas not only disrupt the comfort of people's lives but also adversely affect the investment climate and production activities (Adekoya & Raza, 2016). An empirical study of Islam (2014) for the case of 27 developing countries found out a negative relationship between economic growth and crime. Similar to Islam's findings, the research study conducted by Havi (2014) in Ghana also discover that the correlation coefficient between economic performance and the crime rate is negative and significant. The existence of a negative relationship between crime and economic growth caused by crime adversely affects production activities and output growth in the economy (Neanidis & Papadopoulou, 2013; Motta, 2016).

Research conducted by Goulas & Zervoyianni (2015) using a panel of data sets of 26 countries found that crime has an asymmetric effect on economic growth depending on the level of macroeconomic certainty. Crime is not a barrier to growth when economic conditions

allow investment growth. Conversely, when economic conditions vis-to-vis uncertainty conditions, the crime has a negative impact on economic growth. In the macroeconomic uncertainty, their findings prove that every 10% increase in crime caused per capita income to fall by between 0.49% and 0.62%. The research findings of Ahmad et al. (2014) in Pakistan also revealed that crime rates has a negative and significant impact on economic growth in the long run, but, in short-run, the effect of crime rates on economic growth is negative but insignificant.

In contrast to the findings above, the results of the Kizilgol & Selim (2017) study for the case of the Turkish economy found a positive relationship between economic growth and criminal activity. Previously, Mulok et al. (2016) also found that the impact of economic growth on crime is found to be positive and statistically significant. The existence of a positive relationship between crime and economic growth is explained by Nayebyazdi (2017) using the Kuznets curve that increasing economic growth can increase income inequality. Due to the fact that in the early stages of economic growth, there is more income inequality and income inequality leads to crime occurrence. The increase in income inequality as a result of economic growth as described in the Kurztnet curve has a strong and robust effect regarding crime rates rising (Lobont et al., 2017).

2.3. The link between law enforcement and crime rates

Several empirical studies regarding the relationship between law enforcement and crime that have been carried out by previous researchers also have not provided the same conclusions. Research conducted by Cook (1979) found that law enforcement can have an impact on the tendency of criminal behavior in the community. Previously, the research findings of Antunes & Hunt (1973) presented empirical evidence that law enforcement allows reducing crime rates. Increasing law enforcement in a region is usually supported by legal instruments such as the police, for example, in handling criminal cases to get to court. Increasing police efforts will lead to increased clearance rates and in turn, reducing the level of crime rates (Cloninger & Satorius, 1979; Alves et al., 2013). Ross & Walker (2016) in their study on the causality relationship between law enforcement and crime rates for the case of California found that lower law enforcement increases crime rates directly.

In contrast to the conclusions of a number of researchers above, the results of the Shepard and Blackley (2007) study found that law enforcement was positively associated with crime rates. The increase in law enforcement is parallel with the increase in crime rates due to the tendency of criminals to carry out their actions caused by various factors such as economic, social, and so on. Therefore, even though law enforcement is increasing, but in poor economic conditions, the crime rates will not decrease.

3. Data and research methods

Dataset used to the study is taken from the annual report of the Indonesian Statistics of Bureau. The data form of the panel data set of 8 provinces from western Indonesia pertaining Aceh, Sumatera Utara, Sumatera Barat, Riau, Jambi, Sumatera Selatan, Bengkulu and Lampung Province with annual data over 2006 to 2007. The economic growth is proxied by regional per capita income (RPI) at a constant price of 2000. The use of regional per capita income in measuring the economic growth of the respective provinces refer to a number of the previous research study (Amri and Nazamuddin, 2018; Amri, 2018; Amri et al., 2019). Law enforcement is measured by the number of criminal cases brought to criminal justice. In other words, the variable is clearance rates to total crime ratio. Further, the measurement of crime rates proxied with the probability of citizens being exposed to criminal acts per 100.000 inhabitants.

The first stage in data analysis is started by analyzing stationarity. We used the Levine–Lin–Chu (LLC) method (Levine, Lin, & Chu, 2002) and the I'm–Pesaran–Shin (IPS) method (Im, Pesaran, & Shin, 2003) to check the order of integration to see when the time series variable attains stationary. The basic principle of the two methods is the Augmented Dickey-Fuller (ADF) test. The LLC method inquires the heterogeneity of intercepts across members of the panel, while the IPS method reviews the heterogeneity in the intercepts and the slope

coefficients. Both tests were applied by averaging individual ADF t-statistics across cross-section units.

The second stage in the method of the analysis is co-integration test. The concept of co-integration, introduced by Granger (1969), is relevant to the problem of determining long-run relationship between the variables. The basic idea that underpins co-integration is simple. If the difference between two non-stationary series is itself stationary, then the two series are co-integrated. If two or more series co-integrated, it is possible to interpret the variables in these series as being in a long-run equilibrium relationship (Engle & Granger, 1987). By contrast, a lack of co-integration suggests that the variables have no long-run relationship-thus, in principle, the postulated variables can arbitrarily move far away from each other.

$$\Delta LRPI_{it} = \alpha_0 + \sum_{j=1}^{n} \beta_{1j} \Delta LRPI_{i,t-j} + \sum_{j=1}^{n} \beta_{2j} \Delta LCrime_{i,t-j} + \sum_{j=1}^{n} \beta_{3j} \Delta LLE_{i,t-j} + \mu_{1t} \quad (1)$$

$$\Delta LCrime_{it} = \alpha_0 + \sum_{j=1}^{n} \beta_{1j} \Delta LRPI_{i,t-j} + \sum_{j=1}^{n} \beta_{2j} \Delta LCrime_{i,t-j} + \sum_{j=1}^{n} \beta_{3j} \Delta LLE_{i,t-j} + \varepsilon_{1t} \quad (2)$$

$$\Delta LLE_{it} = \alpha_0 + \sum_{j=1}^{n} \beta_{1j} \Delta LRPI_{i,t-j} + \sum_{j=1}^{n} \beta_{2j} \Delta LCrime_{i,t-j} + \sum_{j=1}^{n} \beta_{3j} \Delta LLE_{i,t-j} + v_{1t} \quad (3)$$

where $\Delta LRPI$ denotes the first difference of the natural logarithm of regional per capita income as proxies of economic growth, $\Delta LCrime$ denotes the first difference of the natural logarithm of crime rate, and ΔLLE denotes the first difference of the natural logarithm of law enforcement, i denotes the province of i, and t denotes the period of t. Furthermore, α and are constants to be estimated, as well as μ, ε and ν denotes a stochastic error term of the PVAR equation, respectively.

In the next stage, we test the causality relationship between the three variables using Granger Causality VAR methods, so that we can clearly know whether economic growth (RPI) has an impact on crime rate and law enforcement or vice versa the two variables cause economic growth. For each of the two questions, a Chi-square (Wald) test is utilized to test the significance of the effect of the respective exogenous variable statistically. Moreover, the VAR methodology allows us to analysis the impulse response that detects the manner in which each endogenous variable responds to the shocks of the exogenous variable evaluated through the residual variables. Thus, shock spread from one of certain variables to the other within the dynamic structure of the VAR model.

4. THE RESULT AND DISCUSSION

4.1. The descriptive statistics of the variables

The regional economic growth rate in the western region of Indonesia is relatively different between one region and another. This difference indicated by the difference in per capita income of each province. The results of the descriptive statistics show that the highest annual per capita income is IDR12,755.99 thousand. The opposite of IDR4,096.06 thousand with an average of IDR7,326.64 thousand.

Furthermore, the results of the descriptive statistics of crime rates showed that the highest number of 317. This informs that the probability of the community to do criminal acts per 100,000 inhabitants are 317 peoples. On the contrary, the lowest number is 22 peoples. In term of law enforcement, the variable is proxied by the ratio of the resolved cases to total crime cases that show the highest ratio of 79.93 percent point. This thing indicates that the number of criminal cases that successfully prosecuted to criminal system justice was 79.93 percent of the total cases. While the lowest ratio is 11.72 percent point.

The results of the normality test of each of these variables using Jarque-Berra test showed that the p-value of economic growth was 0.096 (> .05), which means that per capita income as a proxy for economic growth normally distributed. Furthermore, the p-value of crime rates and law enforcement respectively amounted to 0.107 and 0.124, which means the two

variables were also normally distributed. The descriptive statistics, the normality test and correlation matrix of the three variables as summarized in Table 1.

Table 1. Descriptive Statistics, Test of Normality and Correlation Matrix

	Percapita Income (IDR1000)	Crime Rates (perpetrators of criminal acts per 100,000 inhibitans)	Law Enforcement (ratio of the resolved cases to total crime cases) (%)
Descriptive Statistics			
Mean	7,326.64	189	48.65
Median	7,032.37	199	45.59
Maximum	12,755.99	317	79.93
Minimum	4,096.06	22	11.72
Test of Normality			
Jarque-Bera	4.668	4.469	4.265
Probability	0.097	0.107	0.124
Correlation Matrix			
Per capita Income	1		
Crime Rates	0.553	1	
Law Enforcement	0.053	0.022	1

Source: Author's Computation using E-views 9.0.

Table 1 above also represents the long-run correlation between the three variables. The nature of relations between per capita income and crime rates is strongly positive which is shown by a correlation coefficient of 0.553. Furthermore, the correlation coefficient between income and law enforcement and between per capita income and crime rates of 0.053 and 0.022, respectively. The coefficients are close to zero, which means the relationship is very weak.

4.2. The result of unit root test

Prior to conducting any econometric analysis, it is important to examine whether the panel data are stationary (or unit root). As explained earlier, the unit root test in this study using six methods. The tests are namely Levin, Lin & Chu (LLC), I'm, Pesaran & Shin (IPS), ADF - Fisher X2, ADF - Choi Z-stat, PP – Fisher dan PP – Choi test. The result of the test as summarized in table 2.

Table 2. The Result of Panel Unit Root Test

No	Variable	Methods	Individual Intercept				Intercept & Trend			
			Level		First Difference		Level		First Difference	
			T-stat	P-value	T-stat	P-value	T-stat	P-value	T-stat	P-value
1	Law Enforcement (LLE)	Levin, Lin & Chu	-3.657	0.000	-12.752	0.000	-13.663	0.000	-12.038	0.000
		Im, Pesaran & Shin	-2.299	0.011	-6.118	0.000	-4.416	0.000	-3.105	0.001
		ADF - Fisher X^2	29.506	0.021	66.175	0.000	43.602	0.000	52.542	0.000
		ADF - Choi Z-stat	-2.6115	0.005	-5.553	0.000	-2.688	0.004	-4.4116	0.000
		PP – Fisher	29.280	0.022	72.713	0.000	33.086	0.007	53.236	0.000
		PP – Choi	-2.667	0.004	-6.347	0.000	-2.174	0.015	-4.839	0.000
2	Crime (LCrime)	Levin, Lin & Chu	-0.957	0.169	-0.507	0.306	1.728	0.958	-4.302	0.000
		Im, Pesaran & Shin	0.784	0.784	-1.010	0.156	2.628	0.995	-0.654	0.256
		ADF - Fisher X^2	8.961	0.915	23.563	0.099	4.698	0.997	21.503	0.160
		ADF - Choi Z-stat	0.961	0.832	-1.366	0.086	3.111	0.999	-1.727	0.042
		PP – Fisher	24.472	0.079	65.722	0.000	12.418	0.715	70.615	0.000
		PP – Choi	-1.521	0.064	-4.831	0.000	3.347	0.999	-5.887	0.000
3	Economic Growth (LRPI)	Levin, Lin & Chu	4.591	1.000	-4.379	0.000	-6.492	0.000	-6.524	0.000
		Im, Pesaran & Shin	6.172	1.000	-2.059	0.019	-1.433	0.076	-1.736	0.041
		ADF - Fisher X^2	1.355	1.000	30.572	0.015	26.990	0.042	36.195	0.003
		ADF - Choi Z-stat	6.304	1.000	-2.135	0.016	-1.033	0.151	-2.579	0.005
		PP – Fisher	3.403	0.999	35.766	0.003	7.591	0.960	53.255	0.000
		PP – Choi	6.133	1.000	-2.811	0.003	2.419	0.992	-3.820	0.000

Source: Author's Computation using E-views 9.0

As shown in table 2 above, at the level, the majority of the respective p-value for all methods of panel unit root test is greater than 0.05. This indicates that the variables are non-stationer in level. However, the p-value is less than .05 at the first difference neither for Individual Intercept or Intercept & Trend. Thus, the variables achieved stationary at the first difference.

4.3. The result of co-integtation test

The co-integration tests aim to determine whether the variables studied toward long-run equilibrium one another. In this respect, we utilized Pedroni's (1999) co-integration test which suggests there are seven statistical methods to detect the presence of cointegration phenomena in the panel data set. The methods divided into two groups. The first group is namely cointegration in the within-dimension (panel test) namely the v-statistical panel, rho-statistical panel, PP-statistical, and ADF-statistics panel. The second group is the co-integration test of between dimension (group test) including Group rho-Statistics, Group PP-Statistics, and Group ADF-Statistics. The tests propose two hypotheses consisting of a null hypothesis proposing the existence of co-integration between the law enforcement, crime rates, and economic growth, and the alternative hypothesis suggesting the variables are co-integrated. The rejection of one of the hypotheses was based on the p-value generated by the output E-views with the criterion that the alternative hypothesis is accepted and vice-versa the null hypothesis is rejected if p-value < .05. On the contrary, the alternative hypothesis is rejected, and the null hypothesis is accepted if p-value> .05. The result Pedroni's cointegration test as shown in Table 3.

Table 3. The Result of Pedroni's residual-based cointegration test

Panel Cointegration Statistics (Within-Dimension)		
Test Statistics	Statistical Values	
	Individual Intercept	Individual Intercept and Trend
Panel v-Statistic	-1.105 (0.866)	125.311 (0.000)**
Panel rho-Statistic	1.331 (0.909)	2.308 (0.989)
Panel PP-Statistic	0.776 (0.781)	0.296 (0.617)
Panel ADF-Statistic	2.695 (0.997)	-0.569 (0.285)
Group Mean Panel Cointegration Statistics (Between-Dimension)		
Test Statistics	Statistical Values	
	Individual Intercept	Individua Intercept and Trend
Group rho-Statistic	2.235 (0.987)	3.417 (0.999)
Group PP-Statistic	0.817 (0.793)	0.551 (0.709)
Group ADF-Statistic	2.581 (0.995)	-1.463 (0.072)*

Source: Author's Computation using E-views 9.0

Note: The values in parentheses are probabilities values. Ho: no cointegration; * and ** indicate the rejection of null hypothesis at 90% and 95% significant level, respectively.

Based on table 3 above, it is known that only some criteria can be fulfilled. The statistical tests show that neither one of Panel v-Statistic, rho-Statistic Panel and rho-Statistic Panel are significant for both individual intercept methods and individual intercept and trend method. That things indicated by the p-value of the respective statistic method is lower than 0.05. Furthermore, the statistical test of the ADF-Statistic Panel shows the p-value of 0.0337 (< 0.05) for the individual intercept method and 0.5284 (> 0.05) for the individual intercept and trend. Co-integration test in term between dimension (group test) consists of Group rho-

Statistic, Group PP-Statistic, and Group ADF-Statistic. Neither one of the three statistic methods provides the p-value < 0.05. Referring to the results of Pedroni's (1999) panel cointegration tests as described in table 3 above can be interpreted the absence of co-integrative relations between the three variables. In other word, this thing informs that there is no long-run relationship between them.

Furthermore, acceptance or rejection of the hypothesis with Kao's residual panel cointegration test also based on the p-value. The provision of the test is if the p-value < 0.05 indicate that there is cointegration among the three variables. Otherwise, the p-value > 0.05 means the variables have no cointegrated. The result of Kao's residual panel cointegration test in Table 4.

Table 4. The Result of Kao's Residual Panel Cointegration Test

Null Hypothesis	T-Statistic	P-value
No cointegration	0.499	0.309
Residual Variance	0.002	
HAC variance	0.005	

Source: Authors' Computation using E-views 9.0

Table 4 evinces the results of Kao's (1999) panel cointegration test. The statistical result of the test shows that the p-value of 0.309 (>0.05). Hence, the null hypothesis is accepted and that thing indicates that there is no long-run relationship between law enforcement, crime rates, and economic growth. In other words, there is no evidence pointing out the three variables are co-integrated in the long-run.

4.4. 4.4 The result of the lag length criteria

The tests were determined based on informational criteria - the Akaike information criterion (AIC), Hannan-Quinn (HQ), and Schwarz information criterion (SC), taking into consideration that if the number of lags is too small then the model does not capture all the information while if there are too many lags then the degree of freedom is wasted. Different information criteria suggest different optimal lag lengths for the VAR model, as shown in Table 5. The standard information criteria of sequential modified LR test statistic and Final prediction error shows an optimal lag length of 6. Information criteria of Akaike information criterion also show an optimal lag length of 5.

Table 5. Result of VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	118.1680	NA	6.34e-07	-5.7584	-5.6317	-5.7126
1	139.1155	37.7056	3.49e-07	-6.3558	-5.8491*	-6.1726
2	145.4206	10.4033	4.03e-07	-6.2210	-5.3344	-5.9004
3	155.1603	14.6096	3.97e-07	-6.2580	-4.9914	-5.8000
4	179.0565	32.2599	1.96e-07	-7.0028	-5.3562	-6.4074
5	199.1526	24.1153*	1.21e-07	-7.5576	-5.5309	-6.8249
6	213.6666	15.2397	1.02e-07*	-7.8333*	-5.4267	-6.9632*

Source: Author's Computation using E-views 9.0

Note: * indicates lag order selected by the criterion; LR stands for sequential modified LR test statistic (each test at 5% level); FPE is standing for Final prediction error; AIC stands for Akaike information criterion; SC stands for Schwarz information criterion, and HQ stands for Hannan-Quinn information criterion.

Since the variables achieved stationarity after first differencing and Akaike information criterion shows an optimal lag length of 6, we use the lag length of 6 for the econometric model of panel vector autoregressive.

4.5. The result of panel vector autoregressive

The economic growth in a certain period is positively and significantly influenced by itself at one and five periods earlier. It shows that economic activity produces output (goods and services) in a period capable of increasing production capacity for the next period. The effect

of crime on economic growth shows ambiguous results. In the first period, the variable has a positive and insignificant effect, but in the second period, it has a positive and significant effect on economic growth. This indicates that criminal activities are not an obstacle to economic growth. Even the existence of a positive relationship between the two variables after two periods explicitly informs that the dynamics of the two variables move in the same direction. Furthermore, for the 3-5 period horizon, the effect of crime on economic growth is negative and insignificant. An increase in criminal activities in a certain period has an opposite impact on economic growth in the 3-5 periods later, but not significant.

In terms of the effect of law enforcement, this study found that for one-five period horizons, law enforcement has no significant effect on economic growth. The significant and positive effect of the variable on economic growth exists after the sixth period. This indicates that law enforcement in a certain period has a positive impact on economic growth in the next 6 periods. This finding is consistent with the results of the Morganti & Garofalo study (2019) using a panel of data sets of 62 countries which discovered that law enforcement has a positive and significant effect on economic growth. The complete information of the econometric model analysis which discovers the direction of causality relationship between the variables generated through PVAR as summarized in Table 6.

Tabel 6. The Summary of Panel Vector Autoregressive

Endogenous Variable	Exogenous Variable					
	ΔLRPI		ΔLCRIME		ΔLLE	
	Coefficient	t-statistics	Coefficient	t-statistics	Coefficient	t-statistics
ΔLRPI (-1)	0.5529	3.0034	-1.4108	-0.4249	-11.1917	-3.0625
ΔLRPI(-2)	0.3305	1.6183	3.5625	0.9675	5.0525	1.2465
ΔLRPI(-3)	-0.8239	-2.8750	0.8079	0.1564	-1.8186	-0.3197
ΔLRPI(-4)	0.4307	1.3773	-6.3323	-1.1231	-0.8527	-0.1374
ΔLRPI(-5)	0.8969	3.1942	1.5014	0.2973	17.9517	3.2288
ΔLRPI(-6)	-0.3461	-1.3342	0.1331	0.0284	-1.0964	-0.2129
ΔLCRIME (-1)	0.0041	0.3622	-0.2308	-1.1280	-0.0914	-0.4056
ΔLCRIME (-2)	0.0239	2.2207	0.0983	0.5049	-0.3681	-1.7170
ΔLCRIME (-3)	-0.0085	-0.9789	0.3394	2.1744	0.4733	2.7542
ΔLCRIME (-4)	-0.0011	-0.1640	-0.2144	-1.8523	-0.0633	-0.4963
ΔLCRIME (-5)	-0.0066	-0.9586	-0.1899	-1.5329	-0.0309	-0.2264
ΔLCRIME (-6)	0.0109	1.5171	-0.0434	-0.3323	0.1814	1.2617
ΔLLE (-1)	-0.0071	-0.7469	-0.0959	-0.5565	-0.6547	-3.4506
ΔLLE (-2)	0.0066	0.6825	-0.3324	-1.9093	-0.2592	-1.3526
ΔLLE (-3)	0.0067	1.0512	-0.2759	-2.3866	-0.4789	-3.7631
ΔLLE (-4)	-0.0015	-0.2136	-0.1319	-1.0587	-0.8881	-6.4743
ΔLLE (-5)	0.0031	0.3095	-0.2489	-1.3669	-0.5143	-2.5661
ΔLLE (-6)	0.0205	2.8755	-0.1470	-1.1453	-0.0847	-0.5991
C	-0.0016	-0.2048	0.0813	0.5777	-0.3900	-2.5183
R-squared	0.7099		0.1790		0.7640	
Adj. R-squared	0.0014		0.4563		0.5529	
S.E. equation	0.0082		0.1474		0.1623	
F-statistic	6.3016		1.4724		8.0149	
Akaike AIC	-6.4698		-0.6856		-0.4934	
Schwarz SC	-5.6676		0.1166		0.3088	
Mean dependent	0.0434		-0.0039		0.0304	
S.D. dependent	0.0152		0.1627		0.3340	

Source: Author's Computation using E-views 9.0

Note: t statistics > 2,00 indicate a significant effect; and t statistics < 2,00 indicate an insignificant effect.

As shown in Table 6 above, at the 2-period horizon, the influence of crime on economic growth is positive and significant. Conversely, at the 3-5 period horizon is negatively insignificant. The existence of same direction relations between the two variables is in line

with the results of the study of Kizilgol & Selim (2017) in the case of the Turkish economy finding a positive relationship between economic growth and the number of criminal actors. Conversely, this finding is a contrast to the empirical findings of Kathena & Sheefeni (2017) for the case of the Namibian economy, which concluded that the increase in crime rates lead to economic growth decrease. The research study of Blackburn et al. (2017) also points out that crime has a negative effect on growth. Similar to the findings, Diaw et al. (2014) also proved a number of contradictive results regarding the nature of the causal relationship between crime and economic growth.

The negative effects of crime rates on economic growth are due to criminal activities having a destructive impact on the economic activities of the community. The activities besides being able to cause on social insecurity in the community, but also impact on the uncertainty of business prospects which is, in turn, reducing economic performance (Estrada & Ndoma, 2014). These findings confirm the empirical research conducted by Motta (2016) in Latin America, which has revealed that there is a negative relationship between criminal activity and economic performance.

Economic growth has no significant effect on crime rates. This indicates that the tendency of criminals to engage in criminal activities not be influenced by the intensity of the economic activities of the communities. Output growth in the economy does not impact on the behavioral intentions of criminal actors in realizing their evil deeds. This finding is contrary to the findings of Mulok et al. (2016) in Malaysia concluded that the impact of economic growth on crime rates is statistically significant.

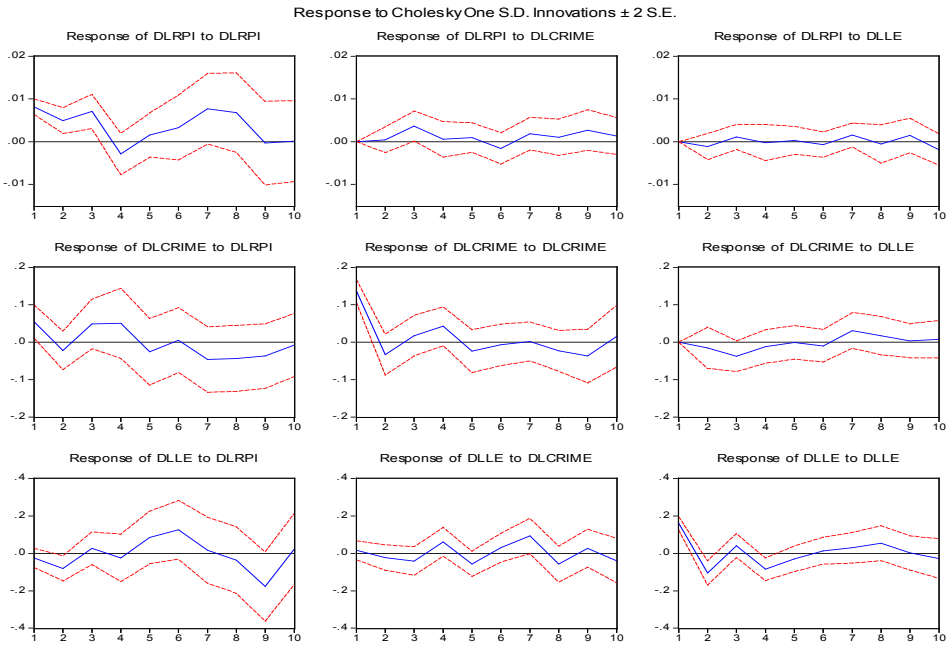
Crime rates for a certain period were positively and significantly affected by the crime rates of the previous 3-period. In other word, the increase in crime at the period of t, prompt an increase in crime at the following 3-period (t+3). The perceived benefits which are obtained by the perpetrators of certain criminal activities encourage them to repeat the evil actions in the future. This is what causes crime to have a positive effect on its own self.

Law enforcement has a negative and significant effect on crime rates in the 3rd-period. The increase in law enforcement for a certain period has a negative effect on the crime rates of the three periods later. The ability and success of law enforcement officials get perpetrators up to court be able to reduce the desire of them to repeat the criminal activities. Accordingly, there is an adverse relationship between the two variables. Furthermore, economic growth and crime rates had a positive and significant effect on law enforcement at the 5th and 3rd period, respectively. The higher the intensity of economic activity, the higher the crime rates, and the more the number of criminal cases resolved to the criminal system justice. The existence of a positive and significant effect of crime rates on law enforcement is consistent with the results of Shepard and Blackley's (2007) study concluding that the arrest of criminal offenders by law enforcement officials are positively related to the higher levels of crime rates.

4.6. The result of impulse response function

The impulse response function is used to detect the behavior of a variable in responding to the shock of its own self and other variables in a dynamic model. In this respect, the IRF analysis aims to investigate the response of law enforcement, crime rates, and economic growth when the shock that occurred in its own self individually or other variable changes.

Figure 1. Result of Impulse Response Function



The economic growth positively responds to the shock of its own self within the 1-3 period horizon. Hereinafter, the response was negative in the 4th period and then positive in the 5-9 period. In the 10th period, the response towards the long-run equilibrium. The response of economic growth to the shock of crime rates is relatively small but tends to be positive during the analysis period. Further, the response of economic growth to the shock of law enforcement is also relatively small and is around the long-run equilibrium line.

The response of crime to the shock of law enforcement is negative during the 1-7 period horizon, then positive in the 8th period. Hereafter, in the 9-10 period horizon, the response was relatively small and towards the equilibrium point. The response of law enforcement to economic growth is negative until the third period. Then, the response is positive during the fourth to seventh period. Further, law enforcement responds negatively to economic growth from the eighth period and then toward the balance point in the tenth period. The response of law enforcement to shock in crime rates positive in the first period, then negative in the second and third periods. The response fluctuates until the tenth period approaches the equilibrium point.

4.7. The result of variance decomposition analysis

One way to determine how important the different exogenous shocks are in explaining the dependent variables is to calculate the fractions of the forecast error variance of these variables attributable to the respective orthogonal shocks. The analysis would reveal the contribution of the variable in explaining the forecast error variance of either itself or others. The variance decomposition analysis is utilized to assess the dynamic interactions between the variables in panel VAR model.

The results of the variance decomposition are shown in Table 7. In general, the results further substantiate the earlier findings which base on the impulse response function. Variations in regional economic growth (RPI) variable explain around 89.65 percent of its forecast error variance at the 5-years horizon, indicating that decreasing in economic growth is one of the most important variables in explaining the dynamic of its own variance. The VDA result also shows that crime rates and law enforcement contribute up to 8.78 percent and 1.57 percent of the forecast error-variance of economic growth at the 5-years horizon, respectively. This indicates the two variables are not one of the important factors in explaining the evolution of regional economic growth in western Indonesia.

Table 7. Variance Decomposition of Variables

Period	Variance Decomposition of ΔLRPI:			Variance Decomposition of ΔLCRIME:			Variance Decomposition of ΔLLE:		
	ΔLRPI	Δ LCRIME	ΔLLE	ΔLRPI	ΔLCRIME	Δ LLE	ΔLRPI	ΔLCRIME	Δ LLE
1	100.0000	0.0000	0.0000	14.0069	85.9930	0.0000	2.2803	1.0231	96.6966
2	98.3844	0.2137	1.4019	14.9694	84.0357	0.9949	15.9937	1.8281	82.1782
3	89.7375	8.6609	1.6016	21.2791	72.6789	6.0419	16.1307	5.1998	78.6695
4	90.0712	8.3876	1.5412	26.2193	68.1651	5.6156	13.9844	10.5393	75.4763
5	89.6552	8.7786	1.5663	27.2433	67.3494	5.4073	21.9237	13.3004	64.7759
6	88.8460	9.4663	1.6876	27.1818	67.1559	5.6623	35.7025	11.7611	52.5364
7	89.4144	8.3766	2.2091	30.7525	61.3926	7.8549	32.3866	19.4841	48.1293
8	90.6482	7.4027	1.9490	33.4058	58.5293	8.0649	31.3311	21.2336	47.4354
9	87.8368	9.6009	2.5624	34.4939	57.9441	7.5621	46.7679	16.8455	36.3866
10	86.3631	9.9965	3.6404	34.3373	58.0193	7.6434	46.1834	17.6135	36.2031
	Cholesky Ordering: ΔLRPI ΔLCRIME ΔLLE								

Source: Author's Computation using E-views 9.0

4.8. The result of PVAR Granger causality test

In order to determine the direction of causality relationship among the variables, we employee Granger causality/block exogeneity wald tests. The result of the test shows that bidirectional causality exists between crime rates and law enforcement and between economic growth and law enforcement. There is unidirectional causality running from crime to economic growth. Table 8 describes the direction of the causality relationship between the variables.

Tabel 8. The Result of VAR Granger Causality/Block Exogeneity Wald Tests

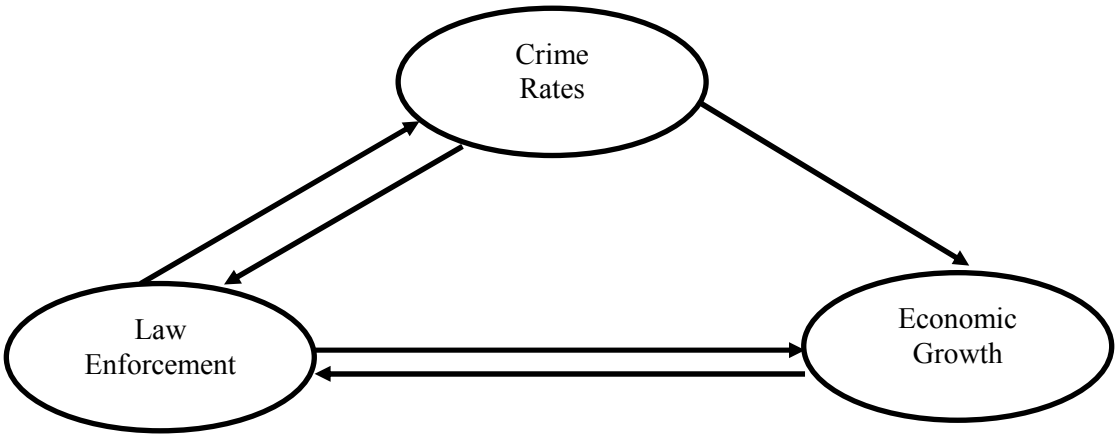
Dependent Variable	*Independent Variable*		
	ΔLRPI	ΔLCRIME	ΔLLE
ΔLRPI	-	(16.809) [0.021]**	(12.313) [0.067]*
ΔLCRIME	(4.026) [0.673]	-	(16.991) [0.009]***
ΔLLE	(32.107) [0.000]***	(28.613) [0.000]***	-

Note: Number in ( ) is chi-square, Number in [ ] is p-value, * significant at 90% level, ** significant at 95% level and *** significant at 99% level,

Source: Author's calculation with Eviews 9.0

Refer to Table 8 above, the direction of causality relationship among the variables as shown in Figure 2.

Figure 2. The direction of causality relationship among the three variables



The existence of bidirectional causality between law enforcement and crime explicitly informs that law enforcement can encourage a decrease in criminal acts in the community. As the PVAR results explained earlier, law enforcement has a negative effect on crime at the 1-5 period horizon. Thus, the decrease in criminal activities is a response to an attempt by security forces to prosecute criminal actors to court. In other words, the decrease of the crime rates caused by the increase of clearance rates as proxies of law enforcement.

This finding supports the research findings of Cloninger & Satorius (1979) confirming that an increase in police efforts will cause an increase in crime clearance rates and in turn to reduce the crime rates. Furthermore, the intensity of crime can also affect law enforcement. Increased criminal activities in the community encourage security forces, especially the police, to increase the intensity of law enforcement. Accordingly, crime clearance rates are also positively and significantly related to the intensity of criminal acts in the community. These results in line with the research findings Shepard and Blackley (2007) which found out that the arrest of crime actors positively related to high crime rates.

Bidirectional causality also exists between law enforcement and economic growth. The running of causality from law enforcement to economic growth indicates that the sustainability of economic activities is a response to law enforcement. The economic activities require the support of conducive social conditions with low crime rates. When law enforcement increases, security is more assurance and in turn, accelerates economic activity in the community. This finding confirms the results of Pere (2015) research for the case of Western Balkan countries which concludes that there is a close relationship between law enforcement practices and economic growth. Previously, empirical studies conducted by Lorenzani et al. (2014) in a number of European countries also proven that law enforcement increases entrepreneurial activity so that it impacts on domestic and foreign investment and in turn, an improves to economic growth.

Further, economic growth can also influence law enforcement. Increased economic growth reflect the increases in economic activity. Economic growth as an indication of an increase in people's income stimulates the interest of criminals to take actions such as robbery, fraud and so on in order to obtain a certain amount of income. Having a response to the conditions, the security officer of the local government tried to encourage law enforcement by taking legal action against the perpetrators of crime.

Unidirectional causality exists running from crime rates to economic growth. This indicates that the production of goods and services in the community response to criminal acts. The interpretation is then in line with the results of the PVAR previously explained that crime rates have a negative effect on economic growth due to its impact on the development of the business activity. The crime rates are associated with the lower probability of enterprise to expanse business activities (BenYishay & Pearlman, 2014).

However, this finding is a contrast to the results of a study in Namibia by Kathena & Sheefeni (2017) showed that there is bidirectional causality running from crime rates to economic growth. On the contrary, criminal activities do not respond to economic growth. This finding is also different from the results of research by Kathena & Sheefeni (2017) for the case of Namibian economy which presents empirical evidence of the existence of a two-way causality relationship between the two variables.

5. Conclusions and Suggestion

This study was intended to investigate the functional relations among law enforcement, crime rates, and economic growth, and detect whether there was causality between these variables. Using the panel data set of 8 provinces from western Indonesia for the period of 2006-2017, the econometric models that were applied to discover these relations were panel cointegration tests, panel vector autoregressive, and Granger causality tests. This study has concluded two important points. Firstly, there is no long-run equilibrium relationship among the three variables. Both crime rates and law enforcement positively affect economic growth. Law enforcement has a negative and significant effect on crime rates, and vice versa crime rates have a positive and significant effect on law enforcement.

Secondly, there was bidirectional causality between crime rates and law enforcement, and between law enforcement and economic growth. Higher law enforcement was a response to

the higher crime rates, and vice versa, the decrease in crime rates was a response to an increase in law enforcement. The increased productive activities in the economy are the economic impact of law enforcement. In the same time, when the intensity of economic activity increased, the local government in western Indonesia effort to improve law enforcement in assuring the economic activity. In addition, there is a unidirectional causality running from crime rates to economic growth. Economic growth has a response to criminal activities. Even though the crime rates did not significantly cause a decrease in the intensity of economic activity, however, the occurrence of the criminal acts such as theft, robbery, and fraud, for example, it still has a destructive impact on the development of the productive economic activities.

Referring to the conclusions above the strategic policy of the local government, particularly for the provinces in western Indonesia should enhance law enforcement to reduce crime rates. Increase the number of police officers, especially regional police, including investigators for criminal acts. So that more criminals who received punishment for their criminal acts. In relation to economic development policies, the government should effort to increase employment creation for the working age population. Thus, they will get a job to avoid criminal acts such as theft, fraud, robbery, and so on.

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DYNAMIC HYDROELECTRICITY CONSUMPTION AND ECONOMIC GROWTH IN APEC COUNTRIES AND INDIA

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Abstract

This study is to analyze the effect of economic growth on hydroelectricity consumption in APEC countries and India. The study uses panel data from 1994 to 2016 with 391 total samples, where the variables in the study are economic growth and hydroelectricity consumption. Panel ARDL is utilized to analyze both short-run and long-run economic growth effects on hydroelectricity consumptions. The results show that there is a positive and significant effect of economic growth on hydroelectricity consumptions in APEC countries and India. To minimize the productions of carbon dioxide, it is recommended to optimize hydroelectricity consumptions in this area because this area is the highest carbon dioxide producers in the world. It is crucial to achieving sustainability in productions and consumptions in this region.

Keywords: hydroelectricity, economic growth, APEC, Panel ARDL
JEL classification: Q01, Q32, Q35, Q43

1. Introduction

Asia Pacific region is the highest producers of carbon dioxide in the world (BP Statistical Review, 2017) because the economic growth in this region is very significant in the world, so energy consumption in this region is also massive from electricity generation to support productions and consumptions. APEC Energy Demand and Supply Outlook (2016) reported that this area used coal and oil as primary energy generations where these nonrenewable resources are fossil fuels. This is the primary generation of carbon dioxide in this area. Meanwhile, another problem is the availability of oil, and coal is minimal and continuously decreases. Renewable resources are essential as future green energy not only in this area but also around the world.

Renewable energy is vital nowadays, and mixed energy use increased from time to time. Inglesi-Lotz (2016) stated that the use of renewable and green energy is essential to achieve the world's safety in energy availability as well as the green world for the next generations. Green energy also produces high economic growth, both short-run and long-run perspectives. The work of Ito (2017) found that (i) renewable energy consumptions have a significant positive effect on emission reductions and positive impact on economic growth; (ii) nonrenewable energy has a long-run negative and significant impact on economic growth; and (iii) there is substitution between nonrenewable and renewable energy.

Furthermore, Cherni and Jouini (2017) found that economic growth increases nonrenewable energy consumptions and carbon dioxide in Tunisia. However, a decrease in nonrenewable energy causes low economic growth. To overcome this problem, it is better to use renewable energy sources such as hydroelectricity. It is supported by the work of Payne and James (2011) showed that there is short-run one-way direction from economic growth to renewable energy consumption and bi-direction in long-run between economic growth and renewable energy consumption in 16 developing countries.

Another research about hydroelectricity consumption and economic growth was conducted by Apergis et al., (2016) in 10 highest hydroelectricity consumptions by using structural break tests, i.e., 1988, 2000, and 2009. They found that pre-1988 period, there is one-way direction causality between real per capita GDP and per capita hydroelectricity consumption.

Meanwhile, the post-1988 period, there is bi-directional between hydroelectricity consumption and per capita GDP both in short-run and long-run. This means that there is an increase in hydroelectricity consumption caused by economic growth. The rise in hydroelectricity implies that there is a decrease in productions of carbon dioxide, hence greener environment.

Haley (2015) stated that hydroelectricity decreases carbon dioxide and increases innovation in high technology, such as electric vehicles (EV). The use of hydroelectricity in APEC counties and India increases from day to day because gov carbon governments in this area aim to decrease carbon dioxide and increase green energy. Only 16 countries of 21 APEC countries use hydroelectricity because of some reasons such as technology availabilities, water, and oil reserves.

China is the highest hydroelectricity consumption among APEC countries with an increasing trend from time to time. The increase in hydroelectricity power because of economic growth and income per capita in China. The second is Canada, the hydroelectricity consumption increase from year to year even though Canada has per capita GDP fluctuated that is not consistent with hydroelectricity consumption. The third is South Korea, this country fluctuated hydroelectricity consumption from 1994 until 2016, and per capita GDP differently increased from time to time. These results show that hydroelectricity consumptions are not consistent to per capita GDP growth in APEC countries. Based on these, it is very interesting in analyzing the effect of economic growth on hydroelectricity consumption in APEC countries and India.

2. Literature Review

Some studies on economic growth and hydroelectricity have been conducted both in developed and developing countries. For example, Ziramba (2013) analyzed the economic growth effect on hydroelectricity consumption in three African countries, i.e., Egypt, Algeria, and South Africa. The results showed that there is neutrality hypothesis in Egypt, causality in Algeria, and conservation in South Afrika. This means that the government in Egypt should implement conservation policies on hydroelectricity consumptions. Meanwhile, this policy can be applied in Algeria because there is causality evidence in this country.

The work of Solarin and Ozturk (2015) confirmed that there are long-run causality relationships between economic growth and hydroelectricity in Indonesia, Argentina, and Venezuela. Furthermore, there is a one-way direction between economic growth and hydroelectricity in Brazil, Chile, Columbia, Ecuador, dan Peru. Meanwhile, hydroelectricity consumption has a positive and significant effect on economic growth in the long-run in Latin America.

Bildrici (2016) analyzed the relationship between economic growth and hydroelectricity consumption, where the results showed that there is short-run causality in OECD countries as high-income countries. Whereas, there is conservation evidence in Brazil, Finland, France, Mexico, the US, and Turkey. This means that conservation policy of hydroelectricity could be implemented with a minimal detrimental effect on the environment and with moderate economic growth. The same results also showed by the work of Koengkan (2017) in Latin America from 1966 to 2015.

Koçak and Şarkgüneşi (2017) also analyzed energy consumption and economic growth in the Black Sea and Balkan countries and found that there is a long-run equilibrium between energy consumption and economic growth. This result is consistent with the work of Khobai and Roux (2018) and Kahia et al., (2017). Based on the results, sustainable economic growth could be achieved through renewable energy.

Meanwhile, the study of Maleddu and Pulina (2018) showed that efficiency in energy consumption is achieved by higher government expenditure on renewable energy. This means that there is a positive significant effect of green energy on economic growth. However, the work of Pao et al. (2019) in Group of Twenty find that there is also a negative and significant effect of economic growth on hydroelectricity consumptions. Based on this, the results of economic growth and hydroelectricity consumptions are mixed, but most of them have positive and significant effects of economic growth on hydroelectricity consumptions.

The previous literature showed that economic growth has a significant effect on economic growth in developed countries and some developing countries. However, the study of economic growth and hydroelectricity consumption is still rare, especially in APEC countries and India. Based on this, it is challenging study about economic growth effect of hydroelectricity consumption in APEC countries and India both in short-run and long-run effects.

3. Research Method

This study explores the effect of economic growth on hydroelectricity in APEC countries and India. India is selected because this country has relatively high economic growth and produces elevated carbon dioxide. To decrease carbon dioxide, it is crucial to utilize hydroelectricity in APEC countries and India because this area provides the highest carbon dioxide in the world.

Panel ARDL model is used in this study with data from 1994 to 2016 or 391 samples. The data are collected from BP statistical Review and World Bank. The relationship between economic growth and hydroelectricity consumption is modeled as follows:

$$\Delta lnHY_{j,t} = \alpha_{0i} + \sum_{i=1}^{n} \alpha_{1i}\Delta lnHY_{j,t-i} + \sum_{i=1}^{n} \alpha_{2i}\Delta lnY_{i,t-i} + \beta_{11} lnHY_{j,t-1} + \beta_{21} lnY_{j,t-1} + u_{j,t} \quad (1)$$

where *HY* is hydroelectricity consumption, *Y* is economic growth, α_1 and α_2 are short-run coefficients, β_1 and β_2 are long-run coefficients, *t* is time series from 1994 to 2016, *i* is countries (17 countries), and μ is error terms.

4. Research Findings and Discussion

4.1. Model Validity Test

Panel unit root test is conducted to test data stationarity before panel ARDL model estimated. Table 1 shows unit root test both individual intercept and individual intercept and trend where the variables have different stationarities, *I(0)* and *I(1)*. For example, variable *HY* is stationer at level; meanwhile, *GDPC* is stationer after first difference. Based on these results, the panel ARDL model is suitable in this study because the variables have different stationarities.

Table 1. Panel Unit Root Test

	LLC	IPS	ADF-Fisher	PP-Fisher
Individual intercept				
GDPC	-0.872 (0.191)	2.785 (0.997)	17.545 (0.991)	12.514 (0.999)
HY	4.824 (1.000)	1.336 (0.909)	47.227 (0.0130)*	85.503 (0.000)**
ΔGDPC	-5.037 (0.000)**	-5.798 (0.000)**	94.952 (0.000)**	145.256 (0.000)**
ΔHY	-12.758 (0.000)**	-14.344 (0.000)**	232.065 (0.000)**	360.862 (0.000)**
Individual intercept and trend				
GDPC	-1.252 (0.105)	-0.816 (0.207)	37.291 (0.320)	14.050 (0.999)
HY	0.362 (0.641)	-1.321 (0.093)	55.4106 (0.001)**	102.981 (0.000)**
ΔGDPC	-3.271 (0.000)**	-3.447 (0.000)**	65.702 (0.000)**	135.915 (0.000)**
ΔHY	-12.621 (0.000)**	-13.260 (0.000)**	204.041 (0.000)**	1898.94 (0.000)**

Sources: Estimated Results, 2018.

Note: *, ** represent 95 and 99 percent level of significance, respectively.

Cointegration test is conducted to evaluate whether the variables in the model have long-run equilibrium, so they are eligible in panel ARDL model. Table 2 presents the cointegration test for the variables in the model. The results show that there is cointegration between economic growth and hydroelectricity consumption. This means that economic growth and hydroelectricity have short-run converge to long-run equilibrium; hence, panel ARDL is valid to be employed in the study.

Table 2. Panel Cointegration Test

Pedroni Cointegration Test	Statistic	Weighted Statistic
Panel v-Statistic	1.6841 (0.046)*	-0.714144 (0.762)
Panel rho-Statistic	-4.913 (0.000)**	-3.913 (0.000)**
Panel PP-Statistic	-6.653 (0.000)**	-7.114 (0.000)**
Panel ADF-Statistic	-1.469 (0.070)	-5.047 (0.000)**
Group rho-Statistic	-1.483 (0.0689)	
Group PP-Statistic	-5.779 (0.000)**	
Group ADF-Statistic	-3.634 (0.000)**	
KAO Cointegration Test	t-Statistic	
ADF	5.722(0.000)**	

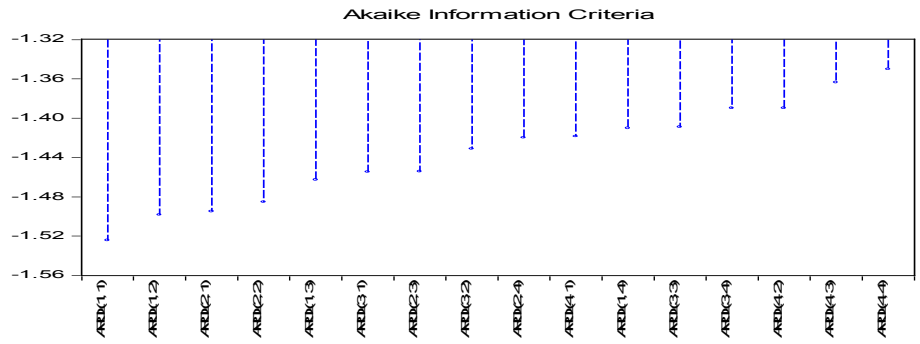
Sources: Estimated Results, 2018.

Note: *, ** represent 95 and 99 percent level of significance, respectively.

4.2. Lag Optimal

Before the panel ARDL estimated, it is imperative to determine lag optimal in the model. Lag optimal is estimated by using Akaike Information Criteria, as presented in Figure 1. The best lag in this analysis is 1,1. Based on this, the panel ARDL model will be estimated with optimal lag is 1,1.

Figure 1. Akaike Information Criteria



4.3. Estimated Panel ARDL for Hydroelectricity Consumption

Panel ARDL model is valid if the estimated error correction term (ECT) of the model is negative and significant. Based on the estimated result in Table 3, the ECT is negative and significant with the coefficient is -0.405. This means that the panel ARDL model can be used in this study. The magnitude of ECT is -0.405 means that if there is a shock in economic growth, the hydroelectricity consumption needs 4.86 months to achieve equilibrium.

Table 3. Estimated Panel ARDL of *Hydroelectricity Model*

Estimated	Variable	Coefficient	t-Statistic
(*Long Run*)	GDPC	0.096	6.523(0.000)**
	C	1.101	3.423(0.000)**
(*Short Run*)	ΔGDPC	0.176	2.435(0.015)**
	ECM(-1)	-0.405	-5.218(0.000)**

Sources: Estimated Results, 2018.

Note: *, ** represent 95 and 99 percent level of significance, respectively.

Table 3 shows that economic growth has a positive and significant effect on hydroelectricity consumption both in long-run and short-run. In the long-run, if economic growth increase by 1 percent, hydroelectricity consumption will increase by 0.096; by assumption, other variables are constant. Meanwhile, in the short-run, the effect of economic growth on hydroelectricity consumption is more significant than long-run. The short-run coefficient is 0.176 means that if economic growth increase by 1 percent, the hydroelectricity consumption will increase by 0.176, other variables are assumed constant. This means that the short-run effect is more significant than the long-run one, where the difference between short-run and long-run is 8 percent.

These results show that there is a one-way direction effect of economic growth on hydroelectricity consumption in APEC countries and India. These results are consistent with the previous studies of Payne and James (2011) and Apergis et al., (2016). From the results, it is essential for the government to increase hydroelectricity consumptions to decrease carbon dioxide problem in the world so that the next generation can enjoy a greener environment with higher economic growth and welfare.

4.4. Cross-section Short-Run Coefficients

The estimated model, as mentioned before, is the panel ARDL model, so the model has a short-run cross-section coefficient for each country in this study. Table 4 shows the short-run cross-section coefficients of each country, where some countries have not significant coefficients such as United State of America, Chile, Australia, Japan, Malaysia, New Zealand, South Korea, Thailand, and Vietnam. Even though the coefficients of these counties are not significant, the increase in economic growth in these countries has a positive effect on hydroelectricity consumption, because the coefficients are positively sloped. These results are consistent theoretically; however, they are not statistically because the contributions of hydroelectricity in certain countries are still relatively small compared to other sources of power.

For the United States, every increase one percent in economic growth will be followed by the increase in hydroelectricity consumption as 0.53 percent, ceteris paribus. The almost the same results are found in Chile, Malaysia, New Zealand, South Korea, Thailand, and Vietnam but with different consumption level of hydroelectricity. Meanwhile, the different results are found in Australia and Japan, where the increase in one percent of economic growth causes a decrease in hydroelectricity consumptions as 0.01 and 0.076 percent, respectively. These results are anomalies because these countries are developed countries where the contribution of hydroelectricity consumptions are higher than the developing ones.

Table 4. Cross Section Short-Run Coefficients

Negara	Cross Section Short-Run Equation		
	C	ΔGDPC	ECT(-1)
United States	1.868[2.40]	0.533[0.529]	-0.411[-10.66]**
Canada	5.262[4.02]	-0.210[-20.23]**	-1.078[-19.16]**
Mexico	2.228[9.68]**	0.237[4.63]*	-0.883[-25.24]**
Chile	0.964[6.12]**	0.126[2.119]	-0.447[-13.24]**
Peru	0.110[10.61]**	-0.142[-15.98]**	-0.036[-14.87]**
Russian Federation	1.449[2.73]	-0.009[-3.92]*	-0.336[-12.17]**
Australia	0.796[7.60]**	-0.010[-0.24]	-0.458[-14.20]**
China	-0.038[-1.146]	0.463[6.55]**	0.012[11.37]**
India	0.345[2.26]	0.467[5.85]**	-0.091[-9.29]**
Indonesia	0.643[6.53]**	-0.255[-6.44]**	-0.362[-9.74]**
Japan	2.400[5.86]**	-0.076[-2.371]	-0.709[-20.59]**
Malaysia	0.001[0.05]	0.035[0.39]	0.041[2.622]
New Zealand	1.415[6.86]**	0.031[2.144]	-0.641[-17.00]**
Philippines	0.653[16.24]**	0.748[9.24]**	-0.49[-23.58]**
South Korea	0.132[12.92]**	0.120[1.076]	-0.520[-13.77]**
Thailand	0.471[9.47]**	0.393[2.183]	-0.487[-11.64]**
Vietnam	0.023[1.145]	0.548[3.08]	0.002[1.01]
New Zealand	1.415[6.86]**	0.031[2.144]	-0.641[-17.00]**

Sources: Estimated Results, 2018.

Note: *, ** represent 95 and 99 percent level of significance, respectively.

Some other countries such as Canada, Peru, China, India, Indonesia, and the Philippines have very significant effects of economic growth on hydroelectricity consumptions compared to Mexico and the Russian Federation. However, economic growth in Canada has a negative and significant effect on hydroelectricity consumption. This result is not consistent with theoretical statement where economic growth has a positive effect on hydroelectricity consumption. The same results are also found in Peru, the Russian Federation and Indonesia. Two factors are affecting the negative effects of economic growth on hydroelectricity consumption. First, the use of renewable energy resources is still limited because the cost of these resources is still expensive. Second, the return on investment of hydroelectricity is very small compared to other fossil powers. The government should provide special incentives for investors in hydropower plants. By providing these incentives, the supply of hydroelectricity will increase, and the role of hydroelectricity power will increase. Hydroelectricity power is essential to ensure the sustainability of the environment and also to decrease global warming.

The consistent results are also showed in Mexico, China, India, and the Philippines, where these countries have positive and significant effects of economic growth on hydroelectricity consumptions. The increase by one percent of economic growth causes the increase in hydroelectricity consumptions as 0.23, 0.46, and 0.74 percent, respectively. These results are consistent with the studies of Solarin and Ozturk (2015), Bildirici (2016), and Koengkan (2017).

5. Conclusions and Recommendations

In general, the results show that there are short-run and long-run relationships between economic growth and hydroelectricity consumption. Some countries have positive and significant effects of hydroelectricity consumption on economic growth, but the other countries are negative and significant effects. In the long-run, the effect of economic growth on hydroelectricity consumption becomes smaller.

Furthermore, there are four categories of results in the study; the first is a positive and significant effect of economic growth on hydroelectricity consumption. Second, positive and not significant effect of economic growth on hydroelectricity consumption, third, negative,

and significant effect. The last if negative and no significant effect of economic growth on hydroelectricity consumption.

It is suggested to the governments in the respective country to increase the use of hydroelectricity consumption and to decrease the fossil electricity power because fossil power harms the environment, especially coal power plant.

The limitations of the study are (i) there is no causality test between economic growth and hydroelectricity consumption; (ii) there should be balanced samples between developed and developing countries to capture the differences. Furthermore, it is imperative to increase the number of countries in the study because the results are mixed compared to other studies.

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DOES QUALITY OF LIFE MATTER FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS IN INDONESIA?

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Abstract

To ensure its sustainable development, although it is not legally binding, Indonesia have strongly committed to support the Sustainable Development Goals (SDGs) that have been initiated by the General Assembly of the United Nations since 2015 with the main targets to end poverty, safeguard the planet, and guarantee the peaceful and prosperous lives of all citizens on the globe in 2030. Amidst the strong commitment of the Indonesian government to include the SDGs' framework in its development agenda, this study empirically examines the extent to which the quality of life has contributed towards achieving the SDGs in Indonesia. Specifically, this study attempts to explore the effect of quality of life on the reduction of poverty and hunger and the increase of access to clean water of the Indonesian across 33 provinces in the country over the period 2010-2017. Using the panel multiple regression approach, the study documented significant positive effects of the income level, tertiary education level, and formal employment status on the reduction on the poverty and hunger index. Additionally, both the tertiary level of education and income positively contributed to the increase in clean water access. These findings shed some lights for the policy-makers to design proper policies for achieving the SDGs agenda through enhancing the citizens' quality of life so that the target of realizing "Zero Goals" where all Indonesian living without poverty and having sufficient access to clean water could be materialized.

Keywords: Sustainable development goals, Poverty, Hunger index, Clean water access.
JEL classification: I31, I39, O18

1. Introduction

There have been many studies discussed the development orientation of "Growth" versus "Development". Growth is identical with traditional development, focusing on increasing a national Gross Domestic Product (GDP), whereas "development" is a more modern concept emphasizing on the increase of per capita income. Thus, the development focuses more on social indicators and highlights the development as a multi-dimensional process. Brinkman (2016) sees growth often not related to development, thus a modern economic development does not compatible with illiteracy and destitution (Kuznets, 1989). Growth by itself is often a forced achievement of numbers, not a result of development towards equity. Growth without development is an experience that often occurs in underdeveloped and developing countries.

Since 2015, the General Assembly of the United Nations has initiated the sustainable development agenda that linked the economic growth and economic development for the purposes of ensuring human welfare and equitable distribution of economic resources both for present and future generations. The sustainable development agenda has been designed based on a comprehensive and integrated response to many social, economic, and environmental challenges, by creating effective and cross-sectoral partnerships (Hoelman et al., 2015). The main targets of the SDGs are to end the poverty, safeguard the planet, and guarantee the peaceful and prosperous lives of all citizens on the globe in 2030.

The SDGs comprise 17 goals and 169 indicators, covering a range of issues that affect both developed and developing countries across the globe, including Indonesia. Since its inception in 2015, the SDGs have been strongly supported by the government of Indonesia by including the SDGs' framework in its national economic development agenda. Of 17 goals and 169 indicators of the SDG agenda, this study only focuses on achieving two-main important indicator of the SDGs, namely environmental problem (i.e., increasing the access to clean water suitable for consumption) and socio-economic problems (i.e., reducing the depth index of poverty, reducing the proportion of people living below the poverty line, and ensuring the adequacy of nutritional consumption of at least <14.000 kcal per capita). To measure the three socio-economic indicators, Gentilini and Webb (2008) has combined it into an index, so-called the Poverty and Hunger Index (PHI). The PHI index offers a better measurement of poverty as it combines several indicators into a single index. Measuring the indicators of poverty separately might provide partial and contradicting information on the existing real poverty problem.

Table 1 illustrates the targets and achievements of the two SDG agenda in Indonesia, namely the PHI and the household access to clean water over the period 2010-2017.

Table 1. Targets and achievement of indicators sustainability development in Indonesia

Indicator	Target				Achievement				Status
	2010	2015	2016	2017	2010	2015	2016	2017	
Poverty and Hunger Index (PHI)	0.45	0.36	0.30	0.20	0.51	0.45	0.48	0.30	Not achieved
Household access to clean water (%)	46.73	69.80	80.00	86.00	42.76	66.5	72.62	78.05	Not achieved

Source: Millennium Development Goals Report (2015) and National Socio-Economic Survey (2017).

As observed from Table 1, the realization of the PHI reduction and the increase in access to clean water consumption were lower than their targets, meaning that the reduction in PHI and the increases in household access to clean water have not been achieved. For example, in 2017, the government of Indonesia targeted to reduced its PHI to 0.20, but its achievement was only 0.30. Similarly, the Indonesian government was only able to increase household access to clean water by 78.05% than its 86% target in 2017. By the year 2019, the government expected 100% Indonesian will have full access to clean water (Central Agency of Statistics of Indonesia, 2016). These stylized facts indicate that the Indonesian government has failed to solve the environmental and socio-economic problems as part of the SDGs.

Although Indonesia recorded the third highest average annual economic growth by 4% after China (9%) and India (5.5%) in the last two decades, over the period 2000-2017 (Tjoe, 2018), but the country failed to reduce the poverty level and increase the household access to clean water, as targeted (See Table 1). The failure of Indonesia's economic growth to provide sustainable development for its citizens further confirms that support economic growth is connected to the decline in illiteracy and destitution (Kuznets, 1989), thus economic development as stated by Brinkman (2016). To reduce and even end the poverty and provide the peaceful and prosperous lives of all Indonesian, the government efforts to enhance economic growth should focus on promoting citizen's welfare in line with the sustainable development agenda. Otherwise, Indonesia will fail to achieve the targeted SDGs by 2030.

There have been many previous measured indicators of sustainable development and investigated their determinants using both time series data (Kader and Parera, 2014; and Haziq, 2017) and cross-sectional data (Basu et al., 2017). For example, Abdalla (2014) assess the adequacy of calories and protein intake in Sudan and Dominguez-Salas et al. (2016) explore the socio-economic predictors of malnutrition among the low-income groups in

Nairobi. There have also been studies investigated the correlation between income levels and food insecurity of rural communities in the US (Annestrand et al., 2017), the influence of education on household food security in rural area in Pakistan (Abdullah et al., 2017), and the effect of educational levels on both income and food security in South Africa (Nwokolo, 2015). However, these studies could not provide comprehensive empirical evidence on the measurement of sustainable development and its determinants since the studies only measure the sustainable development partially, focusing only on selected indicators of single goal of sustainable development of good health and well-being (i.e., nutrition intake and food security) either using time series or cross-section data at the household level. Additionally, these studies only explored selected determinants of sustainable development indicators, namely income and education levels for the cases of the US, African countries, and Pakistan.

Motivated to fill the existing gaps in the previous studies and to provide a more reliable evidence on the sustainable development issue in Indonesia, this study measure the sustainable development more comprehensively using the PHI [i.e., the combination of poverty and hunger indicators (UNDP, 2007)] and the access to clean water of the 33 provinces nationwide in Indonesia. Additionally, the study explores more determinants of sustainable development, comprising levels of income and education as well as the type of decent employment. Specifically, the study aims to determine the effect of the quality of life of the population with indicators of income level, education level and decent work status on the reduction in the PHI and the increase in access to clean water as part of SDGs' realization.

The findings of this study are expected to provide and enrich existing literature on sustainable development, especially for Indonesia. The findings of the study are also hoped to some lights for the government in designing comprehensive policies and providing strategic solutions on achieving sustainable development agenda of "Zero Goals" in Indonesia by 2030.

The rest of the study is structured in the following sequences. Section 2 reviews selected relevant previous studies. Section 3 provides the empirical framework and data, followed by a discussion of the main findings and their implication in Section 4. Finally, Section 5 concludes the paper.

2. Literature Review

The 17 SDGs are the continuation of the eight Millennium Development Goals (MDGs) that stimulated a worldwide campaign from 2000-2015 to end various dimensions of poverty. Unlike the MDGs that only applied to the developing countries, the SDGs apply to all countries on the globe. The MDGs only focused on poverty reduction, while the SDGs focuses on a universal development with-and-for sustainability, comprising new themes of the environment, economy, and society as embedded systems where the pillars of urban areas, water and sanitation, energy, and climate change are prominently featured (Fukuda-Parr, 2016).

To measure the sustainable development, various indices have been introduced such as the well-being Index that are constructed from socio-economic indicators comprises poverty, hunger, education, and health, the environmental sustainability index that comprises indicators of clean water access, proper sanitation, reforestation and waste management, and ecological index that covers the CO2 emission, climate, natural resources, and renewable energy indicators (Kates et al., 2005; and Novita et al., 2015). These approaches to measuring effective sustainable development have considered basic human social needs in the long-term perspective or intergenerational concentrations (Amekudzi et al., 2015).

Based on the Haq's (1995) writing on the reflections on human development, Sen (2000) viewed that promoting global human life could not be simply done through the improvement of the economy of a country, but it should be done through holistic human sustainable development agenda since the enhancement of living standard by reducing poverty and hunger would have more impact on prosperity than just increasing economic capacity and economic growth. Thus, the SDGs are targeted to fulfil the basic needs of all population, thus improve their quality of life (Streeten, 2008). Quality of life is a process of expanding choices for residents to build their lives that are considered valuable and essentials for human development. Living with a quality of life, people can feel a long and healthy life,

knowledgeable and have access to the resources needed for enjoying a decent and normal life. UNDP (2007) has measured the quality of life using indicators of education, health, income, and decent work levels, while OECD (1982) has measured it using indicators of income, housing, environment, social stability, health, education, and decent work.

Based on the above delineation, it is clear that the SDGs of reducing poverty and hunger as measured by the PHI and enhance good health as measured by the access to clean water are determined by many factors, including quality of life indicators, namely: education, health, income, decent work, housing, environment, and social stability. Thus, the next section discusses the relationship between quality of life and the PHI and clean water access.

2.1. The PHI and quality of life

There have many previous studies investigated the effect of quality of life dimension on the levels of poverty and hunger among the citizens worldwide. For example, Faharuddin (2012) explores the effect of income on the decreases in the PHI and documented that per capita income has a strong connection to the reduction in the PHI. More specifically, Wang et al. (2016) reveal that 69% decline in the PHI that is with multidimensional poverty is caused by an increase in a percentage of income. Income reflects the quality of life and poverty level as it measures the level of per capita consumption expenditure. The low level of socio-economic households tends to be poor and very vulnerable to food insecurity, limited water access, unhealthy life, and malnutrition among the pregnant women and children aged 1 to 3 years (van Wesenbeeck et al., 2009). Similarly, income is associated with sufficient nutritional food consumption, thus a healthy life (Dominguez, 2016).

The other quality of life indicators that are related to the PHI are the levels of education, secondary or tertiary level. The levels of education reflect differences in people's behaviour, rationality, and the way of how they make a decision to fulfil their living necessity affect their sustainable development levels of the PHI. In their study, Mom Hogan and Berning (2012), Njong (2010), and Ahmad et al. (2016) found that, on the average, disposable income per household member with the primary education level was lower and tend to be relatively poor than those with the secondary and university education levels. The years of schooling is negatively related to poverty and food insecurity (Abdullah, 2017). Mutisya et al. (2015) revealed that those with a low level of education experienced a higher level of food insecurity and malnutrition problem as they prioritize consuming only staple foods than fruits and vegetables. An increase in the population attending school causes a reduction in food insecurity and increase in nutritional intake. In the study on 12,000 citizens in Cape South Africa, Nwokolo (2015) documented that the levels of education and income positively related to household food security. The low level of income and limited access of household to meet their basic necessities (Annestrand et al., 2017) that is caused by difficulty in finding a decent job due to the low level of education, subsequently causes hunger and food insecurity.

Finally, the next indicator that influences poverty and hunger is the working status. Decent work is a job that provides sufficient income, finances a decent and dignified life, guaranteed physical, psychological security, and safety (Shanto, 2017). Self-employed workers have been a solution in severe poverty although this type of job only provides little economic benefits and welfare for individuals and locales (Goetz et al., 2012). Meanwhile, non-agricultural freelance works are a sustainable job that stabilizes income and reduces poverty (Field, 2014; and Rajapaksha, 2015). Hermawan (2012) found that the development non-agricultural sectors have an important essence to reduce poverty and hunger, as a one percent increase in per capita income in the non-agricultural sector has reduced the poverty rate by 15 percent. Finally, Abreu et al. (2018) found that by switching to employment as an entrepreneur, a worker would gain higher job satisfaction and welfare.

2.2. Access to clean water and quality of life

Clean water is one of the basic needs everybody should have full access used for drinking, cooking, bathing, and other hygienic life purposes (Ministry of Health, the Republic of Indonesia, 2014). Although the government of Indonesia targets a 100% access to clean water by 2019, but over the period 2016-2017, less than 50% of the citizens had access to decent

drinking water or protected piping water (National Socio-Economic Survey, 2017). Having full access to clean water becomes an obstacle when the living standard of the population is low. The knowledge about the importance of health influences the level of clean water consumption. Fan et al. (2013) and Fan et al. (2017) documented that water consumption and water use are highly dependent on the knowledge, attitudes, and behaviour of the citizens. In China, the consumption of water per capita per day from 130 cities significantly increased by 65% over the period 2000 – 2015, which are strongly influenced by meteorological, socio-economic, and income factors. Similarly, Rachmaningtyas et al. (2013) found that education level has a positive and significant influence on clean water access in Indonesia. People with a higher level of education are more oriented to preventive measures for their health by consuming clean water, while people who consumption low quality of water has been at risk of being contaminated.

Apart from the education level, Basu et al. (2017) found that income is also one of the important factors affecting household access to clean water. Similarly, Ahmad et al. (2016) found that the education level has a positive relationship with the consumption of clean water. The higher the level of education, the higher the knowledge of the health of the household, thus they become to be more selective in choosing suitable water for consumption that is bacteria-free. However, the findings of Rachmaningtyas et al. (2013) and Basu et al. (2017) were contradicted to those of Cronin et al. (2017) who found that the level of education and income have no significant effect on the consumption of clean water.

3. Research Method

3.1. Empirical framework

This study investigates the influences of the quality of life on the sustainable development goals of poverty and hunger reduction and increased in clean water access across 33 provinces in Indonesia over the period 2010-2017. Thus, two dependent variables of the Poverty and Hunger Index (PHI) and Access to Clean Water (ACW) are regressed against three-dependent variables of quality of life, namely the level of per capita income (PINC); the level of education, comprising the secondary education (SEDUC) and tertiary education (TEDUC) levels; and the decent employment status, including the numbers of self-employed (SEMP), formal workers (FEMP), and the number of non-agricultural freelance workers (FREMP). With the exception of all other variables, only income per capita variable is transformed into the natural logarithm. A panel data model approach based on Asteriou and Hall (2009) is employed. The data panel modelling is the most efficient and suitable model (Berk, 2010; and Cronin et al., 2017) to be utilized in the study as it investigates the relationship between quality of life and sustainable development goals across 33 provinces in Indonesia over period 2010-2017. The first following estimated panel regression model is used to explore the effects of three qualities of life (i.e., income, education, and employment status) on the PHI:

$$PHI_{i\,t} = \beta_1 PINC_{it} + \beta_2 SEDUC_{it} + \beta_3 TEDUC_{it} + \beta_4 SEMP_{it} + \beta_5 FEMP_{it} + \beta_6 FREMP_{it} + e\upsilon_{it} \quad (3.1)$$

Meanwhile, the second following estimated panel regression model is used to explore the effects of two-quality of life variables (i.e., income and education) on the access to clean water. In this model, we exclude the employment status as the determinant of clean water access due to non-availability of earlier studies suggested this variable as one of the determinants of clean water access. Thus, the model is as the following:

$$ACW_{it} = \gamma_1 LNPINC_{it} + \gamma_2 SEDUC_{it} + \gamma_3 TEDUC_{it} + \varepsilon\upsilon_{it} \quad (3.2)$$

where *PHI* is the Poverty and Hunger Index, *ACW* is the access to clean water, PINC is the per capita income, SEDUC is the secondary level of education, TEDUC is the tertiary level of education, SEMP is the self-employment, FEMP is the formal employment, FREMP is the freelance employee, $e\upsilon$ and $\varepsilon\upsilon$ are the error terms, and *it* is the province *i* of the year *t*.

In estimating the panel data, two prominent generalized least square (GLS) models were usually used, namely the Fixed Effects Model (FEM) and the Random Effects Model (REM) or Error Components Model (ECM) (Gujarati, 2009). The Hausman, Redundant, and Lagrange Multiplier (LM) test would be first conducted to ensure the best suitable model to estimate the data in this study. If *p*-values of the tests are found to be insignificant, it suggests using the REM as the most suitable panel regression model. On the contrary, if the tests are significant, then the FEM model would be adopted.

Prior to the estimation of selected panel model, batteries of classical assumption tests of multicollinearity, and autocorrelation would be conducted. As for the multicollinearity test, the Variance Inflation Factor (VIF) is adopted. If the VIF is smaller than 10, the data are free from the multicollinearity. Finally, the Durbin-Watson (D-W) test is used to check for the autocorrelation, where if the D-W value is around 2, then the data is said to be non-autocorrelation, while heteroscedasticity has been approved by weighting the cross-section weight in panel model (Gujarati 2009).

3.2. Data

This study investigates the influences of the quality of life on the sustainable development goals of poverty and hunger reduction and increased in clean water access across 33 provinces in Indonesia over the period 2010-2017. Thus a balanced panel data, comprising 264 observations are investigated. Data of this study is obtained from the SDGs report, the Indonesian Central Bureau of Statistics, and the National Socio-Economic Survey of the Republic of Indonesia. These data include a number of population, income, labour statistics, and expenditure. The Poverty and Hunger Index (PHI) is calculated based on the formula of the UNDP (2007), comprising the poverty depth index, the proportion of the population consuming below the minimum calorie intake (<1,400 kcal/mg), and the proportion of the population living below the poverty line. These entire PHI indicators are then formulated into a composite measure of the PHI based on Gentilini and Webb (2008), as follows:

$$\mathrm{PHI} = \frac{1}{3}\sum_{i=1}^{3}[(x_i - \min)/(\max_i - \min_i)] \tag{3.3}$$

where x is the actual value of the i indicator, *max* and *min* are the maximum and minimum values of each indicator, respectively. The minimum value is 0 applies for all provinces in accordance with government targets.

In more detail, the data or variables, measurements, and the sources are illustrated in Table 2.

Table 2. Data description

Variable	Description	Scale	Source of Data
1. SDGs:			
a. PHI	Poverty and Hunger Index	Percentage	The SDGs Report (2018).
b. ACW	Access to clean water	Percentage	
2. Quality of Life:			
a. PINC	Income per capita	IDR	Central Bureau of Statistics, Indonesia (2018)
b. Education level:			
i. SEDUC	Secondary Level of Education	Percentage	Central Bureau of Statistics, Indonesia (2018) and the SDGs Report (2018).
ii. TEDUC	Tertiary Level of Education	Percentage	
c. Employment Status:			
i. SEMP	Number of Self-employed	Percentage	National Socio-Economic Survey, Indonesia (2018).
ii. FEMP	Number of Formal Worker	Percentage	
iii.FREMP	Number of Freelance Worker	Percentage	

4. Results and Discussion

4.1. A brief overview of the SDGs and quality of life in Indonesia

Prior to the discussion of the main finding, this section describes the condition of poverty and hunger of population, access to clean water, and quality of life across 33 provinces in Indonesia. As observed from Table 3, on the average, the levels of national PHI, clean water access (ACW), income per capita (PINC), secondary education (SEDUC), tertiary education (TEDUC), self-employment (SEMP), formal employment (FEMP), and non-agricultural freelance employment (FREMP) across 33 provinces in Indonesia for the period 2010-2017 was 25%, 23%, IDR702.69 thousand, 25.77%, 7.26%, 33.28%, 35.06%, and 4.46%, respectively. The province of Bali is found as the province with the lowest value of the PHI by 10%, while the province of Papua is recorded as the highest level of the PHI by 46%. North Maluku is found as the province with the highest level of clean water access by 35%, while Bali is found as the province with the lowest clean water access by 11%. In term of income per capita, the province of Jakarta recorded the highest level of income (IDR1.527.90 thousand), while the province of East Nusa Tenggara recorded the lowest income per capita (USD437.32 thousand).

Next, in the view of education level, the largest population of the province of Jakarta, the capital city of Indonesia was graduated the secondary education (38.41%) and tertiary education (15.59%) levels, while the smallest number of population with the secondary and tertiary education levels were found for the provinces of East Nusa Tenggara (18.41%) and West Kalimantan (4.27%), respectively. Finally, in term of employment status, the largest number of population of the provinces of Maluku, Jakarta, and Central Java are found to work as self-employed (42.80%), formal employment (66.17%), and freelance employment (8.16%), respectively. On the other hand, the least number of self-employed was found in the Province of Riau Island (21.98%), while the least number of populations who worked as the formal employment (17.92%) and freelance employment (0.89%) were both found in the province of Papua.

Referring to Table 3, it shows that the decline in the PHI and increased access to clean water in all provinces in Indonesia have not been achieved as targeted in sustainable development goals. Nationally, on the average, the achievement of the PHI and increase in access to clean water were 25% and 23%, respectively, which are still far from the 0% and 100% targets. In addition, Table 2 also shows a different level of income, education, and employment status of the population across 33 provinces nationwide. Does different achievement of the PHI and clean water access relate to the different level of income, education, and employment status across the provinces in Indonesia? In the next section, this question is answered.

Table 3. Mean values of the SDGs and indicators of quality of life in Indonesia by provinces

Province	PHI (Index)	ACW (Index)	PINC (IDR 000)	SEDUC (%)	TEDUC (%)	SEMP (%)	FEMP (%)	FREM (%)
Aceh	0.29	0.27	717.42	29.69	7.86	35.49	34.04	4.43
North Sumatera	0.23	0.23	636.88	31.67	6.90	29.10	34.81	4.54
West Sumatera	0.17	0.18	734.27	26.74	8.08	39.83	30.56	5.11
Riau	0.23	0.19	829.24	28.61	6.35	32.43	37.05	3.43
Jambi	0.24	0.25	668.46	34.71	7.58	35.00	37.56	4.30
South Sumatera	0.28	0.28	623.39	23.54	5.52	34.03	29.60	2.32
Bengkulu	0.29	0.31	644.47	24.50	6.62	35.37	26.06	3.80
Lampung	0.28	0.24	573.74	21.95	4.55	33.59	26.67	5.87
Bangka Belitung	0.18	0.21	876.49	23.77	6.36	29.15	39.18	4.52
Riau Island	0.21	0.26	1,081.21	31.12	5.85	21.98	65.60	3.38
Jakarta	0.18	0.19	1.527.90	38.41	15.59	22.27	66.17	2.81
West Java	0.21	0.21	720.56	21.90	5.87	29.49	41.75	8.07
Central Java	0.27	0.27	468.87	22.53	6.40	31.32	31.82	8.16
Yogyakarta	0.23	0.29	644.35	23.95	7.69	29.62	37.53	6.70
East Java	0.22	0.22	607.03	26.71	9.43	30.84	31.96	6.96
Banten	0.14	0.12	816.76	23.06	6.16	23.36	55.24	5.82
Bali	0.10	0.11	911.83	29.19	8.15	29.71	39.88	6.56
West Nusa Tenggara	0.28	0.32	545.45	20.19	5.98	34.91	26.50	7.87
East Nusa Tenggara	0.36	0.33	437.32	18.41	6.54	39.08	22.63	2.05
West Kalimantan	0.22	0.18	635.53	19.53	4.27	28.84	30.60	3.01

Province	PHI (Index)	ACW (Index)	PINC (IDR 000)	SEDUC (%)	TEDUC (%)	SEMP (%)	FEMP (%)	FREM (%)
Central Kalimantan	0.18	0.17	682.25	22.11	5.58	31.32	38.57	2.83
South Kalimantan	0.14	0.12	788.41	21.48	5.91	33.85	33.99	4.80
East Kalimantan	0.27	0.27	996.44	32.45	8.10	29.20.	51.94	3.05
North Sulawesi	0.22	0.20	717.45	30.57	7.37	39.49	36.88	6.44
Central Sulawesi	0.26	0.24	624.29	21.79	6.86	34.90	27.15	5.04
South Sulawesi	0.19	0.14	604.75	22.89	8.09	35.07	31.44	2.95
Southeast Sulawesi	0.23	0.19	468.08	27.37	9.55	39.49	29.98	3.37
Gorontalo	0.27	0.23	577.93	18.99	5.71	37.20	28.26	6.46
West Sulawesi	0.23	0.24	477.29	21.60	8.51	37.11	24.11	3.83
Maluku	0.39	0.34	536.43	32.94	8.46	42.80	29.89	2.66
North Maluku	0.35	0.35	551.25	26.46	6.85	37.45	28.12	2.61
West Papua	0.43	0.23	790.26	25.66	7.98	34.69	33.56	2.45
Papua	0.46	0.14	672.70	25.88	8.73	36.12	17.92	0.89
Mean	0.25	0.23	702.69	25.77	7.26	33.28	35.06	4.46

Source: Central Bureau of Statistics, Indonesia (2018), National Socio-Economic Survey, Indonesia (2018), and the SDGs. Report (2018)

4.2. Main findings and their discussion

In this section, the findings from the GLS model on the influences of income, education level, and types of employment on the PHI and access to clean water are reported. However, prior to this, the first step of the study is to identify the most suitable GLS model to estimate the panel data. In selecting the most suitable three-panel models among the common effect model (CEM), random effect model (REM), and fixed effect model (FEM), both the Redundant and Hausman tests are conducted.

As reported in Table 4, based on these tests, the fixed effect model (FEM) is found to be a better model than those of CEM and REM to analyze our data, as indicated by the p-value of the tests which were smaller than its 5% level of significance. In other words, the fixed effect model (FEM) model is found to be the most appropriate model to be adopted in the study to estimate the influences of quality of life factors on the PHI.

4.2.1. Effect of quality of life on the PHI

The findings of the effects of quality life factors of income, education level, and types of employment on the sustainable development goal from the perspective of the PHI are reported in Table 4.

Table 4. The effect of quality of life on the PHI in Indonesia

Variable	Common effect model	Fixed effect model	Random effect model
Constant	0.3410 (10.438)***	0.2640 (12.514)***	0.2750 (9.170)***
PINC	-6.0059 (-0.678)	-2.0087 (-4.189)***	-1.0540 (-2.516)**
SEDUC	-0.0022 (2.589)**	-0.0010 (1.896)*	-0.0015 (-2.349)**
TEDUC	-0.0023 (-1.341)	-0.0030 (-4.046)***	-0.0043 (-3.437)***
SEMP	-0.0007 (1.470)	-0.0050 (-2.358)**	-0.0005 (1.661)
FEMP	-0.0030 (-6.416)***	-0.0020 (-0.502)	-0.0010 (-2.175)**
FREMP	-0.0107 (-5.155)***	-0.0087 (-4.189)***	-0.0014 (-0.715)
R^2	0.2779	0.7602	0.1891
Adj-R^2	0.2610	0.7478	0.8699
F-Statistics	16.4270 [0.000]***	39.4179 [0.000] ***	6.3762 [0.000] ***
Jarque Berra	0.5300 [0.125]	3.2600 [0.651]	0.7100 [0.133]
Durbin Watson	0.58	2.82	1.41
Model selection test	Panel model	Chi-statistics	Remark
Redundant test	FEM	31.4950 (0.000)***	FEM (Ha)
Hausmant test	REM	15.2062 (0.018)	FEM (Ha)
Lm test	-	-	-

Note: Figures in (.) and [.] indicate t-statistics and probability value, while the ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively.

As the study identified the FEM is the best model to be adopted in this study, thus the discussion only focused on the findings of FEM. As observed from Table 4, the study documented a negative relationship between all quality of life factors of income, education level, and types of employment on the PHI at least at the 5% significance level. Overall, these qualities of life factors explained the variations in the PHI by 86.99% as indicated by the adjusted R-square value of 0.8699. This finding indicates that the achievement of PHI target is found to be most affected the quality of life factors, whilst other factors which are not investigated in the model explained variations in the PHI only by 14.01%. This finding is in

line with the study by Goetz et al. (2012) and Rajapaksha (2016) who found that the quality of life was negatively related to the PHI. This further confirms that if the government intends to achieve the sustainable development of the PHI reduction, the focus should be given on improving income, promoting education, and providing more job opportunities to its citizens

Comparing to all quality of life factors, income was found to be the most dominant factor affecting the realization of achieving the SDGs' target of reducing poverty and hunger index. Particularly, if the per capita income increased by 1%, thus the PHI index could be reduced by 10.54%, while other variables of education level and employment only contributed 0.1% - 0.4% reduction in the PHI. However, the tertiary education level has contributed more to the reduction in the PHI by 0.43% than the secondary level of education which only contributed to the reduction in the PHI by only 0.15%. This further indicated that the higher level of education is necessarily needed to accelerate poverty and hunger reduction as the employment with a higher level of education status would get a better payment. Finally, in the view of the employment status, only the formal employment, such as labour in across the economic sectors in Indonesia has contributed towards the reduction in the PHI by 0.10%, while other types of employment, i.e., self-employed and freelance employment have no significant effect on the reduction of the PHI as these types of employment commonly paid with the lower level of salary. The salaries received by these employed workers were usually below the level of provincial minimum wage and were insufficient to fulfil their basic needs and thus reduced their poverty and hunger problem. This finding suggests the importance for the government to ensure the employers to pay their workers at least in accordance with the set minimum wage levels across the provinces nationwide. Those employers who fail to provide an appropriate level of salary to their workers, the government should impose a just penalty.

Overall, our findings are supported by the previous studies such as Wang et al. (2016) who recorded that an increased in income has significantly reduced multidimensional poverty problem. The significance of education levels both secondary and tertiary in reducing the PHI is in line with the studies by Thapa (2013), Nwokolo (2015), and Saad et al. (2011). According to them, the education level, especially the tertiary education level has significantly contributed to poverty and hunger reduction. Finally, the finding of the negative significance of formal employment on the PHI is also supported by those of VanWey and Vithayathil (2014) who documented that formal employment has positively influenced the PHI reduction. However, our findings of the insignificant influence of self-employment and freelance employment on the reduction in the PHIs contradicted to the finding by Pavithra and Vatta (2013). In their study, Pavithra and Vatta (2013) found that the non-agricultural freelance employees were found to be the most important workers in the rural economy to support the livelihoods and eliminate poverty and hunger of rural residents, while Abreu et al (2018) found that self-employment, particularly the entrepreneurs enjoyed higher level of income and welfare.

Furthermore, Dominguez-Salas et al. (2016) also documented that the socio-economic status such as income and education level affected the malnutrition problem in Nairobi, where the low level of socio-economic status caused consumption of calorie inadequacy, which finally increased the number of children who are malnourished and growth stunted. Finally, chronic food insecurity has been caused by the lack of income and limited access of the household to meet their minimum standards of food needs (Annestrand et al., 2017).

Our findings further suggest the importance of the government to prioritize the poverty reduction agenda on promoting the socio-economic status of the citizens as it positively contributes towards the reduction of the poverty and hunger in Indonesia, and consequently would realize the aspiration of SDGs' target in the country. The Indonesian government suggested providing free education by offering more scholarships for poor-smart students. The education institutions should pay more attention to the quality of higher education that is oriented to learning-by-doing, so that the graduates produced would not only academically intelligent but they also would both affectively and psychometrically intelligent. In addition, the government should offer more job opportunities through the inclusive sustainable development agenda. The government should provide more business space for independent entrepreneurs administratively and bureaucratically. Creating more jobs through small-medium enterprises (SMEs) financial supports would enhance the per capita income of the

population and in turns would realize the aspiration of the country achieving the SDGs' target by 2030.

4.2.2. Effect of quality of life on the clean water access

Next, the findings of the effects of life quality factors on the achievement of the SGDs' target from the perspective of clean water access water across 33 provinces in Indonesia over the period 2010-2017 are reported in Table 5. As observed from Table 5, based on the Redundant, Hausman and Lagrange Multiplier (LM) tests, the study found that the p-value of the test is smaller than its 5% level of significance, indicating the rejection of the null hypothesis of the FEM. In other words, the REM model is found to be the most appropriate model to be adopted in the study to estimate the influences of quality of life factors on the access to clean water. Thus, the next discussion is only focused on the findings of REM.

Referring to the random effect model (REM) in Table 5, the overall variation in the access to clean water is explained by 22.71% changes in the quality life factors of income per capita and education levels, as indicated by the R2-adj value of 0.2271. This indicates that there are many other factors might have an effect on clean water access among the population in Indonesia. These factors include the water infrastructures, the level of rainfall, level of population awareness on the healthy life, forest damage rates, number of population, quality and quantity of raw water supply, and so on.

Table 5. Effect of quality of life on clean water access in Indonesia

Variable	Common effect model	Fixed effect model	Random effect model
Constant	37.9960 (8.449)***	34.2670 (6.463)***	37.9960 (8.449)***
PINC	13.9780 (6.990)***	0.0006 (3.641)***	0.0083 (3.658)***
SEDUC	-0.0052 (-0.317)	0.0830 (0.431)	-0.0310 (6.509)***
TEDUC	2.0037 (6.509)***	2.1840 (6.637)***	2.0037 (8.449)***
R^2	0.2359	0.43036	0.2359
Adj -R^2	0.3635	0.34209	0.2271
F-Statistics	0.0889 [4.000]	4.92195 [0.000]***	26.7587 [0.000]
Jarque Berra	0.7303 [0.113]	3.2301 [0.640]	0.6102 [0.122]
Durbin Watson	0.79	2.34	1.98
Model selection test	Panel model	Chi-statistics	Remark
Redundant test	CEM	32.287 [0.000]*	FEM (Ha)
Hausman test	REM	3.350 [0.340]*	REM (Ho)
Lm test	CEM	26.576 [0.000]*	REM (Ho)

Note: Figures in (.) and [.] indicate t-statistics and probability value, while the *** indicates significance at the 10% level.

Comparing to the quality of life factors of education and income levels, the study recorded that the tertiary education level played a dominant role in increasing the level of clean water access. Specifically, a 1% increase in the population in tertiary education level caused an increased in the access to clean water by 200.37%. However, a 1% increase in the population in the secondary education level contributed to the decline in clean water consumption by 3.10%. Finally, an increase of 1% of per capita income only contributed to the increase in clean water access by Indonesian population by only 0.83%.

Our finding of the greatest role of the tertiary level of education and the negative influence of secondary level of education on the increase in clean water access further indicate the higher level of education of the population, the higher would be their awareness and knowledge of important to live healthy by consuming hygienic water. Our findings are in line with the research conducted by Team Water Wise from Charles Darwin University, supported by the research grant from the Australian Aid (Hobgen et al., 2016), who found that level of education contributed towards a higher level of daily clean water consumption.

Our study also found a positive effect of income on clean water access, as the availability of sufficient income to pay water bill ensures the fulfilment of clear water access by the population. This finding is supported by Zeneli (2016), Haziq and Panezai (2017) and Fan et al. (2013) for the cases of Albania, Afghanistan, and China, respectively. Apart from the meteorological factors and socio-economic status, level of income was found to be the most influential factor affecting the daily consumption of clean water in Albania, Afghanistan, and China. These findings further implied that the government's efforts to increase the access to clean water should be focused on enhancing the population's income and education level. Offering more job opportunities through the creation of more financially supported SMEs and providing more scholarships for the lower-income group's citizens would enhance the

education level of the population and consequently increase their per capita income that finally contributes toward the realization of the SDGs' aspiration nationally by 2030 where all population has full clean water access. If the government could provide a gradual clean water access subsidy or granting free access by the poor to the clean water on the gradual basis continuously, it would finally realize the 100% target of the SDGs for the Indonesian to have fully clean water consumption by 2030.

Finally, all variables used in our estimated GLS models have been checked their classical assumptions problem. All variables investigated in the study were normally distributed based the Jarque-Bera test, no multicollinearity problem as indicated by the Variance Inflation Factor (VIF) with the value between 1.054-1.3213; homoscedastic as indicated by the Breusch-Pagan (BP) p-value, and non-autocorrelated as indicated by the Durbin-Watson (DW) values of 0.164 – 2.032. These findings indicated that the estimated variables in our models have fulfilled all classical assumption, thus produce reliable and robust findings that could be inferred for policy formulation.

5. Conclusion

The indicators of sustainable development from the perspectives of poverty and hunger reduction and increase in clean water access in Indonesia have not yet reached the target. The achievement of SDGs is very much related to the level of quality of life such as levels of income, education, and employment status. This study investigated empirically the effect of quality of life on the reduction in the poverty and hunger index (PHI) and the increase in access to clean water across 33 provinces in Indonesia over the period 2010-2017. Using the panel regression model, the study found that the increase in quality of life has contributed to the decline in the PHI and the increase in clean water access.

Comparing to all quality of life factors, income was found to be the most dominant factor affecting the realization of achieving the sustainable development target of reducing the PHI. In addition to the income, the tertiary education level has contributed more to the reduction in the PHI than the secondary level of education, indicating the importance of having a higher level of education to accelerate the poverty and hunger reduction as the employment with a higher level of education status would get a better payment. In the view of the employment status, only the formal employment, such as labour in across the economic sectors in Indonesia has contributed towards the reduction in the PHI, while other types of employment, i.e., self-employed and freelance employment were found to have no significant effect on the reduction of the PHI.

As for the access to clean water, the study documented the highest contribution of the tertiary level of education to the increase in clean water access, followed by the increase in population per capita income. However, the secondary level of education was found to adversely affect the clean water access. These findings further indicate the significance of the population to have a higher level of education, particularly knowledge of important to live healthily by consuming hygienic water.

Thus, to achieve the sustainable development targets of fully uplift the population from the poverty and hunger and provides full access to the clean water; the government should design policies focusing on the enhancement of the quality of life of the citizens. Granting more scholarships for the poor-smart students and creating more jobs by giving financial support to the SMEs nationwide would enhance the per capita income of the population, education level, and employment opportunities. This would, in turns, realize the aspiration of the country achieving the sustainable development target of "zero goals" by 2030. To accelerate the achievement of the sustainable development target of full clean water access, the government might provide subsidy or granting free access by the poor to the clean water nationwide.

Further studies on the topic of achieving sustainable development in Indonesia could provide better and comprehensive empirical findings by considering more variables in the model of estimation. These factors could include the water infrastructures, the level of rainfall, level of population awareness on the healthy life, forest damage rates, quality and quantity of raw water supply, and so on. Other political, socio-economic, technological, legal, and environmental factors might also be considered. Additionally, comparing different countries across the regions into the analysis would also enrich the existing empirical shreds

of evidence on influences of quality of life factor on the realization of the sustainable development target. Finally, comparing the private and public organization would also enrich the existing empirical findings on the investigated topic.

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RENEWING AN ECONOMIC POLICY FOR A RISING UKRAINIAN REGION: SMOOTHING DISCRETE SHIFTS AND MASTERING NEW COMPETENCIES

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Abstract

The article develops a methodology for applying the competence-based approach to use on a sub-national level in order to determine points of growth of a regional economy. A proprietary meta-model is proposed that links 'to-do tasks' for regional public authorities with essential competences. It also contains some methodological conclusions with the modernization strategy of a regional economic policy on the example of modern Ukraine, which is designed due to comparing an existing approach and approach modernized. Departed from the modernization meta-model and strongly relying on discreteness (discontinuity) as the natural property of any modernization, the authors substantiate the mechanism for overcoming undesirable discrete shifts during the modernization. Then, the relevant methods and forms of international centers of competence for the responsible development of a limited number of necessary competencies are discussed. A national network of competence centers is proposed as an optimal and sustainable way to run those centers in the future. Generally all findings were originated according a methodology on desk research, data collection and fresh expert survey of Ukrainian stakeholders.

Keywords: smart growth, regional economic policy, public policy, competencies, competence-based approach, modernization, Ukraine, mechanism

JEL classification: O38, R58, R50

1. Introduction

This paper aims to explore the relationship between the sustainability of modernization changes in regional policy and some necessary competencies peculiar to a region and its regional governance system. This article is not an exhaustive document with any ultimate conclusions, but it carries our attempt to bind some specific qualities of a region to management actions required. Our key assumption is that the application of a competence-based approach can be applied both at the corporate level (where it was originated 40 years ago from) and at sub-national public governance level and sector, which is undergoing the greatest changes and is a very interesting area for research today.

What remains understudied is which obstacles to modernize a sub-national policies (Ertugal, 2018; Muller, 2015; Callois, 2018; Latypova, 2015)? What competencies are needed the most to ensure regional power to self-developing (Nells et al., 2018; Agnew, 2013)? Do regional authorities need instrumental beacons additionally to political ones (Clarke, 2017; Ansel & Gash, 2009)?

To engage with these issues, this paper examines the substance of sub-national economic public policy that purports to be smarter, more sustainable and more flexible. But is it possible all together at once? We recognize that many European regions have long gone this stage by, but perhaps none of them will be able to offer a universal recipe, addressing it for Ukrainian colleagues too. But it doesn't mean that now is the time to "reinvent the wheel" and get experienced researcher back through a few decades. Although, up-rising challenges of globalization, low fertility of the indigenous population, migration, growing discontent and low confidence in many national authorities etc. are being deposited one on the other, and jointly create a difficult predictable mix. No one knows a strong recipe how to do now. But solutions are already being invented on-the-way by both developed and developing regions and countries. There are no doomed countries in big Europe, but there is a high uncertainty for all. That is why we offer and examine a not very popular view on problem solving with the competence-based approach inside.

Naturally, dealing with a modernization trajectory for each specific region is regularly set by the frames of national strategies. In particular for Ukraine's case, this is the National Strategy for Regional Development of Ukraine till 2020 and its similar strategy-newcomer on 2021-2027 years that is already being drafted. In this respect, an important prerequisite for the modernization transfer is the competence-based approach and, respectively, a methodology for forming the core competences of a region.

Generally, this article has a solid theoretical and methodological tendency and is designed in logics as follows: started from general international universality it passed to specifics of a growing Ukrainian region, and then concluded to multinational universality applicable to numerous developing countries or metropolitan regions that have their ambitions for smart growth but constrained in external investments in.

The paper is structured as follows. The next section outlines six key specific definitions crucial for understanding a general logics and context. The third section briefly encompasses the methodology. The forth section discusses the obtained propositions and theoretical results and their importance in explaining new shape of a regional economic policy. The fifth section discusses main findings and their broader implication.

2. Definitions of notions

To define the key notions, the authors use key terms in the following meanings (Dunayev, 2017a):

– by modernization, a 'growing capacity for social transformations' (Roxborough, 1998) is meant;

– by a regional economic policy, we mean a public socio-economic policy of multilevel development of a region and its territorial communities which includes a system of integrated and coordinated plans and actions of local development actors that is aimed to reduce internal economic inefficiency and social inequality (Dunayev, 2017b);

– by modernization of regional economic policy, we understood "progressive and guided social transformations of complex public-administrative and economic relations at the regional and interregional levels that manifest themselves differently, depending on the system of values and priorities under specific historical conditions" (Dunayev, 2017b);

– by regional core competence is a set of rather unique competitive advantages of a region that can not be duplicated precisely by any other regions and assuring its sustainable higher positions (Vinnik, 2014: p. 29);

– by a governance mechanism, we mean a means of solving contradictions in a phenomenon or a process;

– by a mechanism for prevention and overcoming discrete shifts, is meant a social governance mechanism . By its nature, this mechanism is seemed as social, even if additionally comparing it with some analogies, e.g. social stabilization and correction

mechanisms (Smelser, 1965; Coser & Rosenberg, 1957), mechanisms for coordinating actions (Habermas, 1981) etc.

3. Methodology

Since the early 1990s, some concepts of strategic management of the 1970s-1980s have been shifted by the resource-based view (RBV). While traditional concepts were concentrated on external environment for a company, the resource theory reflected opposing views and focuses on studying strengths and weaknesses of a company, as well as searching for core competencies and company's merits to reshape its competitive advantage better. Actually, the RBV is never considered as something revolutionary due to being based on classic works (D. Ricardo, E. Penrose, J. Schumpeter), as well as papers on corporate strategy (K. Andrews, A. Chandler, Ch. Snow, Cyert & March (Cyert & March, 1963) etc.)). At that time the RBV was quickly spreading, and in the 1990s it's reshaped in a new direction of the strategic management theory (Vinnik, 2014: p. 26). Besides others, the Wernerfelt's conclusion is considered important claiming that traditional organization's analysis would benefitting much in terms of resources rather than products (Wernerfelt, 1984), and then his assumption that this approach could be an independent paradigm in the theory of strategic management. According to the RBV, resources, dynamic abilities, and core competencies are considered as the basic concepts for analysis.

Generally, a competence is defined as "a range of issues within someone's cognizance; a scope of someone's authority, jurisdiction" (Ozhegov, 1990), or "proficiency at something; a range of powers of an organization, institution, person» (Yaremenko & Slipushko, 2006). C. Prahalad and G. Hamel were the first to introduce *core competences* as the notion, defining it as "specialized collective knowledge of an organization, aimed to coordinate different-type production skills and integrate multiple technological flows" (Prahalad & Hamel, 1990, 1996). The core competences are different from competences in that they are: typical only of those entities, whose indices exceed the average level; distinguished by their uniqueness; characterized by complexity making them hard to pattern after; associated with satisfaction of customer (target group) needs; beneficial in raising a product value more than other competences.

Although the competency-based approach was born for professional education and then also transmitted to organizational management in mid. 1970-s, in last decade it's believed as widely spread in policy analysis and new public management (Shafir, 2012; Coe Regan, 2016; CoARC, 2012; Berman&West, 2008; de Lancer Jules & Holzer, 2001 etc.). Moreover, according to the Camagni's approach (Camagni, 2002), a region can also be regarded as a 'quasi-corporation' with some qualities of an economic organization i.e. a large entity taking part in competition for markets of commodities, services and capital. And by analogy to the competitive capacity of an industry or economy, a region's leading position can be achieved due to competitive strengths of its constituent elements, conditions for their efficient interaction, and the capability of a region to provide for its own sustainable and dynamic development, while maintaining high and stable living standards of its population.

Based on this, we consider appropriate to apply those provisions of the RBV theory and the core competencies concept to the regional economy and regional policy. And, if traditional resource theory is losing its relevance to a company within modern market conditions due to more influential external environment and global competition, then in relation to a regional system, internal sources impacts the most, appealing to competitive advantages of a higher order. Indeed, transferring core competencies on the sub-national level, core competences can be effectively applied only on the basis of regional specialization and priorities determined by a local public consensus. For example, in present-day EU, the core competences of regions are completely related to the chosen 'smart specialization'; for a case of Ukraine, this choice is quite probable in a much longer perspective. In view of this, we deem it possible to apply the concepts of the resource-based theory and the concept of competences to modernization of a *regional economic policy* (*hereinafter - REP*) of Ukrainian regions. While under the current market conditions the resource-based theory becomes irrelevant for an organization due to a change of emphasis and the determining impact of the external environment on the organization's competitive efficiency (Latynin & Lukashov,

2017), in the case of regional systems, the major influence is exerted by internal sources i.e. competitive advantages of higher order.

One of the methodological features of this paper is that it generally relies on a methodology on desk research, data collection and interviews to Ukrainian stakeholders. So some theme-related conclusions were done upon an original expert survey "Determining the ability of regional economic policy Ukraine to change" were held by the co-author (Igor Dunayev) independently and for his own funds. This survey was continuing in 2017 and has embraced 44 leading experts from 14 regions of Ukraine and Kyiv city. It was conducted anonymously in online-mode via specially designed questionnaires in Google Form encompassing 43 complex questions, and containing both open-ended and[1]. The survey did not provide a responder with possibility to correct his/her answers when they completed a questionnaire. The questionnaire was included four questions for the overall presentation of the expert (region, professional work area, education, and gender) and main theme-relevant 43 questions on the subject theme severely.

4. Results

As noted above, the general methodological framework of this study was supplemented by an authentic all-Ukrainian expert survey (as mentioned in the section above). As some selective results prove (see Appendix A), the most important ways of how to improve regional governance are:

- establishing a system of comprehensive analysis and forecasting of blocking and destructive influences and factors in all manifestations in a regional socio-economic policy;
- establishing determined conditions and criteria for optimal modernization of a regional economic policy, as well as developing some measures to mobilize own regional potential, especially economic potential;
- overcoming financial and mental dependence on external sources avoiding disparity and non-mutual benefits.

In modern Ukraine, an understanding of what is regional economic policy should to be oriented at is becoming more clear and clear (Dunayev, 2019). It's about wider use of competitive advantages in some specific areas, coordinating regional strategies with sectoral strategies, mitigating market failures through effective resource redistribution. But it's possible only if cardinal institutions modernization and growth of human capital, in particular, in public administration would occur.

These items enable us to summarize the possibilities of how to adopt organizationally the competence-based approach to renovate a regional economic policy in Ukraine, as follows:

- the competence-based approach reflects the main aspects of the process of modernizing a REP through a more active involvement of life-long learning systems, upgrading of skills, and correct behavior;
- the competence-based approach manifests itself in renewed knowledge, public-administrative and economic know-how under the country's changing socio-economic situation;
- the competence-based approach is a prerequisite to act efficiently in a factual surroundings;
- applying the competence-based approach requires a set of methods and technologies oriented to create conditions for achieving success, forming and strengthening potential for changes, and developing proper thinking.

[1] More expanded sociological results arisen from this expert survey are available from Igor Dunayev's post-doctoral thesis (in Ukrainian) and some published papers (Dunayev, 2018; Dunayev, 2017b).

In order to evaluate the quality of mastering core competences and their effective application in implementing a regional innovation strategy, it is necessary to have a complex competence evaluation method. For this purpose, it is expedient:

- to design a framework management meta-model on the basis of the competence-based approach that would take into account the specific features of a desired trajectory of a particular region's development, in the first place, availability and quality of human potential and the main regional strengths;
- to create a set of simulation exercises, which would make it possible to observe acquiring of the desired competences by modernization process participants, enhance their involvement and lower their psychological stress;
- to provide an effective system for monitoring and control of the processes of knowledge transfer to regional managers and their acquiring of competences, with recording of behavioral indicators to obtain an adequate summative evaluation of the achieved level of core competences in the region.

Guided by a need of modernization regional development in recent Ukraine, a meta-model of enhancement of core competences to renovate a regional economic policy titled "A Modernization Region" (Figure 1) is proposed. This authentic meta-model was designed on the basis of the Ukrainian Strategy for Regional Development till 2020 and the Ukrainian Energetic Strategy till 2035 (Ministry of energy and coal industry of Ukraine, 2017), with regard to strategic view and logical transition in regional modernization (Dunayev, 2017b : 217-218) (See Appendix C). To our opinion, it includes baseline competences pertaining to the four basic elements of the modernization system, as public administration, economy, space, and institutions. We underline that these system-based elements are crucial for further reshaping a methodological basis.

Figure 1. "A Modernization Region" meta-model designed by using the competence-based approach).

Reference tasks for regional public authorities according to the elements of the system for modernization of a regional economic policy	Core competences required of a regional governance system	Desired business competences of change leaders
Modernized 'public administration' (MPA)		
Setting regional priorities, standards and interaction procedures	C_{mpa1} "Openness to new technological and market know-hows" C_{mpa2} "Capacity for value-based targeting" C_{mpa3} "Availability of highly-qualified management staff" C_{mpa4} "Capacity for providing weighty incentives and output bonuses" C_{mpa5} "Capacity for de-blocking changes due to formal and informal institutions"	Strategic thinking, persistence, political support from a team, managing competences of subordinates and structures, management of consistency
Renovating regional system for training project manager staff and reserve		
Changing approach from rules and regulations to dialogue-vision-planning		
Focusing public policy on facilitation of processes for individuals and businesses		
Balancing between state regulation and provision of sufficient implementation standards		
Integrating regional elites		
Introducing result-oriented management practices		
Complementing state and regional programs without overlapping		
Modernized 'economy' (ME)		
Initiation and selection of large projects	C_{me1} "Multichannel and flexible project co-financing" C_{me2} "Trust in a state partner under public-private partnership" C_{me3} "Streamlined procedures of public-private partnership and risk-taking by the state partner" C_{me4} "Well-prepared investment projects and industrial sites are available" C_{me5} "International integration of local business and openness to new technologies"	Business reputation, support for business communities, combining project and process approaches to management, capacity for long-standing motivation by own example
Facilitation of access to external resources for business		
Coordination of relations between the government and local industries		
Interregional economic cooperation of a region and communities		
Effective and transparent management of available property and finances		

Diversification of sources for funding priorities		
Initial co-financing of local infrastructure		
Modernized 'space' (MS)		
Encouragement of communities to make their own plans and programs	C_{MS1} "Formed functional ties between territories in Ukraine" C_{MS2} "Skills for combining internal assets with external possibilities" C_{MS3} "Overcoming spatial inertia by responsiveness to innovations" C_{MS4} "Efficiency of international efforts of local communities" C_{MS5} "Ability to socialize and integrate arrived people without losing regional identity"	Change advocacy, capacity for cooperation in an international (multicultural) team
Resource support for communities' local priorities		
Unified approaches and equal possibilities for all internal communities and small cities		
"More for more": different-level relations with different communities based on their needs		
Promoting integration of incomers and labor migrants into local communities		
Modernized 'institutions' (MI)		
Delegating part of authority and resources	C_{Mi1} "Initiative for changes" C_{Mi2} "Capacity for identifying economic agent groups, advancing demands for new institutions, and integrating them" C_{Mi3} "Elaborated processes of considering institutions' complimentary nature" C_{Mi4} "Developed transparent rules of controlling known rules of the game" C_{Mi5} "Capacity of institutions for changes"	Political support from a team, ambition
Developing and implementing a policy of group leadership		
Promoting integration of a region and communities into international environment		
Developing relations on the basis of the modern relationship culture		
Consolidating leadership potential of stakeholder groups		
Coordinating behavior and representing shared values		

Source: Igor Dunayev's findings.

It's natural to consider modernization through these system-based elements. So, for each of the elements, 5 sufficient minimum competences are proposed. These proposed competences are supposed to undergo a certain transformation during the REP renovation in Ukrainian growing regions. Further adjustments of a regional administrative system to acquire proposed competences will be possible due to communications and cooperation between national, regional, and local authorities with other stakeholders and related subjects only.

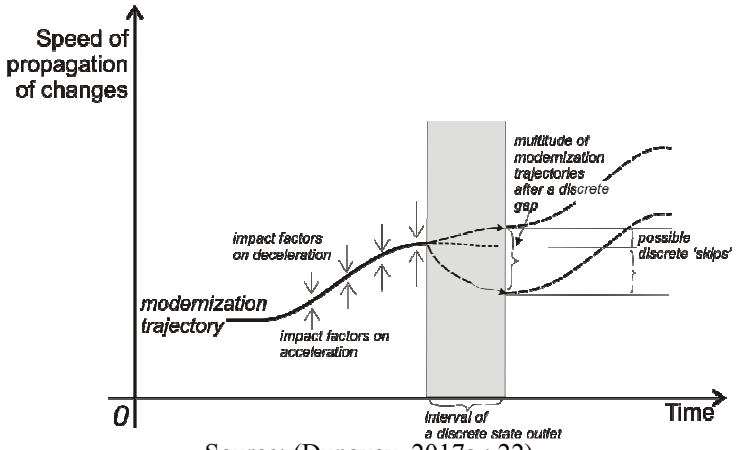
Considering such expected capacities as flexibility, coordination, inclusiveness (as figures A-3 & A-4 in the Annex A prove), we can propose to regard effectiveness as a main criterion for competence optimality of a modernized regional management system.

Taking into account the drafted "A Modernization Region" meta-model (See Figure 1), the next step will require drafting and description of *a mechanism for prevention and overcoming discrete shifts* from a trajectory under regional economic policy modernization using the competence-based approach.

Logically, this mechanism follows from a catch-up modernization' property as an objective phenomenon (See Figure 2 below), and can be presented as an aggregate of stages, desired competences, conditions and risks of managing modernization during the formation of a modernized REP. It functions with due regard to: available resources (material, human, financial, information etc.); the impact of central, regional, and municipal authorities, civil institutions; a direct participation of diverse business and expert organizations and international partners, including donors and foundations. An expected outcome of the mechanism's functioning can be moving along the trajectory with minimal deviations as well

as growing resource efficiency of regional development due to improvement of labor productivity through application of competences acquired during modernization development.

Figure 2. Discreteness in an abstract modernization process



Source: (Dunayev, 2017a : 22)

If the competence-based approach is considered to be applied, so some specific features of the mechanism would be: (a) identification of competences necessary to form the policy and strategy of a region's modernization development; (b) using the necessary competences to develop, implement, and evaluate the policy; and (c) determining a set of competences to create the meta-model of "A Modernization Region".

The process of developing the mechanism for overcoming discrete shifts in modernization of the REP with the use of the competence-based approach may include:

- clarification of the purpose and specific tasks of forming a strategy for modernization development of a region;
- a comprehensive analysis of the current internal environment of a region (resources, problems, target groups and stakeholders, interdependences);
- determining conditions, factors, and resources for strategic modernization development of a region;
- a detailed elaboration of the structure of the mechanism for overcoming discrete shifts in modernization of a REP with specification of its elements;
- defining stages of forming a strategy for modernization development of a region with identification of the necessary competences for each stage;
- specification of available and desired competences of the key participants of the modernization process;
- description of functional and institutional interrelations within the mechanism;
- planning of expected results of the mechanism's operation with account of the acquired competences.

The stages of the mechanism for overcoming discrete shifts in modernization of a REP are given in the figure (See Appendix B). Within the mechanism, the expected results are defined in the form of institutional competences of the authorities and non-governmental participants of a REP modernization, as well as risks, "lines of stress", and key resources for acquiring the necessary competences. As a result of the mechanism's operation, these characteristics change which is presented in Figure 2: achievement of an objective; fulfillment of the task of raising the development efficiency; a system of measures for modernization development; change of economic, political, etc. factors and the external environment; and the acquired competences and creation of the meta-model "A Modernization Region" (Dunayev, 2017c). As Appendix B proves, some necessary actions are identified for each stage of this

mechanism, as well as desired competences of the subjects of REP modernization are determined. The process of their regulation is decentralized (according to the author's model of coordinated self-development of a region) and is based on a network, in particular – horizontal, cooperation of its participants. The backbone of that cooperation is a network of 'centers of modernization competences' in regions, which comprises various educational and non-governmental business, public, and expert organizations. Acquiring desired competences determines the final outcome of the mechanism's functioning: promotion of sustainable modernization movement along the chosen trajectory avoiding discrete shifts.

It is a clear-cut justification of structural priorities, identified through the 'reasonable specialization' of a region as well, rather than non-organizational perturbation related to clusters without estimated resource that will make a key factor of success of regional development in general, allowing each specific region to develop over a long term. We deem it necessary (although insufficient) to create yet more of regional development agencies and other structures, with partially overlapping functions of administrations and leading business associations, and the same functions being performed by the same personnel, as there are no other cadres in a region. Organizational changes take time and require establishment of a new structure, that is why it is expedient to use the elaborated functions of analyzing a region and preparing development programs (with the work coordinated by means of the proposed model of a region's 'guided self-development'). For this purpose, it is suggested to start the analytical work on substantiation of regions' specialization, development of cooperation ties within the framework of cooperation development models which would strengthen the mutual positions of regions and not the positions of recipient regions only, without reaping equal benefits in return. As a consequence, a new model of productive force allocation in the territory of Ukraine will need to take into account both the national tasks of development, management, maintenance and protection of territories (economic and spatial components of the REP modernization), and possibilities for interaction and joint private business development (public-administrative and institutional components).

5. Discussion

A review of the modern specialized literature (EGTA, 2017; Miller et al, 2012; Shraer & Latypova, 2013) enables us to make a conclusion that at the stage of forming the mechanisms for modernization of a REP, a conditional region will need to have a new type of network organizational structures – centers of competences, instead of conventional regional development agencies. In case of the centers' success under a rapid dissemination of knowledge, their most useful evolutional variety will be 'clusters of competences'.

Centers of competences are organizational structures of enterprises, more rarely – of regions, designed to expand experts' cooperation in order to create favorable conditions for exchange of useful information, and as a result – to conduct assessment, benchmarking and monitoring of the most important areas of activity by gathering knowledge and finding ways to apply it to the maximum effect. In fact, knowledge and processes are integrated through regulated access of the interested persons to information resources and provision of effective communication. Within the centers of competences typology, the following four types are differentiated: a) centers aimed to collect the best experience, find and systemize the most effective practices; b) centers aimed to develop technological standards, standardization of individual operating procedures; c) centers designed to service various projects and initiatives, related to knowledge management; d) centers oriented to provide a general integration of processes and sharing of knowledge within an organization. Although in most cases the centers of competences are branch-specific, providing services in information technologies, audit, consulting, engineering and other fields (Latypova, 2015), they can also be built by the territorial principle of participants' interaction. The Center for technological competences within the techno-park zone of Saint-Petersburg can be an example. Although St. Petersburg model is more similar to a branch cluster than a traditional center of competences, however this model is quite acceptable, since terminologically there is no final consensus among the concerned parties. With regard to the available environmental and infrastructural problems in the districts of Kharkiv region, it is deemed requisite to propose creating centers of engineering competences, focusing on industrialization of small cities and solution of environmental problems of sewage purification, for instance, by the European technology of

electrochemical synthesis "iMETland" (iMETland, 2017). In this case, a suitable example could be the small town of Pervomaiskyi (in Kharkiv region, North-East of Ukraine), with its long-term project of step-by-step creation of an industrial park on the basis of an integral complex of facilities of the former chemical plant. However, there exists a functional risk of assigning new functions to centers for competences and their positioning as 'specialized service centers' with an emphasis on the prestige of trades, leaving scientific research competences disregarded.

In this context an important and promising task for regional authorities, apart from establishing centers of modernization competences (or other organizational forms of new knowledge concentration and innovations), is formation of 'clusters of competences'. It is these non-rigid organizational structures that can provide a cumulative effect from generation of innovations due to combining heterogeneous knowledge, skills, abilities, responsibility and decision-making readiness of all the process participants. It is particularly true under the conditions of social demand for a greater economic self-sufficiency of regions and the anticipated administrative and territorial reform in Ukraine. Against the background of the Ukrainian interregional cooperation, organizational units of lower level and smaller in size are more likely to be inefficient. Since foreign investors are usually more interested in specific business platforms and predictability of legal regulation of economic management (Worldbank, 2017a, 2017b), the domestic entrepreneurs are liable to be concerned in specific local projects of a high rate of return and a regular level of transactional (corruption) risks which failed to bring about a progressive renovation of economic management and governance in Ukraine in the past, too. In these circumstances, it is reasonable to regard 'clusters of competences' as a certain aggregation of diverse interrelated skills and capacities of individual specialists to be used for fulfillment of common social tasks under the renovation of public governance and new industrialization in Ukraine.

In order to introduce the mechanism more effectively, we propose to develop the main provisions and set up a network of centers of modernization competences covering both a conditional region and interregional cooperation. Local subjects of this network, when interacting, will popularize the necessary competences at the local level and, which is more important, consolidate them with respect to sustainable renovation of a public REP. The subjects in question should include non-profit and non-governmental organizations: the leading universities with their specialized laboratories; business and social associations, incorporating legal persons; and regional and local development agencies, which under Art. 19 of the Law (Parliament of Ukraine, 2015) have acquired the relevant status.

The network of centers of modernization competences is designed to collect, create and disseminate advanced technological knowledge and new management practices. These centers act as communicators, integrators of positive local initiative and a kind of a 'mediate' between science and business, with account of each region's specificity, but essentially without affecting the regional political agenda.

Unlike regional development agencies, centers of competences should not necessarily be established at the initiative of a regional council or regional public administration; neither should they be separated as a non-profit organization or claim the status of a single official regional institution providing regional development through a broad scope of work – from training and creating incentives for investment in a region to support start-ups and search for investor aftercare.

It is proposed to form a network of centers of modernization competences in three stages:

1) Searching for teams and leaders who are potentially capable of organizing a network activity in the field of their professional and scientific interests and competences. A search for innovational ideas and leaders is carried out by way of holding open recruitment examinations, contests of breakthrough projects, head-hunting, temporary integration of applicant resume databases of the national (e.g. recruitment to newly established directorates of some ministries beginning from 2017 (Ukrainian crisis media-center, 2017) and regional levels, etc. For acceleration of modernization processes, several centers should be created in a region, despite competition among them.

2) Getting teams and leaders involved in joint activity by holding sessions, collaborative project planning and implementation.

3) Cooperation of teams and leaders – to jointly draw up a long-term program for developing a network of centers of competences, formalize collaboration relations, and promote program realization (Dunayev, 2017).

Establishment of the network of centers will make it possible to better prepare, and most significantly, link "the growing points" in public administration and local project management by key areas or in accordance with a region's reasonable specialization, and, respectively, by the regions of Ukraine. It is especially topical in relation to quality formalization of local investment initiative – from generation of an idea to preparing a pre-project documentation.

From the onset, creation of this kind of a network of centers of modernization competences should be a concern of regional bodies of authority: regional councils and regional administrations. However, their establishment should be financed jointly from different-level budgets: regional, national (the State Fund for Regional Development of Ukraine), that of local non-governmental sector, and by external donors. It is proposed to support the network through creating a common infrastructure for the work of all the network centers, performing the following functions:

- working out of an information and communication platform, designed to promote the development of a society of stakeholders who are interested in developing regionally specified competences and desired capacities due to establishment of communicative environment, educational web portal, and a distributed knowledge database;
- development and spreading of basic training courses in the field of international finances, systemic engineering, regional governance systems;
- promoting an open knowledge base;
- arrangement of internships for network center participants to be trained in innovation projects abroad and in Ukraine (transfer of knowledge);
- organization and holding of international schools on the selected topics (transfer of knowledge);
- encouragement of mutual integration, scientific and engineering projects of centers of competences.

At the initial stage, customers of the new type of knowledge and competences can be local middle-size and big business (aided by NGOs and business associations); in the long term, the pool of customers is sure to grow.

As early as 2019, the initiative can also be presented as a joint project of regional authorities to receive co-financing from the State Fund for Regional Development of Ukraine. In case the initiative is presented in the form of a project, its uniqueness will consist in its orientation to fulfill long-term tasks of the regional or even national scale: creating institutions and developing individuals who will become change agents, making a REP of a new generation in practical integration of management, education, and business, providing real incentives and promising forms of young people's employment, without having to look for opportunities in a foreign land. Therefore, the goal of the project can be creation within two years of a network integrating ten centers of competences and selection by regional consensus of desired capacities.

6. Conclusion

1) However, one should confess that applying the competence-based approach at the sub-national level is still based on some important assumptions. Longing for quick image benefits among voters and foreign partners, a regional government can easily apply some activities those proposed in this article. But it will be far from the due concentration of efforts and responsibility to enable quantity grows into quality as it's stated in a universal dialectics rule. So, as a simple toolkit for tracking progress, the article proposes applying the trajectory of modernization changes, that is fed by actual data come from expert surveys and consensus forecasts for the implementation of to-do tasks.

2) Since in practice many deviations from a given modernization course are caused by a lack of flexibility and lack of necessary competencies (in human capital, in a regional governance system), so a relevant competent-based approach is considered to mitigate these risks. It involves designing some logical links between to-do tasks for local authorities and demanded competencies of a regional governance system, desirable business competencies and leaders of change, the stage of achieving the necessary institutional competencies by the subjects of modernization. Regional centers of modernization competency and subsequently their networks are become an important element in Ukraine recently.

3) Some recommendations as to introduction of the mechanism for overcoming discrete shifts from the set trajectory under a regional economic policy modernization with account of the competence-based approach are given below:

a) preparatory and planning actions unit:

– to conduct analysis of the internal and external environment of a region and give a clear substantiation of the identified structural priorities that will form the image of a regional economy and, consequently, the regional economic policy of the future;

– to start an open expert dialogue about determining 'reasonable specialization' of a specific region on the lines of the European experience;

– to determine a project group of experts who possess a set of the necessary competences to design and implement an effective strategy for modernization development of a region;

– to provide training of a project group with the aim of developing a capacity for spreading of the necessary competences in regional environments;

– to draw a plan and allocate resources for gaining international experience and implementation of the European programs of inter-municipal cooperation within the framework of common projects and in the sphere of transfer of technologies into the Ukrainian infrastructural projects of public-private partnership. An example of such programs is the actual non-governmental international European Green Technology Alliance (European Green Technology Alliance, 2017) with the appropriate bases of the best technologies and access to funds on preferable credit terms and on the basis of co-investment in Ukraine (started from September 1, 2017);

b) resource-providing actions unit:

– to describe the arrangement of the necessary institutional transformations and changes in the regulatory developmental framework of a region, in particular – 'project offices' and the regional fund of funds for co-financing of capital-consuming projects;

– to identify the priorities of regional development, hence, determining in a consensus manner the key modernization competences;

– relying on the above, to form a regional center(s) of modernization competences in a conditional region;

– to develop stages of the mechanism introduction, describing the sequence actions to form a regional modernization development strategy;

– to establish a set of interactions among the elements of the mechanism for overcoming discrete shifts with regard to the competence-based approach;

c) executive and monitoring actions unit:

– to pilot and adjust procedures of joint project implementation by international consortia of co-executives, as well as practices of applying and mastering systemic interdisciplinary competences;

– to generate due in-coming and out-coming information flows;

– to test the mechanism for creating an effective model of regional modernization development;

– to specify the results of project groups introduction and work in regions, in particular those results, which are common to different groups and international partners;

– to draw a road map and make an ultimate management decision as to introduction of the mechanism for overcoming discrete shifts with the competence-based approach into activity of a specific region;

– to organize work monitoring;

– to provide inter-municipal programming of activities according to the

"Modernization Region" model.

4) Finally, the paper proposes a suitable for modern Ukraine substantiation of a way of securing and developing essential competences in a Ukrainian region. The ways of reshaping a coordinated network of regional centers of modernization competencies are presented, which, unlike typical regional development agencies with a wide range of functions, will be able to concentrate resources to get advanced at least one required competence. It is considered that they would be able for networking and taking a broad target audience in, and then to evolve to 'clusters of competencies'.

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APPENDICES

Appendix A

Figure A-1. Distribution of respondents' answers to the question: "What parameters of a recent Ukrainian regional economic policy and strategy are most likely to be improved?", in %

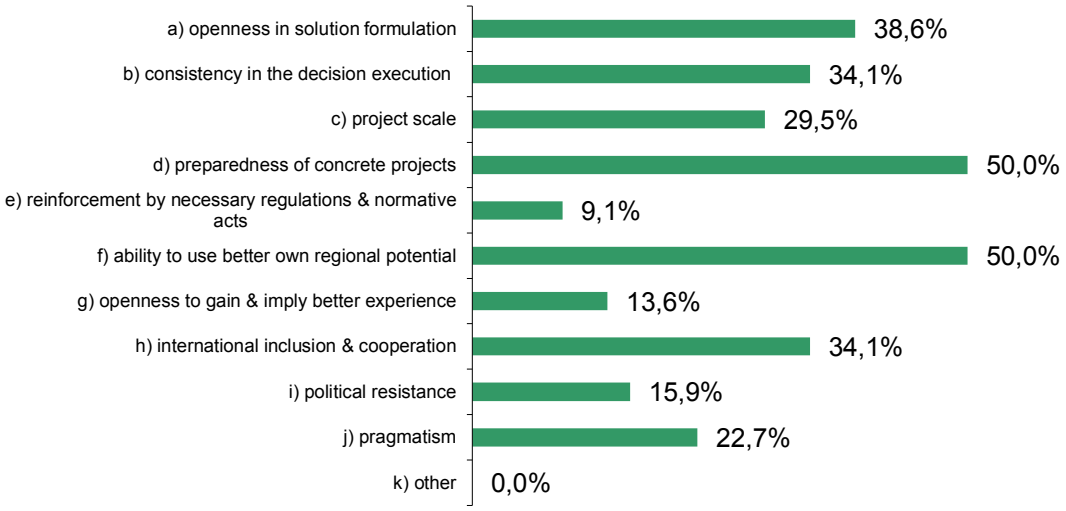


Figure A-2. Distribution of respondents' answers on assessing some actual qualities of effective governance owned by present-day regional state administrations and regional councils in Ukraine, in %

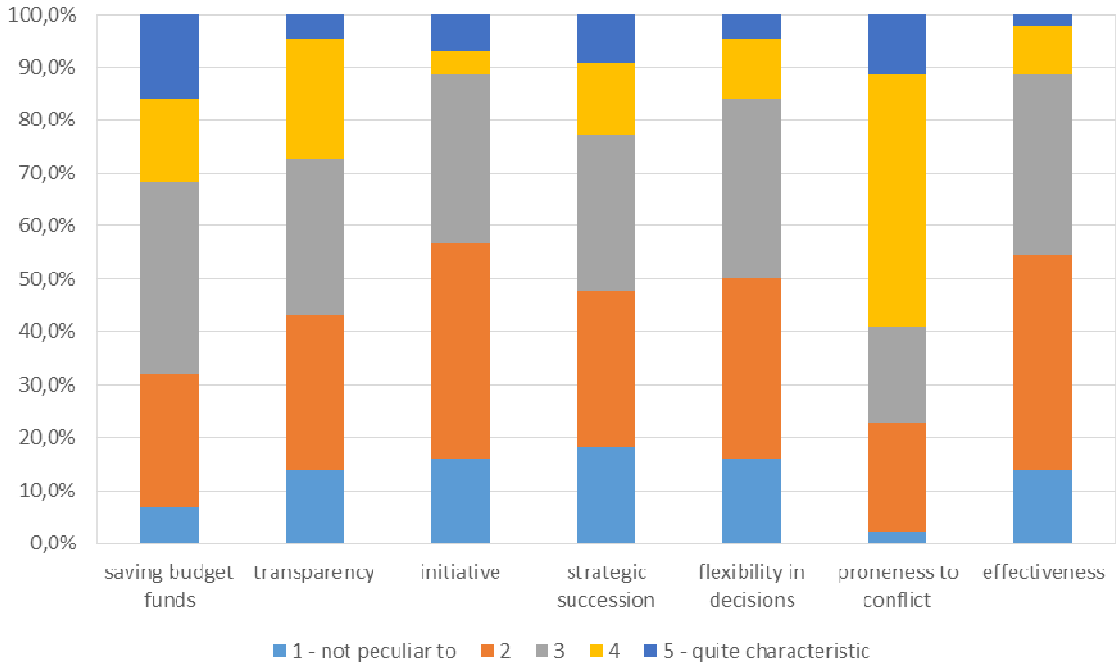


Figure A-3. Distribution of the experts' answers to the question "Which promising institutions can improve the ability of the regional community and authorities to more effectively maintain the desired trajectory in economic change? (up to 3 options could be chosen)

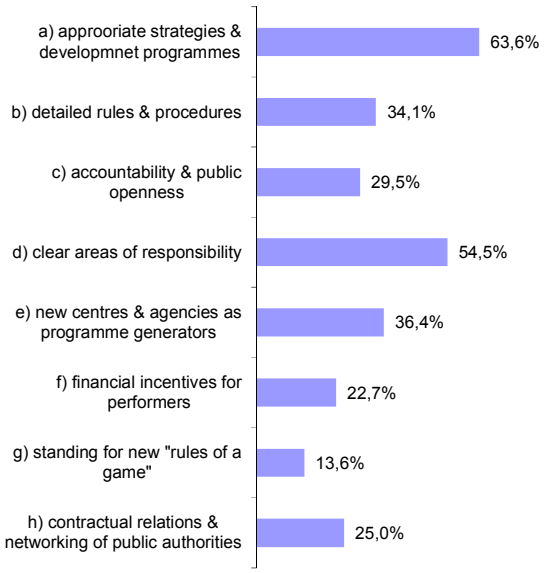
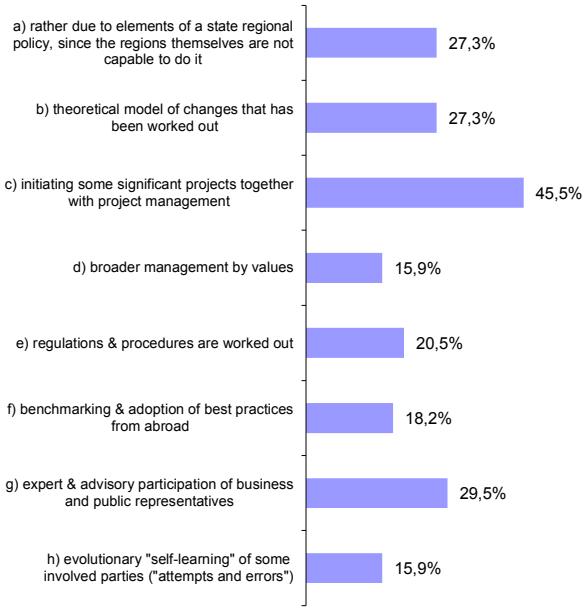
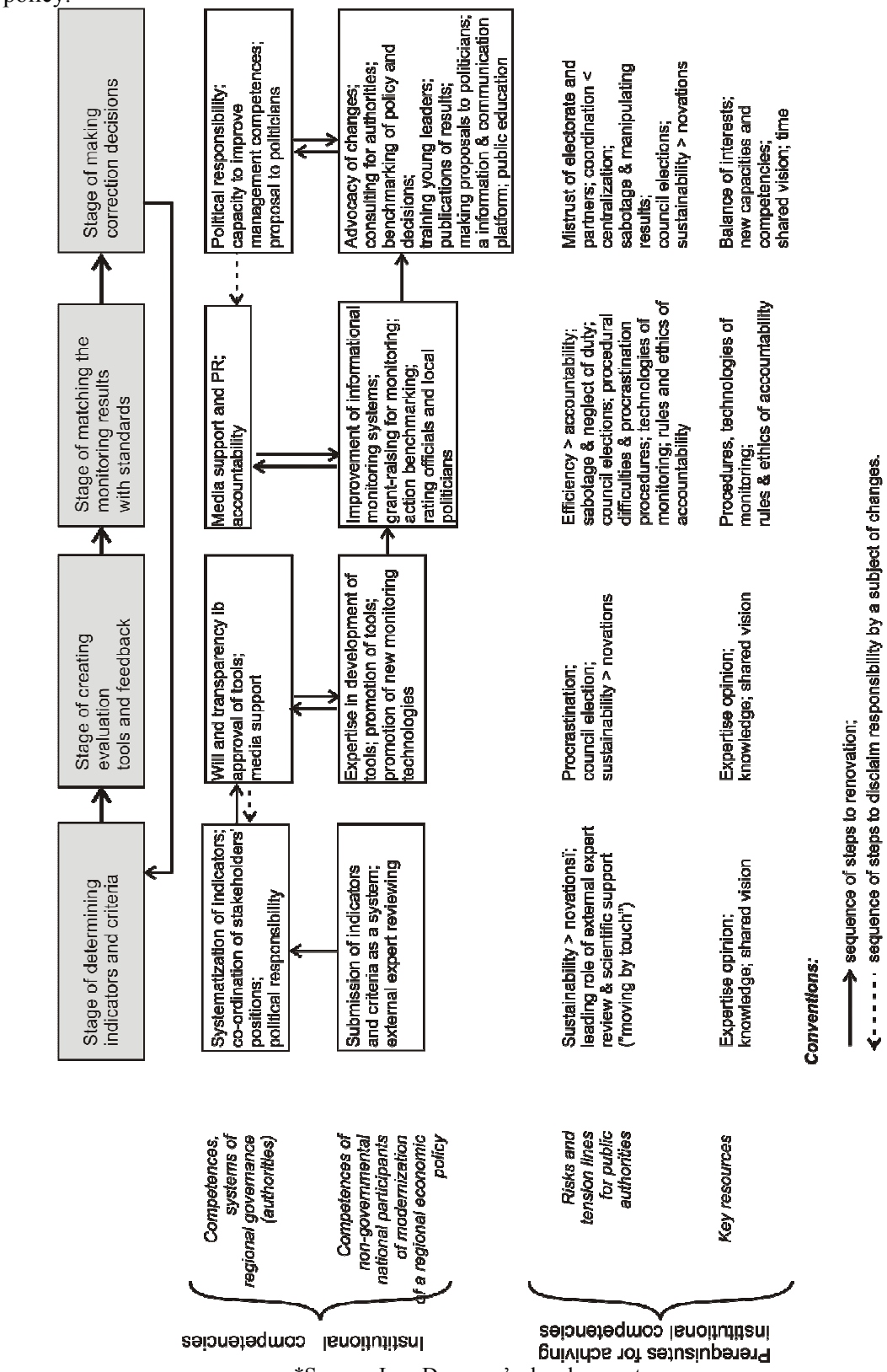


Figure A-4. Distribution of respondents' answers regarding the best tools can be used to improve coherence and consistency in some changes in the regional economic policy and strategy, in %.



Appendix B

Stages of acquiring the necessary institutional competences by the modernization subjects through the mechanism for overcoming discrete shifts in modernization of a regional public policy.



*Source: Igor Dunayev's development.

Appendix C

The logics of a modernization strategy of a regional economic policy

Main problem spheres	Existing approach	Approach modernized
Target setting	The primacy of institutional goal-setting with elements of problem orientation and level-level consistency prevails. Lacking the clear logic of achieving goals	A transition towards value-setting guided by the interests of the local community and the state. Awakening of the interests of different groups for large-scale tasks
Dominants of the regional economic policy	It exists in the course of the recent governmental regional policy; it combines aligning & stimulation through financial redistribution between the regions-entities & applying competitive approach too. Own economic initiatives of the regions are poorly presented	Reshaping of institutional, legal, organizational & economic conditions for coordinated self-development of Ukrainian regions in economic, spatial, environmental and social spheres
A method of interaction between public authorities and proper tools applied	Inflexible interaction of authorities during implementing the regional economic policy	A coordinated system of regional public governance due to a balance of economic interests, long-term strategies and inter-sectoral integrated projects inspired by the interests of all levels
Regional spatial disproportions solving	Inability to resolve existing spatial problems due to regular methods & state-owned resources. A blurriness of attention between various sectoral policies and an ulterior impact. Spot tactics with no strategic approach	Shaping some functional relationships between areas. Mobilizing local assets & knowledge, and then combining them with external capabilities
Regulatory and legal support	It predominantly exists in the recent state regional policy. An obligatory vertical integration of development goals at different levels through strategies has been implied. Initiatives of the regions are mostly fragmented and one-sided.	It motivates regional authorities to more consistent and purposeful normative legal acts & managerial decisions. Applying integrated and versatile development programs with significant coverage
Complimentary nature & integration of regional development documents	It exists from the national level & lower, sub-national & municipal ones	More enforcing existing practices due to joint initiatives on networking through functional augmentability and common interest
Financial resources	Using specialized structural funds from the national budget and regional budgets' funds that were increased substantially due to decentralization reform	More enlarging some recent gains through applying additional channels of extra-budget co-financing, investment activity liberalization and own tax base expansion.

*Source: Igor Dunayev's development based on Lopez-Acevedo etc. (2017), OECD, (2009) p. 83-84, Sulakshin etc. (2009), NISD (2016).

EXPLORING THE COMPONENTS OF THE INTELLECTUAL CAPITAL IN TROSO WEAVING SMEs

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Abstract
This study aims to test and analyze the effects of intellectual capital to competitive advantage and company's performance at Troso traditional weaving business. The variables in this research are human capital as exogenous variable and structural capital, customer capital, competitive advantage, and company performance as the endogenous ones. The subject of the study was 200 sample consisting 572 craftmen. This research applies structural equation modelling. The result of SEM analysis fulfills Goodness of Fit Index criteria, i.e. chi-square value = 432.543, significance probability = 0.000, RMSEA = 0.070, CMIN/DF = 1.966, TLI = 0.885, CFI = 0.900, GFI = 0.849 and AGFI = 0.810. Based on the research result, it can be concluded that human capital, structural capital, and customer capital influence on competitive advantage and company performance.

Keywords: Intellectual Capital, Competitive Advantage, Company Performance
JEL classification: A, M12, J24

1. Introduction

The Indonesian micro and medium enterprises has an important and dominant roles in the country's economic growth. During the 1997 Indonesian economic crisis and global's in 2008, these enterprises were proven survived and they could even become the country's economic preserver. Considering the amount of these existing micro and medium enterprises as well as their dominant roles in the economic, thus the indicator of the Asean Economic Communities (AEC) success depends on their preparations.

To Indonesia, the establishment of AEC 2015 creates both internal and external challenges amongst the ASEAN nations themselves; in addition to the competition with other countries such as China or India. (Huang & Liu, 2005), describes that in order to prepare for the tough global market competition, intellectual capital has to be improved as a substantial strength to push the economic growth. With greater number of micro medium enterprises compared to another country, Indonesia has bigger chance to be able to compete in global market.

The world is fast moving from a production-based economy to a knowledge-based one (Drucker, 1993; Powell and Snelman, 2004 in Huang & Wu, 2010). This insists SME's to change business strategies from labor-based business to knowledge-based business, thus the main character of the company becomes knowledge based. In this knowledge-based economy, the competitive advantaged obtained by company is no longer determined by ownership or the functions of conventional production factors such as engines or labors, but more to the functions of production factors based on knowledge, innovation, and technology.

According to Ernst & Young (2006), such advanced country as The United States has 60 percent knowledge-based workers. By increasing the knowledge of the workers, a corporation is able to conduct more effective and efficient activities (Hernandez & Noruzi, 2010).

To improve the product competitiveness, micro medium enterprises should pay more attention on intellectual capital as one of their business strategies. The biggest capital owned by micro and medium business is intellectual capital. This capital is a source of creativity, innovation and business model. For example, textile micro medium business of *Tenun Ikat Troso* (weaving) implements this kind of capital to improve their competitiveness.

This *Tenun Ikat Troso* (Troso weaved clothing) product is one of Indonesian famous clothing product besides *batik*. It is originated from Troso village in Jepara, Central Java

province. It has been the second famous product of the village after furniture. The residents of the village has possessed the skills to weave cloths since 1935 and the cloth was previously known as *Tenun Gendong* as their heritage. In 1943, *Tenun Pancal* (paddled weaving) started to operate and since 1946 up to now, people has been operating *Alat Tenun Bukan Mesin* (a non-engine weaving tools).

This research is unique because of the concept of intellectual capital is not known to most managers in the industry in Indonesia, especially weaving and textile industry in general.

The research of this case study is based on the findings of the previous research. Sharabati *et.al* (2010), Chen *et.al* (2004), Daud & Amri (2008), Majeed, S. (2011), Rezaian & Naeji (2012), Mananeke (2012), Obeidat *et.al* (2017) and Hamid *et.al* (2017) state that intellectual capital affects the corporate's performance; on the contrary, Kuryanto & Syarifuddin (2009) states that there is not any positive relation between the corporate performance and intellectual capital.

2. Literature Review

2.1. Organization Performance

The performance of an organisation has always created problems for profit or non-profit corporation. According to Horne and Wachowicz (2008), performance is a result in certain period. In order to perform well, everyone should conduct the best effort positively. It also applies for a company, when a company conducts the business activities well, it will result in good performance.

Organization has an important role in our daily lives and therefore, successful organization represents a key ingredient for developing nations. Thus, many economists consider organizations and institutions similar to an engine in determining the economic, social and political progress (Gavrea , Ilies, & Stegerean, 2011). Besides, performance is a result of the organization's objectives. The concept of business performance covers multi dimension. Pelham (1997) in Mananeke (2012) suggests that the indicators of performance cover: firstly, company's efficiency (relativity of product quality, new product success, and customer retention level). Secondly, the growth / market share (sales level, sales increase level and relativity of market). Thirdly, the connection of ROE, profit margin, and ROI.

Another opinion stated by Gharakhani, D and Mousakhani, M (2012) suggests that performance refers to the ability of the organisation to create certain level of results and activities. In the study of Majeed (2011), it is inspected that the relationship between the company's competencies and thier performance is examined. When reviewing the importance of current or potential competencies, the managers should have a clear interest in finalising that where these qualities will lead to choose different benefits. Almost in all organisations there is a good association between company's competitive advantage and its performance. These advantages lead the company towards attaining high profits.

2.2. Knowledge Management and Intellectual capital

In the knowledge-based economy, the nature of resources has been changed. In agriculture-based economy and industrial-based economy the organizations mainly based on tangible assets but now in a knowledge-based economy, intangible assets are considered as the vital resources for the success of organizations (Khalique, 2012). Knowledge in an organisation is a demand due to its ability to make it reliable, steady and competitive. Knowledge is a fusion of information, experience, values, organisations and expertises' opinions. These make knowledge become contextual, relevant, and executable information (Turban, McLean & Wetherbe, 2002) in Setiarso, *et.al* (2009). The ability of companies to manage intellectual capital (IC) assets is inseparably related to its knowledge management (KM) capability (Andreeva and Kianto, 2011; Rajesh et al., 2011; Ramadan et al., 2017). Intellectual capital is another term of knowledge including its financial knowledge. The term of Intellectual Capital, which was firstly stated by John Kenneth Galbraith in 1969, became popular with theoretical and industrial practical publications.

Understanding the intellectual capital embedded in an organisation requires organisational members to assess their core competencies; they can achieve or have achieved "best-in-the-

world" status. The intellectual capital of an organization represents the wealth of ideas and the ability to innovate which later will determine the future of the organization (Sharabati et al., 2010).

Intellectual capital can be defined as intellectual material that has been "formalized, captured and leveraged" to create assets of higher value (Stewart, 1997), (Prusak, 1998). Intellectual Capital can be classified as human capital, organisational capital and customer capital (Edvinsson and Sullivan, 1996; Dumay, J., 2016; Roos and Roos, 1997; Stewart, 1995). Following the study of Edvinsson and Malone (1997), Sveiby (1997), Roos *et.al* (1997), Bontis (1999), O'Donnell et al. (2006), Curado and Bontis (2007), and Sharabati *et.al* (2010) among others, intellectual capital is defined as encompassing: human capital; structural capital; and relational capital.

Wu and Tsai (2005) extend the concept of intellectual capital in their research and identify two more components namely, social capital and technological capital. Ramezan (2011) argued that intellectual capital model is based on human capital, organisational capital, social capital, technological capital and business process capital or customer capital. Khalique *et.al* (2013), argued that intellectual capital covers six main components known as the (1) Human Capital, (2) Customer Capital, (3) Structural Capital, (4) Social capital, (5) Technological Capital and (6) Spiritual Capital. However, this study is at preliminary stage, therefore, the researchers used only three components namely human capital, customer capital and structural capital.

Human capital covers human resources, knowledge and competency, employee education, the job and age. Human capital refers to employees who work for the success of the organisation. It is considered as the main component of intellectual capital. It is also the crucial source of employees' knowledge, skills, competencies, capability, and innovation. (Khan, 2014; Isaac *et.al*, 2010; Shaari *et.al,* 2011; Choo & Bontis, 2002; Bontis *et.al*, 2000; Bontis, 1998; and Edvinson & Malone, 1997). Human capital basically means the knowledge acquired by a person who increases the value of his contribution to the firm and his own productivity (professional qualifications) (Fernandez *et.al*, 2000).

Customer capital is the another main component of intellectual capital and it is mainly based on the relationships between the enterprise and its customers (Khan, 2014; Shaari et al., 2011; Tai-Ning et al., 2011; and Edvinson & Malone, 1997). It is very important to organisation to have good relations with its customer, in which it could enjoy the competitive advantage (Roos *et.al*, 2001). Customer capital of an organisation is based on the knowledge embedded in its customers, suppliers, the government or related industry associations and its customer's relations (Khan, 2014; Mangena *et.al*, 2010; Bontis *et.al*, 2000; Bontis, 1999; Bontis, 1998). There is no ambiguity for any organisation that its main source of revenue generation is its customers; therefore it is obligatory for an organisation to create good relations with its customers and to win them by fulfilling the need (Tai-Ning *et.al*, 2011).

Customer capital refers to the customer satisfaction, customer loyalty to the organisation. It uses market information in order to attract customers and to maintain them. The main issue of customer capital is the available knowledge in marketing channels and relation to its customers. It also indicates the potential ability of organisation due to its external intangible factors (Skyrme, 2003 in Khajeh *et.al*, 2014).

Structural capital relates to the company's competencies in performing its routines, as well as its structures and processes which enable the employees to contribute their best to be more productive (Mangena *et.al*, 2010). According to Stewart (1997), structural capital covers the knowledge of information technology, the product copy right, the designs and the trademarks. While Chen *et.al* (2004) states that structural capital refers the systems, the structures, and the on-going procedures of a business in an organisation.

2.3. Competitive Advantage

A company can be stated to have competitive advantages when it can create higher economic values compared to other companies in the industry. Moreover, the most important thing to do is to keep the sustainability of the competitive advantages (Barney & Clark, 2007). Competitive advantages is a result of abnormal profit (Peteraf, 1993) or the above average returns by using special features of the company (Lin & Huang, 2011). It can be classified

into two advantages; first, the logistic-based advantages (Kamboj et al, 2015) and resource-based advantages (Barney, 1991). This study applies the second approach, the resource-based competitive advantages.

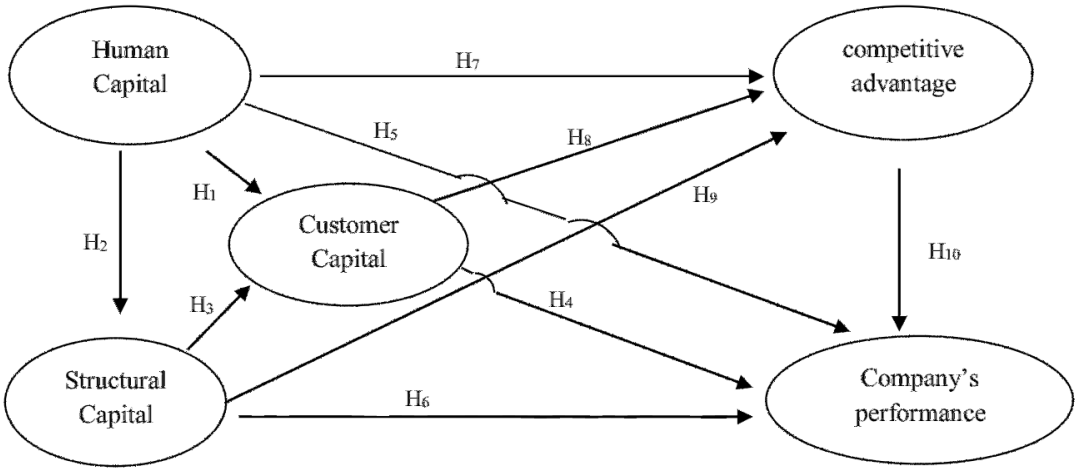
An organisation generally uses intellectual capital as a guide to create sustainable performance and competitive advantages (Cohen & Kaimenakis, 2007; Halid et al, 2018). Intellectual capital becomes an organisation's main source in terms of economic-based knowledge, to gain its competitive advantages and as its main pillar of economic-based knowledge. Intellectual capital management directs a company in making precise decision in its business activities, its investment, and its organisation management to achieve competitive advantages (Shaari *et.al*, 2011). It has been considered by an organisation as the main resource of competitive advantage which affects creativity and innovation level (Taliyang *et.al*, 2011).

3. Research model and methodology

Intellectual capital is not created one at a time from human capital, structural capital, or customers, but from the interactions among the capital (Stewart, 1998). Batgerson (2003, in Nawawi, 2012) states that knowledge management is a sistematic approach conducted to manage intellectual asset and other information so it gives competitive advantage to the company. The Depatment of the Navy (DON) of the United States, in their approach, states that the knowledge management improves an organisation's performance through effetiveness, productivity, quality and innovation improvement. (Ross & Sclzulte, 2005 in Nawawi, 2012). Cabrita & Vaz (2006) also describe intellectual capital as an intangible asset that can be used as a sustainable source of competitive advantage; though its components must make interactions to create values.

This study uses several variables. Human capital as an exogenous variable while structural capital, customer capital, competitive advantage and organisational performance are the endogenous ones.

Figure 1. Research design and Hypothesis



Sources : Sharabati et. al. (2010); Majeed (2011); Lakhal (2009); developed.

H_1 : Human Capital positive influence to Customer Capital
H2 : Human Capital positive influence to Structural Capital
H3 : Structural Capital positive influence to Customer Capital
H4 : Customer Capital positive influence to company's performance
H5 : Human Capital positive influence to company's performance
H6 : Structural Capital positive influence to company's performance
H7 : Human Capital positive influence to competitive advantage
H8 : Customer Capital positive influence to competitive advantage
H9 : Structural Capital positive influence to competitive advantage
H10 : Competitive advantage positive influence to company's perfomance

Table 1: Variables and research indicator

Variables	Indicators	Symbols
Human Capital	Employees' capabilities & experience	X_1
	Employees' satisfaction	X_2
	Employees' creativity & innovation	X_3
	Employees' education & training	X_4
	Employees' value & culture	X_5
	Loyality & commitment	X_6
Structural capital	Organisation's culture	X_7
	Organisation's process efficiency	X_8
	Information system	X_9
	Organisation's structure	X_{10}
	Organisation's research & development	X_{11}
	Knowledge retains	X_{12}
Customer Capital	Basic marketing capability	X_{13}
	Customer loyalty, suppliers & partners	X_{14}
	Customer's satisfaction, suppliers & partners	X_{15}
	Market intensity	X_{16}
	Knowledge on customers, suppliers, & partners	X_{17}
	Strategic companionship, legality & arrangement	X_{18}
competitive advantage	Innovative product	X_{19}
	Better quality of product & service	X_{20}
	Reliable shipping	X_{21}
	Lower company costs	X_{22}
	Inventories	X_{23}
	Competitiors new product launch	X_{24}
Company's performance	Company's efficiency	X_{25}
	ROI	X_{26}
	Growth or ROI	X_{27}
	Growth of sales	X_{28}
	Market share growth	X_{29}
	Profit margin on sales	X_{30}
	Whole competition position	X_{31}
	Market share	X_{32}

Source : Li et.al (2004), Chen et.al (2004), Cohen & Kaimenakis (2007), Sharabati et.al (2010), Shih et.al (2010), Mananeke (2012), and Rezaian &Naeiji (2012), development

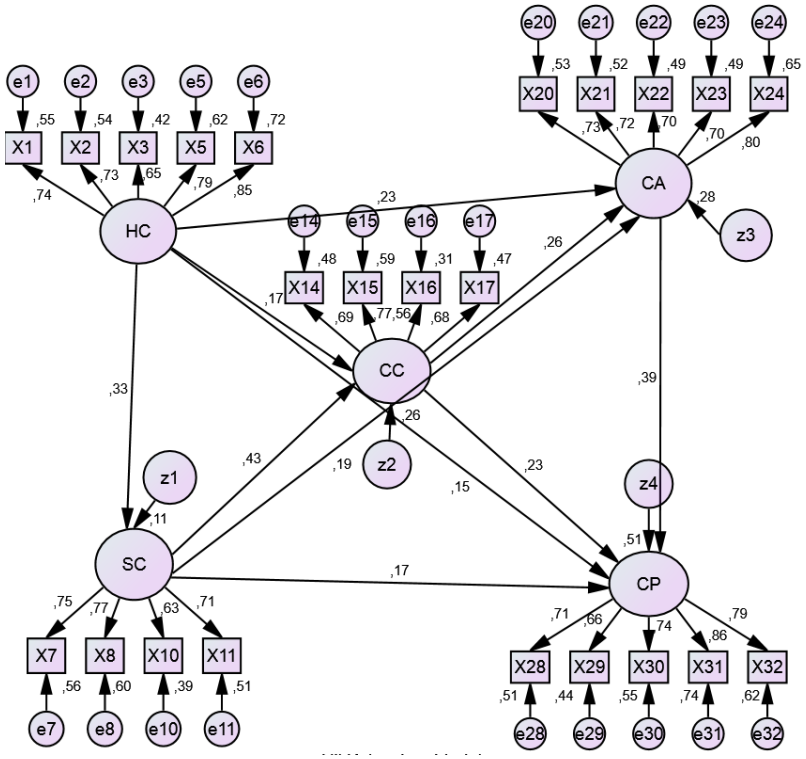
The study uses Confirmatory Factor Analysis and Full Model of Structural Equation Modelling (SEM) as data analysis, covering seven steps of criteria evaluation goodness of fit. (Ferdinand, 2016). They are: (1) Theoretical Model Development, (2) Path Diagram Development, (3) Path Diagram Conversion to Model of Structural Equation Modelling, (4) Designation of Input Matrics & Proposed Model Estimation, (5) Identification Problem Chances, (6) Goodness of Fit Criteria Evaluation, and (7) Interpretation of Test Result & Model Modification.

Goodness of Fit Criteria Evaluation covers Proper & Statistic Test: Likelihood ratio chi-square statistic (χ^2), Root Mean Square Error Approximation (RMSEA), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), The Minimum Sampel Discrepancy Function or Degree of Freedom (CMIN/DF), Tucker Lewis Index (TLI) dan Comparative Fit Index (CFI), Reliability Test, Validity Test & SEM Assumptions.

Moreover, we have to oversee other fit criteria: RMSEA, GFI, AGFI, CMIN/DF, TLI and CFI, which show proper fit values recommended. The test result of endogenous construct confimatory shows that indicators X_7, X_8, X_{10}, X_{11}, X_{14}, X_{15}, X_{16}, X_{17}, X_{20}, X_{21}, X_{22}, X_{23}, X_{24}, X_{28}, X_{29}, X_{30}, X_{31} and X_{32} are valid.

The result of Full Model SEM process shown in figure 2.

Figure 2. Confirmatory Factor Analysis Structural Equation Model (SEM).



source: development result, 2018

The test of models show that it fits to the data used in the study, eventhough probability is 0.000 and significance of chi-square is 432,543. On the other hand, the values of RMSEA, GFI, AGFI, CMIN/DF, TLI and CFI range on the expected values. Based on the goodness of fit criteria, it can be concluded that SEM specified in this study fits the data.

From the data process, we can see that each indicator or dimension of model from each underlying variable shows a good result (CR > 1.96). All values of loading factor for each indicator is smaller than 0.05. With this result, it can be stated that these underlying construct indicators have shown strong indicators in the underlying variable measurements. Moreover, based on the analysis on confirmatory factor, this reasearch model can be used for future studies without any modification.

3.1. Assumption test

Data normality can be shown with the existence of Critical Ratio (CR) with treshold value of ± 2.58 on significance level 0.01 (Ferdinand, 2016). The data process showing multivariate CR 2.240 means that the research data was normal distributed.

Outliers multivariate evaluation can be conducted by using the mahalanobis distance measure to each variables equally in a multidimension room. The mahalanobis distance measure is based on the value of chi-square in the distribution table χ^2 on free level as many as variables used in the research. This research uses p<0.001 which is χ^2 (23; 0.001) = 49.73. That makes the data with mahalanobis distance bigger than 49.73 is considered as multivariate outliers. This evaluation uses no data considered as outliers.

In the evaluation of multicollinearity or singularity in variables combination, we need to observe covariant matrix determinant. A tiny determinant indicates the existence of multicollinearity or singularity (Tabachnick & Fidell, 1998 in Ferdinand, 2006) so the data is not valid for the research. From data process, the result of covariant matrix determinant values away from zero, 0,108. It can be concluded that multicollinearity or singularity does not exist making the data valid for research.

The Convergent Validity test can determine whether each indicator validly estimated measures dimension of the tested concept or not; by knowing that each indicator has a critical ratio twice bigger than its error standard. The result of the study shows that all indicators

make estimation value with critical error bigger than twice its error standard. Thus, it can be concluded that the variable indicators are valid.

The result of reliability test shows that all reliability values are above 0.70. This means that SEM model measurement fulfills the requirements of measurement reliability. It is similar to extracted variance value which is above 0.50. This means that SEM model measurement is qualified as a good extracting factor.

3.2. Hypothesis Test

The hypothesis test was conducted buy examining CR value and P value on the result of Regression Weights Full Model as shown on the table compared to required statistic limit, which is above 2.00 (CR) and below 0.05 (P). The research hypothesis is accepted when Regression Weights Full Model result show the required value (Byrne, 2016).

Table 2. Hypothesis Test Result Summary

Hypothesis	CR & P value	Test Result
H_1: Human Capital influence to Customer Capital	CR = 1,886 P = 0,059	Not Accepted
H_2: Human Capital influence to Structural Capital	CR = 3,792 P = 0,000	Accepted
H_3: Structural Capital influence to Customer Capital	CR = 4,435 P = 0,000	Accepted
H_4: Customer Capital influence to company's performance	CR = 2,507 P = 0,012	Accepted
H_5: Human Capital influence to company's performance	CR = 2,061 P = 0,039	Accepted
H_6: Structural Capital influence to company's performance	CR = 2,057 P = 0,040	Accepted
H_7: Human Capital influence to competitive advantage	CR = 2,787 P = 0,005	Accepted
H_8: Customer Capital influence to competitive advantage	CR = 2,644 P = 0,008	Accepted
H_9: Structural Capital influence to competitive advantage	CR = 2,021 P = 0,043	Accepted
H_{10}: Competitive advantage influence to company's perfomance	CR = 2,507 P = 0,012	Accepted

source : Proccessed Primary Data, 2018

4. Conclusion

From the results of hypothesis test it can be concluded that human capital does not significantly influence the customer capital. This illustrates that customers are not affected by industry resources. Customers have believed that craftsmen have had the ability and high experience and commitment to troso woven products. The quality of weaving from Troso has been well known.

Human capital have a positive and significant effect on structural capital. This shows that ability and loyalty and commitment of human resources will determine structural capital. Besides that human capital also has a positive and significant effect on company performance and also influences competitive advantage. The management must be able to channel the capabilities, ideas and innovations of employees into the company's work system. In addition, the higher employee loyalty to the company, the more attention to efficiency, culture, structure, and company development. In addition, the better the ability, experience and commitment of weaving craftsmen will increase the market share of the results of Troso woven products. In addition, it will also increase competitive advantage. This study also supports the results of research including Daou et al. (2013), Ning et al. (2011), Shih et al. (2010), Sharabati et al. (2010), Uadiale & Uwuigbe (2009), Cohen & Kaimenakis. (2007), Cabrita & Vaz (2006), Chen et al. (2004), and Bontis (1998).

Furthermore, Structural capital have a positive and significant effect on customer capital. In addition, it also has a positive and significant effect on company performance and also on competitive advantage. This shows that the work process in producing efficient and fast weaving products and various types of products will maintain customer loyalty. In addition, it will also increase company profits and market share. With production efficiency will reduce production costs, so as to increase competitive advantage in a sustainable manner. This study supports the results of research from Daou et al. (2013), Soret et al. (2010), Sharabati et. Al (2010), Uadiale & Uwuigbe (2009), Yusuf & Sawitri (2007), Cabrita & Vaz (2006), Astuti & Sabeni (2005), Chen et. Al (2004), and Bontis (1998).

Then, Customer capital have a positive and significant effect on company performance and also have a positive and significant effect on competitive advantage. This illustrates that customer satisfaction and loyalty is very important to increase sales growth and market share of troso woven products. For this reason, it should be noted that troso weaving products not only provide a standard model, but need to keep abreast of consumer tastes, so that customer loyalty is maintained. This will increase the company's profits and increase the competitive advantage of weaving products both at national and international levels. The results of this study are also supported by the results of the study of Daou et al. (2013), Sharabati et. Al (2010), Soret et. Al (2010), Uadiale & Uwuigbe (2009), Cabrita & vaz (2006), Chen et.al (2004), and Bontis (1998).

The results of this study also showed that the competitive advantage of troso weaving had a positive and significant effect on the performance of the troso woven SMEs. This shows that the higher the attention to product quality, product diversity, product availability and distribution speed will increase profit margins, market share and sustainable company performance. This is in accordance with the results of a study from Prasetya et al. (2007), Li et al. (2004), Chen et al. (2006), and Purnama & Setiawan (2001).

Local government is expected to keep giving trainings to the weavers equally, and to everybody without exceptions. Central government is also expected to help lifting up the trend of traditional weaving of Troso as well as other weaving products around Indonesia.

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COMPARING THE FORECASTS OF THE DEMAND FOR MONEY IN MALAYSIA WITH THE INCLUSION OF FINANCIAL INNOVATION USING DIFFERENT ESTIMATION METHODS

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Abstract

In this paper, we compare the forecasting performance of multivariate models (ARDL/VECM/DOLS/FMOLS) versus univariate models (ARIMA/ETS) for the purpose of forecasting the real demand for money in Malaysia using monthly data during 2010Q1-2018Q4. This study overcomes the issue of misspecification by incorporating financial innovation in the money demand function using separate measures of payment instruments (credit card, charge card, debit card, e-money), payment channels (Real Time Electronics Transfer of Funds and Securities or RENTAS, Interbank GIRO, Financial Process Exchange or FPX and direct debit) and payment channels (Automated Teller Machines or ATM, mobile banking) to capture the effect of financial innovations. The multivariate models which are categorized into structural models (relying on a structural relationship between money demand and other variables) are also cointegration based models meaning that variables have long-run associationship and move together in the long-run while non-structural (non-cointegration) based techniques (ARIMA and ETS model) do not rely on such a structural relationship. We conclude that structural models are better for longer term forecasting. Non-structural models (notably ARIMA) have better forecasting performance for short term horizons such as one year than they do for long term horizons. However, our findings indicate that even for short term horizons, structural models do better than non-structural models but the gap between forecasting accuracy for these two kinds of models is much narrower in the short term horizon compared to long term horizon. The results also indicate that FMOLS has the most predictive power among cointegration/structural/multivariate based models for both short (12-months) and long-time (60-months) horizons. In the context of this model (FMOLS), financial innovation have positive yet small impact on money demand in Malaysia. Finally, we do out-of-sample forecast using FMOLS.

Keywords: Malaysia, Money Demand, Financial Innovations, Multivariate, Univariate, Cointegration

JEL classification: E41, E42, E52

1. Introduction

In the new environment of modern commerce and technological progress, traditional means of payment is no longer satisfying the need for more convenient, quicker, and more secure means of payment. The evolving commercial models pushed the payment systems constantly to catch up with the requirements of these models and transform into highly sophisticated modern electronic payment instruments. New payment standards were set by the fast growth of digital commerce which has had an impact on the evolution of current electronic payment instruments that in turn has reduced transactional and financial risks. Modern payment systems are crucial in our daily life and in the well-functioning of the economy. A set of instruments, and interbank funds transfer clearing systems that guarantee the circulation of money create the foundation of modern payment systems.

Since the introducing of new payment technologies, this traditional money demand relationships have changed causing traditional money demand function instable. High auto correlated errors, implausible parameter estimates and persistent over prediction can also be attributed to the ignorance of the rapid growth in financial innovation. Therefore, in specifying money demand function, we need to be aware of the importance of including innovation variations in the money demand function. In order to highlight our findings and compare it with other recent studies that used similar method, we discuss some of the most recent studies.

Investigation of the stability of money demand has received a lot of attention due to its importance for the successful implementation of monetary policy. The most prominent of these studies include Meltzer (1963), Darrat (1985), Adam (1992), Hoffman et al (1995) and in recent years Bahmani-Oskooee (2001), Hamori (2008), Bahmani-Oskooee and Gelan (2009).

Stability of money demand enables monetary authorities to control inflation effectively through adjusting the money supply while instability of money demand is a hinder for the proper monitoring of prices. A stable money demand is an indication of how effective the use of monetary aggregates is, in the conduct of monetary policy. Therefore, we need to make sure we have an answer to this important question. For monetary policy to be efficient, it needs to have predictable effect on the macroeconomic variables. The necessary condition for this is a stable money demand function. Whether or not a money demand is stable makes a difference between efficient and inefficient monetary policy.

The demand for money function creates a platform to investigate the effectiveness of monetary policies which is crucial for macroeconomic stability provided that this money demand is stable. Owoye and Onafowora (2007) point out that in order to control inflation rate, we need a stable money demand function. Baharomshah et al. (2009) state that if a steady and state relationship between money demand and its determinants (including financial innovation) exists, then the central bank will be able to use monetary policy to affect important macroeconomic variables successfully which in part plays a vital role in stimulating economic growth and stability.

Prior to the mid-1970s, stability of money demand was ensured with the inclusion of only interest rate and output (Goldfeld and Sichel, 1990). However, there has been mixed results in regards to the stability of money demand after the introduction of recent financial innovations over the last few decades. Therefore, researchers such as Arrau and De Gregorio (1993), Arrau et al (1995), Ireland (1995), Attanasio et al (2002), Hafer and Kutan (2003), Mannah-Blankson and Belyne (2004), Hye (2009), Alvarez and Lippi (2009) and Nagayasu (2012) began to include financial innovation in the money demand specification to achieve stability and to avoid some of the issues faced by traditional money demand specification such as autocorrelated errors, persistent over prediction and implausible parameter estimates (Arrau et al, 1995). Ignoring these innovations could lead to misspecification of the money demand through over estimation, or so called “missing money” (Arrau and De Gregorio, 1991). Besides, the failure of co-integration of the money demand can be attributed to the exclusion of financial innovation in the money demand function.

Forecasting of money demand as a basis on policy instrument, is considered essential for decision making of the central bank (Choi & Oh, 2003). Monetary authority need the forecast of money demand to choose appropriate monetary policy actions to maintain price stability and sustain long run economic growth. The problem with producing an accurate money demand forecast is that is to find a suitable estimation method for money demand that yields the most accurate forecast. That justifies why we need to compare the performance of money demand forecasting obtained from different estimation methods. Controlling inflation can be done at its optimum level only if the most accurate forecast of money demand is obtained which in turn depends on applying the most appropriate estimation method. In implement more appropriate rules and regulation to achieve the targets set by the policy makers, they need accurate pictures of current economics which is only possible by applying those methods with lower forecast error criterion (the most important of all, Root Mean Square Error or simply RMSE). Various methods ranging from univariate (such as exponential smoothing), to multivariate regression model (such as VECM) models have been used in estimating and forecasting economic and financial variables.

Many researchers have been trying to establish a model with the lowest out-of-the-sample forecast error. We will evaluate in-sample forecasting performance of estimated money demand function in Malaysia by comparing cointegration based method with non cointegration based method to test this hypothesis that cointegration property of the model improves the forecasting performance. First, we construct multivariate and univariate time series forecasting models using econometric methods that includes both the conventional (traditional) determinants of money demand (GDP and interest rate) in addition to financial variables to proxy the effect of financial innovation on the demand for money. Second, we produce both short-term (1-year) and longer term out of sample forecasts (5-years) using the estimation methods that provides the most accurate in sample forecast). The benchmark for choosing the method with the best forecasting performance is mainly Root Mean Square Error (RMSE) but other criteria such as Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE) and Theil's U Statistic will also be considered.

Based on these steps, we can define 3 general objectives as below: a) Determining which forecast (either dynamic or static) is superior for each model, b) Comparing in-sample forecasts from all of the models to determine which model provides the most accurate forecast, c) Determining if non contegration model performs better in short-time horizon (1-year) or in long-time horizon (5-year) when it comes to forecasting, d) Doing out-of-sample forecast using the model with the best in-sample forecasting performance, and e) Estimating the models using the best (selected) estimator and comparing the estimated coefficients of the financial variable when the models include different sets of these variables (PI, PS and PC) to determine the impact of financial innovation on the demand for money in Malaysia.

After a brief introduction, we provide a literature review. Then, methodology will be provided with detail explanation of the background of the method used in this research and the money demand specification. It is followed by estimating the models using different sets of financial variables along with evaluating and comparing the forecasts based on these estimates. Summary and conclusion ends up the paper.

2. Literature review

Williams (1997) used cointegration and error correction model to forecasting the demand for currency in Jamaica describing the adjustment path for currency demand relative to the consumer price index (CPI), the weighted average deposit rate, the exchange rate as well as consumer imports comprising food and nondurable items. He used monthly data from 1990:12 to 1996:12. His finding indicates that in the short run, the main basis for holding cash balances is for transactions. The ECM term was negative and highly significant indicating the existence of a long run relationship between currency demand and the various macroeconomic variables. Appropriateness of model specification and lagged data availability for variables is considered an issue in a structural specification. Therefore, ARMA model is preferred for the purpose of forecasting currency demand.

Anderson-Reid (2008) estimated the effect of the non-cash means of payment (debit and credit cards in particular) on the demand for currency in Jamaica by applying the error correction method. The performance of this ECM model was compared to that of a short-run model and a univariate Autoregressive Integrated Moving Average (ARIMA) model to analyse the power and ability of the model for forecasting purpose. ECM model included currency in circulation, consumer goods imports, the consumer price index (CPI), the 3-month Treasury bill rate and the exchange rate. ATM volume, EFTPOS volume and the number of debit cards and credit cards were also included. The model was of the logarithm functional form that included M (currency in circulation), P (the price level), NOND (consumer goods imports) and TBlL (the interest rate on 3-month Treasury bill). ATM volume, EFTPOS volume and the number of debit and credit cards in circulation are denoted by ATMV, POSV and Card, respectively. All of the variables are in logarithms except for the interest rate variable that is in levels. Consequently, estimates of the coefficients are actually the elasticity as the model is in log functional form.

Hoffman and Rasche (1996) compare the forecasting performance of a co-integrated system with that of a non-cointegrated VAR system. They consider eight years out-sample

forecast horizon for the US economy and conclude that only at longer forecast horizon, co-integrated system performs better than the non-cointegrated VAR system.

Using simulated and real data from the UK, Canada, Germany, France and Japan and interest rate data from the US and Taiwan, Lin and Tsay (1996) conclude the forecast performance of ECM for simulated data is superior while that for real data is mixed (due to deficiency in forecast error measure).

Cassino and Misich (1997) used ARIMA model to forecast the demand for currency in New Zealand and conclude that the error correction model's out-of-sample forecasts over this period are inferior to the forecasts from ARIMA.

Deng and Liu (1999) deal with the demand for money, including narrow money (M1) and broad money (M2) in China using data from the first quarter of 1990 to the fourth quarter of1994. They obtained forecasts over different horizons. Based on the cointegration and error‐correction model that merges the short‐run and long‐run equations. They find that both the fitted values and predictive values for M1 and M2 are satisfactory. Finally, they give forecasts for M2 from the first quarter of 1995 to the second quarter of 1996.

Using annual data from 1867 to 1966 (for model specification) and annual data from 1966 to 2000 (for out-of sample forecast evaluation) for the United States, Wang and Bessler (2004) conclude that ECM is as the best model for three to four year ahead forecast.

Jansen and Wang (2006) compare the forecasting performance of the co-integration based ECM between the equity yield on the S&P 500 index and the bond yield with that of univariate models and found ECM superior to the univariate models for longer-horizon forecasts.

3. Methodology

3.1. Background

After collecting the required data (monthly data during 2010M1-2018M12, 108 time-series observations) for Malaysia, we will do a comparison between forecasting power of the 5 estimation methods (ARDL, VECM, DOLS, FMOLS, ARIMA and Exponential Smoothing) for short-time (one year or 12 months) in both static and dynamic forecasts, separately. Financial variables included in the model are credit card, charge card, debit card and e-money which makes payment instruments. Next, the same process will be done for a longer period (5 years) to determine how forecasting performances of the different methods varies over different time horizon. After this, we will turn to models that include payment systems (RENTAS, Interbank GIRO and FPX & Direct Debit) and finally to models that include payment channels (ATM and mobile banking). Internet Banking is excluded in this model as the data for the mentioned duration is not available. The current study overcomes the issue of misspecification by incorporating financial innovation in the money demand function using separate measures of payment instruments (credit card, charge card, debit card, e-money), payment channels (RENTAS, Interbank GIRO, FPX and direct debit) and payment channels (ATM, mobile banking) to capture the effect of financial innovations.

Before proceeding to estimation, we need to make sure that the all of the variables (including dependent variable) are non-stationary but when we convert them to first-differenced, they become stationary. In order to do so, we conduct unit root test using the Augmented Dickey-Fuller (ADF) test statistic. Then, we need to find out whether or not these variables cointegrated. Using Johansen Cointegration Test, we conclude that the variables are cointegrated or they have long-run associationship.

The objectives of this analysis is to estimate the demand for money in the presence of financial innovations for the purpose of forecasting money demand in future. We shall use Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) as superior methods to the OLS for many reasons. Finally, we will do forecasting based on these estimation method. "Root Mean Squared Error" is selected as the benchmark (among other measures) to evaluate the forecasting performance of these methods.

Engle and Granger (1987) state that "co-integration implies the existence of an error correction model (ECM) and ARDL model that links the long-run equilibrium relationship implied by co-integration with the short run dynamic adjustment mechanism that describes how the variables react when they move out of long-run equilibrium." In other words, ECM

and ARDL has the advantage of containing both long-run levels and short-run first differences of non-stationary variables.

ARDL. Pesaran et al. (1999) define another property of this method as capable of examine long-run and cointegrating relationships among variables. This gives ARDL an advantage age over other single equation cointegration procedures. It is able to estimate the long and short-run parameters of the model simultaneously yet avoid the problems posed by non-stationary data. Also, there is no need to determine the order of the integration amongst the variables in advance. Having the same order of integration for variables is a requirement for other approaches. In addition, it is statistically much more significant approach for the determination of the cointegration relationship in small samples, while allowing different optimal lags of variables. Using ARDL (p,q) technique, Pesaran et al. (1999) incorporated the dynamic heterogeneous panel regression into the error correction model. The advantage of VECM over VAR (which you estimate ignoring VECM) is that it produces more efficient estimates. Another advantage of VECM is that it has a good interpretation with long term and short term equations. If data is non stationary, forecasting with VAR is not possible due to violating stationarity assumption which adds to the benefit of using VECM.

An autoregressive integrated moving average (ARIMA) model is a generalization of an autoregressive moving average (ARMA) model fitted to time series data to improve forecasting ability. This model is used when series are non-stationarity so it can be eliminated by applying the "integrated" part of the model that is differencing step. In order to make the model fit the data as well as possible, three features of this kind of model is used: The AR part (regressing the dependent variable on its own lagged values) denoted by p (the order of the autoregressive model), The MA part (a linear combination of error terms whose values occurred contemporaneously and at various times in the past) denoted by q (the order of the moving-average model) and the "integrated" part (replacing data values with the difference between their values and the previous values) denoted by d , the degree of differencing (Hyndman and Athanasopoulos, 2015).

When two out of the three terms are zeros, the model is reduced to a based one. For example, ARIMA (1,0,0) which refers to a general form (ARIMA(p,d,q)) is actually AR(1), ARIMA(0,1,0) is I(1), and ARIMA(0,0,1) is MA(1). Box–Jenkins suggested an approach to estimate ARIMA models.

“Exponential smoothing is a time series forecasting method for univariate data. Time series methods like the Box-Jenkins ARIMA family of methods develop a model where the prediction is a weighted linear sum of recent past observations or lags. Exponential smoothing forecasting methods are similar in that a prediction is a weighted sum of past observations, but the model explicitly uses an exponentially decreasing weight for past observations” (Brownlee, 2018).[1]

For the purpose of forecast evaluation, first we choose “Root Mean Squared Error” (RMSE) as benchmark. This statistic refers to the gap between forecasted money demand and actual money demand in logarithm form. Smaller RMSE means better forecasting or more predictive power.

3.2. Specification

The general form of the theory of money demand can be represented as below:

$$\frac{M_t}{P_t} = \Phi(R_t, Y_t)$$

where M_t is the demand of nominal money balances, P_t is the price index that is used to convert nominal balances to real balances, Y_t is the scale variable relating to activity in the real sector of the economy (here, GDP as the best proxy for such a variable), and R_t is the opportunity cost of holding money (here, the interest rate as the best proxy). We start the

[1] https://machinelearningmastery.com/exponential-smoothing-for-time-series-forecasting-in-python/

empirical estimation of money demand functions with introducing the long-run, log linear function that is of the form

$$\text{Log}\left(\frac{M_t^*}{P_t}\right) = \alpha + \beta_1 \log Y_t + \beta_2 R_t + \varepsilon_t$$

Desired stock of nominal money is denoted by M^*, P is the price index that we use to convert nominal balances to real balances, Y is the scale variable, and R is the opportunity cost variable. The conventional money demand $M^d = (Y_t, R_t)$ is misspecified and leads to the bias that gets into the estimated coefficients. Therefore, it has to be enriched with financial innovation (r*) so that it can be represented implicitly as $M^d = (Y_t, R_t, r^*)$, (Serletis, 2007) that is:

$$\text{Log}\left(\frac{M_t^*}{P_t}\right) = \alpha + \beta_1 \log Y_t + \beta_2 R_t + \beta_3 r_t^* + \varepsilon_t$$

The coefficient of interest β_3 which represents the effect of financial innovation on money demand is expected to be negative according to most of the literature on financial innovation (see Arrau et al (1995), Lippi and Secchi (2009) and Attanasio et al (2002)) although a few studies such as Hye (2009) and Mannah-Blankson and Belyne (2004) do indicate a positive relationship. The coefficients on income β_1 and the Treasury bill rate β_2 are expected to be positive and negative respectively as money demand theory predicts. The data are monthly, from 2010(M1) to 2018(M12).

In estimating the effect of financial innovation on the demand for money, we estimate a semi log-linear specification of the form:

$$\text{Log MOD} = \beta_0 + \beta_1 \text{Log GDP} + \beta_2 \text{ RIR} + \beta_3 \text{Log (Financial Innovation)} + e_t$$

The conventional theory of demand for money is the basis for this specification. We use a traditional specification of the conventional demand for money using ARDL model where MOD denotes real demand for money, GDP denotes real gross domestic product, RIR is the real interest rate (3-months treasury bill), Financial Innovation is the proxy for capturing the effect of financial innovations on the demand for money, and e_t is the error term. Data is collected from the official website of the Bank Negara Malaysia (BNM). Consumer Price Index (CPI) was used to convert nominal data to real data. Real interest rate (RIR) was calculated using the formula: (1+ (NIR)) / (1+ (IFR)) where NIR is the nominal interest rate and IFR is the inflation rate.

In general, the retail payments in Malaysia can be divided into three - Retail Payment Systems, Retail Payment Instruments and Retail Payment Channels.

Types of retail payment systems includes: 1) National Electronic Cheque Information Clearing System (eSPICK), 2) Shared ATM Network, Interbank GIRO, 3) Direct Debit and Financial Process Exchange.

Types of retail payment instruments includes: 1) Cheques, 2) Credit cards, 3) Charge cards, 4) Debit cards, and 5) E-money.

Types of retail payment channels includes: 1) Internet banking, 2) Mobile banking, and 3) Mobile payment.

The first regression includes CRC (the nominal value of credit cards transactions), CHC (the nominal value of charge cards transactions), DEC (the nominal value of debit cards transactions) and EMO (the nominal value of E-money transactions).

The second regression includes REN (the nominal value of RENTAS transactions), IBG (the nominal value of Interbank GIRO transactions) and FDD (the nominal value of FPX and Direct Debit transactions).

The third regression includes ATM (the nominal value of ATM transactions), MOB (the nominal value of Mobile Banking transactions). IB (the nominal value of Internet Banking transactions) is excluded in the regression as the data are not available.

The data are monthly, from 2010(M1) to 2018(M12) for all of the models and were retrieved from the official website of Bank Negara Malaysia. They are all in million Ringgits (real terms), and in logarithm form except for interest rate (RIR).

The study follows a traditional money demand specification by Holly (1999), Rinaldi (2001), Anderson-Reid (2008), Hamori (2008), Hataiseree (2010), Rauf and Khan (2012), Oyelami and Yinusa (2013), Kasekende (2016), ect.

4. Empirical findings

We compare the predictive power of the models in 3 ways: First, we do a comparison between static and dynamic forecasts for each model. Second, we compare the forecasting accuracy of dynamic forecasts of different models to determine which model provides superior dynamic forecast. Third, we do the same as for static forecasting and select the model with the best forecasting performance. Fourth, based on the forecasting evaluations, we decide which forecast (static or dynamic) is superior. All of the forecasts are done in short-time dimension (1-year or 12-months) and long-time dimension (5-years or 60 months) to determine how forecasting performances varies over time

After collecting the required data (monthly data during 2010M1-2018M12, 108 time-series observations) for Malaysia, we will do a comparison between forecasting power of the 5 estimation methods (ARDL, VECM, DOLS, FMOLS and ARIMA) for long time (5 year or 60 months) in both static and dynamic forecasts, separately. Financial variables included in the model are credit card, charge card, debit card and e-money which makes payment instruments.

Next, the same process will be done for a short period (1 years or 12 months) to determine how forecasting performances of the different methods varies over different time horizon. After this, we will turn to models that include payment systems (RENTAS, Interbank GIRO and FPX & Direct Debit). Finally we target models that include payment channels (ATM and mobile banking). Internet Banking is excluded in this model as the data for the mentioned duration is not available.

The current study overcomes the issue of misspecification by incorporating financial innovation in the money demand function using separate measures of payment instruments (credit card, charge card, debit card, e-money), payment systems (RENTAS, Interbank GIRO, FPX and direct debit) and payment channels (ATM, mobile banking) to capture the effect of financial innovations.

4.1. Payment Instruments (PI)

4.1.1. Unit root tests (Augmented Dickey-Fuller test statistic)

Unit root tests show that these series are non-stationary in levels, but become stationary after first differencing.

Table 1: Unit root tests (Probabilities)

Variables	Level (Prob.)	First Differenced (Prob.)
LMOD	0.3861	0.0000
LGDP	0.4759	0.0001
RIR	0.3702	0.0000
LCRC	0.2203	0.0000
LCHC	0.4212	0.0000
LDEC	0.9029	0.0000
LEMO	0.8269	0.0000

Table 2 provides another way of looking at the test of the stationarity of variables by applying ADF test. Test results indicate that series are integrated of order one over the sample period as all of the series are non-stationary in the level but after first differencing, they become stationary regardless of the lag length or the information criteria.

Table 2: Unit root tests (t-Statistic)

Variables	ADF Test Statistic	10% Critical Value	5% Critical Value	1% Critical Value	Test Result
Log level of each series					
LMOD	-2.383298	-3.151673	-3.452358	-4.046072	Fail to reject
LGDP	-2.214722	-3.154273	-3.456805	-4.055416	Fail to reject
RIR	-0.793189	-1.614713	-1.943912	-2.587172	Fail to reject
LCRC	-2.747966	-3.154562	-3.457301	-4.056461	Fail to reject
LCHC	-1.71412	-2.581596	-2.8892	-3.493747	Fail to reject
LDEC	-0.405447	-2.405447	-2.8922	-3.500669	Fail to reject
LEMO	-0.755846	-2.581595	-2.8892	-3.493747	Fail to reject
Log difference of each series					
LMOD	-10.45483	-3.151911	-3.452764	-4.046925	Reject
LGDP	-28.80087	-3.153989	-3.456319	-4.054393	Reject
RIR	-12.87554	-3.152153	-3.453179	-4.047795	Reject
LCRC	-11.802256	-3.154562	-3.457301	-4.056461	Reject
LCHC	-12.42993	-2.581596	-2.8892	-3.493747	Reject
LDEC	-8.063768	-2.583192	-2.8922	-3.500669	Reject
LEMO	-10.68131	-2.581596	-2.8892	-3.493747	Reject

4.1.2. Optimum lag selection for the autoregressive model to be estimated by DOLS and FMOLS

According to Table 3, we choose the number of lags with corresponding minimum AIC/SC, that is, 1. It means that in estimating the model, we have to include only one lag of the dependent variable. Therefore, we proceed to cointegration test (and later estimation) using 1 lag.

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	PPE	AIC	SC	HQ
0	79.86506	NA	0.009752	-1.792388	-1.764236	-1.781046
1	301.2423	4326918*	6.51e-05*	-6.800960*	-6.744657*	-6.778277*
2	301.5404	0.575977	6.62e-05	-6.785009	-6.700555	-6.750985
3	301.6077	0.128393	6.76e-05	-6.763811	-6.651204	-6.718444
4	303.3378	3.263576	6.65e-05	-6.780404	-6.639646	-6.723696
5	304.7621	2.654405	6.59e-05	-6.790047	-6.621138	-6.721998
6	305.6683	1.668330	6.60e-05	-6.787916	-6.590856	-6.708526
7	305.8089	0.255502	6.73e-05	-6.768383	-6.543171	-6.677651
8	305.8213	0.022428	6.89e-05	-6.745940	-6.492576	-8.643866

* indicates lag order selected by the criterion. **LR**: sequential modified LR test statistic (each test at 5% level); **FPE**: Final prediction error; **AIC**: Akaike information criterion; **SC**: Schwarz information criterion; **HQ**: Hannan-Quinn information criterion.

It is clear from Table (4-2) that all of the criterias refer to 1 lag as the optimum number of lags.

4.1.3. Optimum lag selection for VECM

Before estimating VECM, we need to know how many lags should be included in the model. VAR Lag Order Selection Criteria leads us to the optimum number of lags. Too many lags lead to loss of degree of freedom. That is why, instead of choosing 8 lags according to AIC, 1 lag is chosen according to SC.

Table 4: VAR Lag Order Selection Criteria

Lag	LogL	LR	PPE	AIC	SC	HQ
0	547.9099	NA	1.08e-14	-12.29341	-12.09635	-12.21402
1	1032.613	881.2792	5.43e-19	-22.19576	-20.61927*	-21.56063*
2	1091.500	97.69897	4.42e-19	-22.42047	-19.46455	-21.22960
3	1147.179	83.51830*	4.00e-19*	-22.57226	-18.23692	-20.82566
4	1187.691	54.32274	5.38e-19	-22.37935	-16.66458	-20.07701
5	1239.189	60.86076	6.07e-19	-22.43611	-15.34192	-19.57804
6	1292.897	54.92928	7.24e-19	-22.54312	-14.06951	-19.12932
7	1334.137	35.61601	1.33e-18	-22.36675	-12.51371	-18.39721
8	1426.916	65.36713	9.52e-19	-23.36173*	-12.12926	-18.83645

4.1.4. Unrestricted Cointegration Rank test or (test of the existence of long-run associationship)

The last step before proceeding to estimations, is to make sure that the variables used in the model are cointegrated or they have a long-run associationship. For this purpose, we use two tests namely, Trace test and Max-eigenvaue test. According to Table 5, Trace test indicates 2 cointegration equation at the 0.05 level.

Table 5: Trace test

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None*	0.547684	198.2924	125.6154	0.0000
At most 1*	0.387305	116.5750	95.75366	0.0009
At most 2	0.240351	66.11652	69.81889	0.0952
At most 3	0.165011	37.80198	47.85613	0.3107
At most 4	0.111606	19.22730	29.79707	0.4767
At most 5	0.062145	7.038262	15.49471	0.5732
At most 6	0.004164	0.429747	3.841466	0.5121

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 6: Max-eigenvalue test

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None*	0.547684	81.71748	46.23142	0.0000
At most 1*	0.387305	50.45843	40.07757	0.0024
At most 2	0.240351	28-31454	33.87687	0.1994
At most 3	0.165011	18.57467	27.58434	0.4481
At most 4	0.111606	12.18904	21.13162	0.5291
At most 5	0.062145	6.608515	14.26460	0.5364
At most 6	0.004164	0.429747	3.841466	0.5121

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Max-eigenvaue test also indicates 2 cointegration equation at the 0.05 level Therefore, there is strong evidence of existence of cointegration among variables. In other words, the variables have long run association.

4.1.5. Five-years/sixty-months (2014M1-2018M12) in-sample forecast

We forecast the demand for money (MOD) in logarithm form for 5 years ahead using DOLS, FMOLS, ARDL, VECM and ARIMA models. The data contains monthly series from 2010M1 to 2018M12. Out of this data, we take a sample from 2010M1 to 2013M12 for estimation and use the estimated parameters to forecast MOD (using the methods) for the

period 2014M1-2018M12 which is 5 years (60 months). The conventional determinants of money demand, (gross domestic product and interest rate) along with financial variables will be included in the models and the forecast will be done. Then, we compare the actual values with the dynamic/static forecasted values to determine the predictive power of the two models as follow: 1) The actual values will be compared with the dynamic and static forecasted values for each model, 2) The actual values will be compared with the dynamic forecasted values for all the models together 3) The actual values will be compared with the static forecasted values for all the models together, 4) We will determine which forecast (either dynamic or static) has more predictive power for a specific model, 5) We will determine which model has the best forecasting power when it comes to dynamic forecasting, and 6) We will determine which model has the best forecasting power when it comes to static forecasting

The difference between dynamic and static forecasts arises because of their estimation procedure. While the value of the previous forecasted value of the dependent variable is used to compute the next one by dynamic forecast, static forecast uses the actual value for each subsequent forecast.

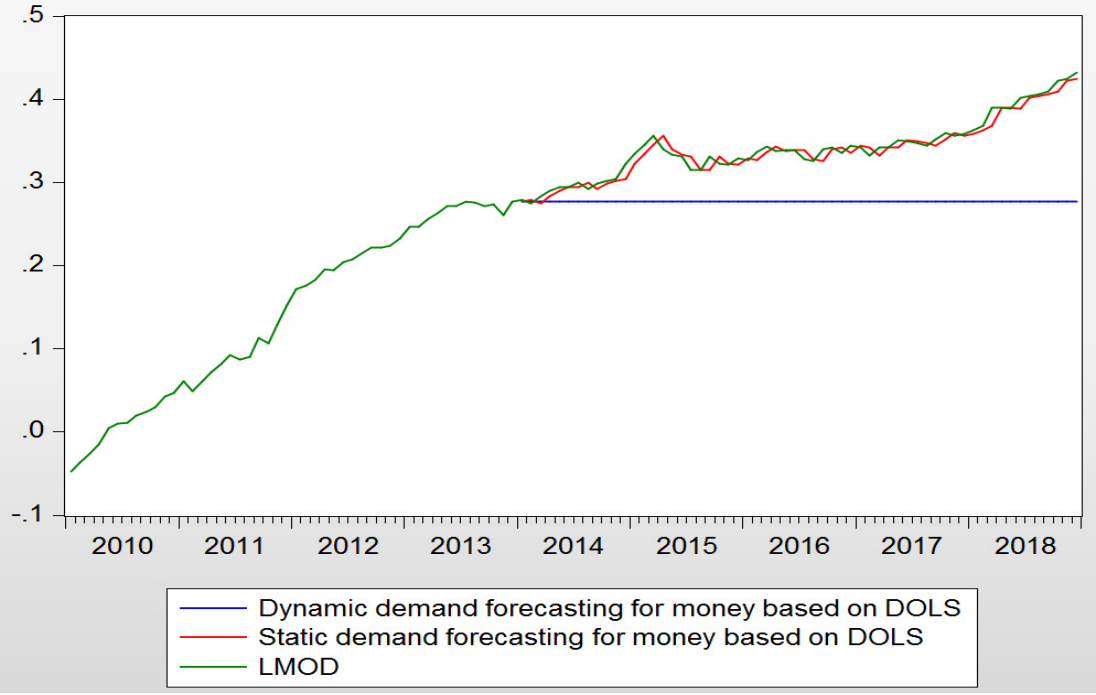
Table 7: DOLS estimation output

Variable	Coefficient	Std. Error	!t-Statistic	Prob.
LMOD(-1)	1.000000	2.59E-13	3.86E+12	0.0000
LGDP	-1.66E-13	6.61E-14	-2.505841	0.0227
RIR	-1.25E-14	1.12E-14	-1.120482	0.2781
LCRC	2.41E-13	1.23E-13	1.952236	0.0676
LCHC	-3.79E-14	1.09E-13	-0.348359	0..318
LDEC	-1.74E-13	8.77E-14	-1.987295	0.0632
LEMO	-4.70E-14	4.62E-14	-1.016535	0.3236
R-squared	1.000000	Mean dependent var		0.153620
Adjusted R-squared	1.000000	S.D.dependent var		0.096501
S.E. of regression	6.43E-15	Sum squared resid		7.04E-28
Long-run variance	7.79E-29			

Note: Fixed leads and lags specification (lead=1, lag=1). Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth.

Here, we estimated the model including payment instruments using DOLS with one lag of the dependent variable as indicated by VAR Lag Order Selection Criteria in Table 3.

Figure 1: Comparing dynamic and static forecasts based on DOLS estimation



According to Figure 1, while static forecast closely follows the actual values of the dependent variable, dynamic forecast divert from the actual value from the starting point of forecasting (2019M1) and it distances most from the actual value at the end of forecasting period (2023M12) meaning that the gap between actual values and forecasted values for dynamic forecast is much wider than that of static forecast. Nest, we turn to FMOLS to determine how these two forecasts behave based on this method.

Table 8: FMOLS estimation output

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LMOD(-1)	0.930718	0.045930	20.26403	0.0000
LGDP	-0.021579	0.010383	-2.078286	0.0443
RIR	0.006232	0.001709	3.647252	0.0008
LCRC	0.047669	0.016448	2.898245	0.0061
LCHC	0.013137	0.013061	1.005820	0.3207
LDEC	0.014671	0.015574	0.941995	0.3520
LEMO	-0.015067	0.009497	-1.586457	0.1207
R-squared	0.995167	Mean dependent var		0.149722
Adjusted R-squared	0.994423	S.D.dependent var		0.099019
S.E. of regression	0.007395	Sum squared resid		0.002133
Long-run variance	1.91E-05			

Note: Fixed leads and lags specification (lead=1, lag=1). Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth

Figure 2: Comparing dynamic and static forecasts based on FMOLS estimation

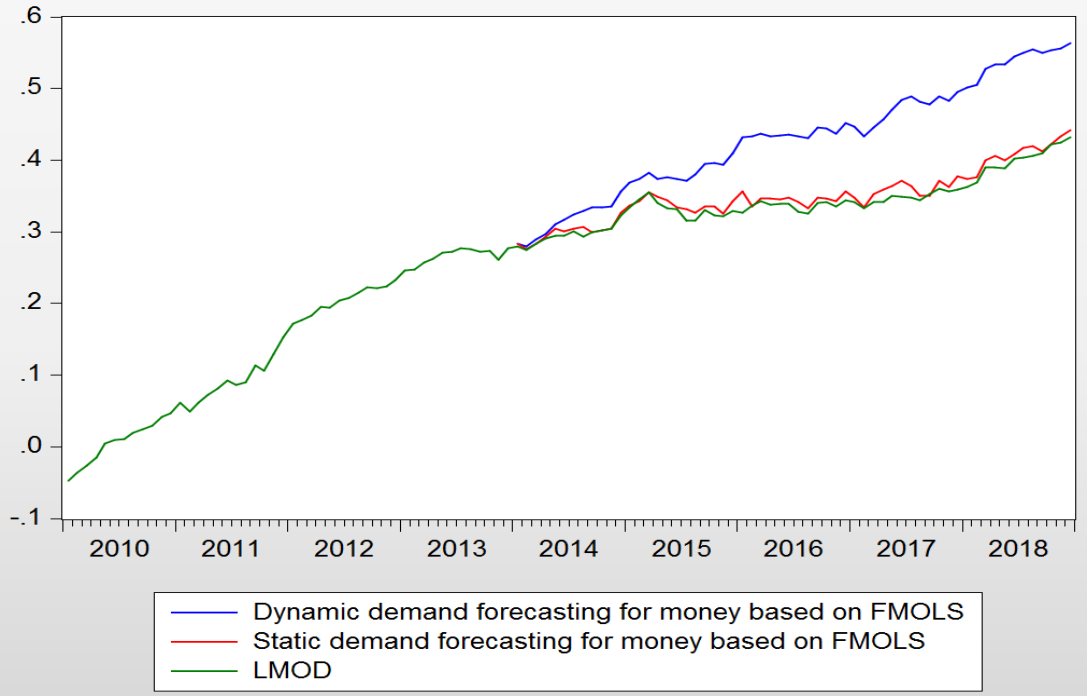


Figure 2 offers another way of looking at this comparison. While static forecast closely follows the actual values, dynamic forecast gets further distant (moves further from actual values) as times goes by. Now, we obtain forecasts based on the estimated coefficients from ARDL method.

Table 9: ARDL estimation output

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LMOD(-1)	0.297882	0.146440	2.034160	0.0519
LMOD(-2)	0.238265	0.159840	1.490643	0.1476
LGDP	0.097817	0.090585	1.079839	0.2898
LGDP(-1)	-0.261708	0.150252	-1.741796	0.0929
LGDP(-2)	-0.137040	0.150713	-0.909281	0.3712
LGDP(-3)	0.266963	0.095006	2.809947	0.0091
RIR	0.008358	0.002552	3.275579	0.0029
RIR(-1)	0.007048	0.002722	2.589190	0.0153
RIR(-2)	0.009549	0.003076	3.104933	0.0044
LCRC	0.109198	0.039410	2.770798	0.0100
LCHC	0.000716	0.024714	0.028989	0.9771
LDEC	-0.020566	0.030028	-0.684907	0.4992
LDEC(-1)	0.084128	0.025018	3.362678	0.0023
LDEC(-2)	-0.014388	0.024626	-0.584274	0.5639
LDEC(-3)	0.028572	0.023337	1.224336	0.2314
LDEC(-4)	0.052678	0.020244	2.602148	0.0149
LEMO	-0.019713	0.015556	-1.267172	0.2159

R-squared	0.997954	Mean dependent var	0.157451
Adjusted R-squared	0.996741	S.D.dependent var	0.094093
S.E. of regression	0.005371	Akaike info criterion	-7.331166
Sum squared resid	0.000779	Schwarz criterion	-6.641820
Log likelihood	178.2856	Hannan-Quinn criter.	-7.075523
Durbin-Watson stat	2.016813		

Selected Model: ARDL(2, 3, 2, 0, 0, 4, 0). Model selection method: Akaike info criterion (AIC).

The best ARDL model is selected automatically by the software using Akaike info criterion (AIC). Software has chosen 2 lags of dependent variable (money demand), 3 lags of the first independent (explanatory) variable which is GDP, 2 lags of real interest rate (RIR), no lags of credit cards (CRC), no lags of charge cards (CHC), 4 lags of debit cards (DEC) and finally no lags of e-money (EMO) which gives the model the minimum AIC. This selected ARDL model is used to obtain dynamic and static forecasts for the purpose of comparison.

Figure 3: Comparing dynamic and static forecasts based on ARDL estimation

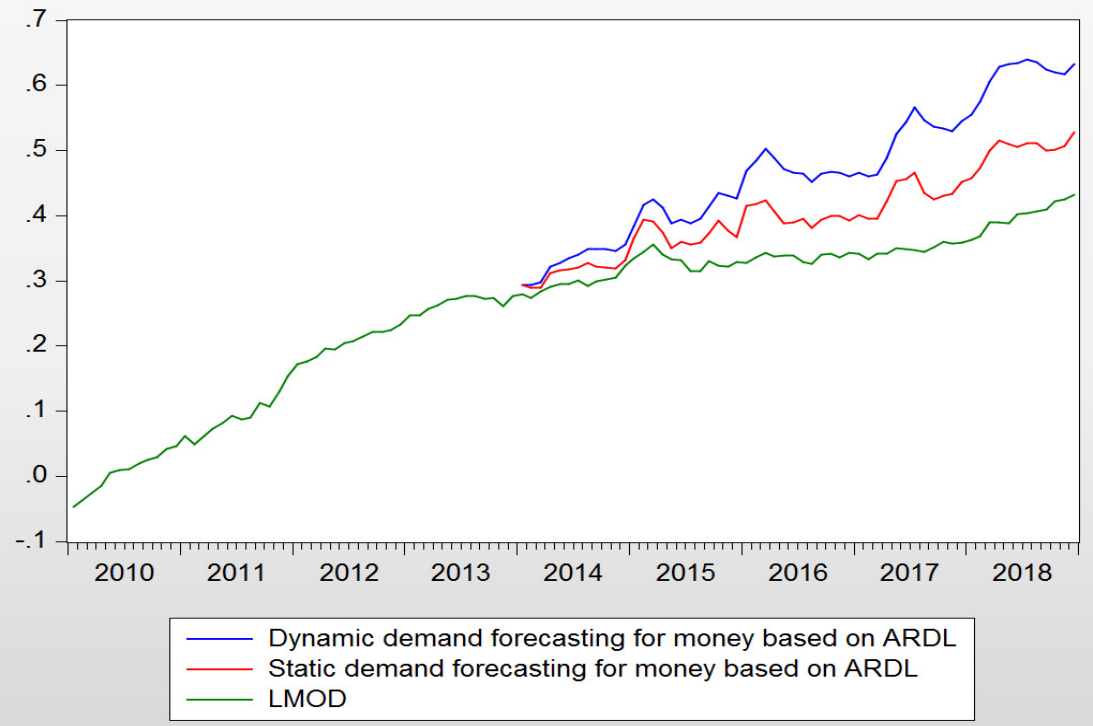


Figure 3 compares dynamic forecast versus static forecast. It can easily be seen that the static forecast is closer to actual values compared to dynamic forecast for the entire forecasting period. Table 10 summarized the results of forecasting measures.

Table 10: Forecast measures based on static forecast using different methods

Forecast Measures/Methods	DOLS	FMOLS	ARDL
RMSE	0.0080	0.0102	0.0694
MAE	0.0063	0.0082	0.0613
MAPE	1.8611	2.4025	17.344
TIC	0.0117	0.0147	0.0922
BP	0.1036	0.6195	0.7803
VP	0.0154	0.0237	0.1679
CP	0.8809	0.3566	0.0516
TUC	1.0000	1.2453	8.0760
SM	1.8732	2.3588	15.691

RMSE: Root Mean Squared Error; **MAE**: Mean Absolute Error; **MAPE**: Mean Abs. Percent Error; **TIC**: Theil inequality Coefficient; **BP**: Bias Proportion; **VP**: Variance Proportion; **CP**: Covariance Proportion; **TUC**: Theil U2 Coefficient; **SM**: Symmetric MAPE.

So far the two important conclusions are that 1) Static forecast is superior to dynamic forecast for all of the methods and 2) DOLS has the best forecasting performance with regard to static forecast (closely followed by FMOLS).

Next, we are eager to find out how these forecasts behave under VECM estimation. Therefore, we proceed to derive long-run (cointegration equations) and short-run (error corrections) estimates as follow.

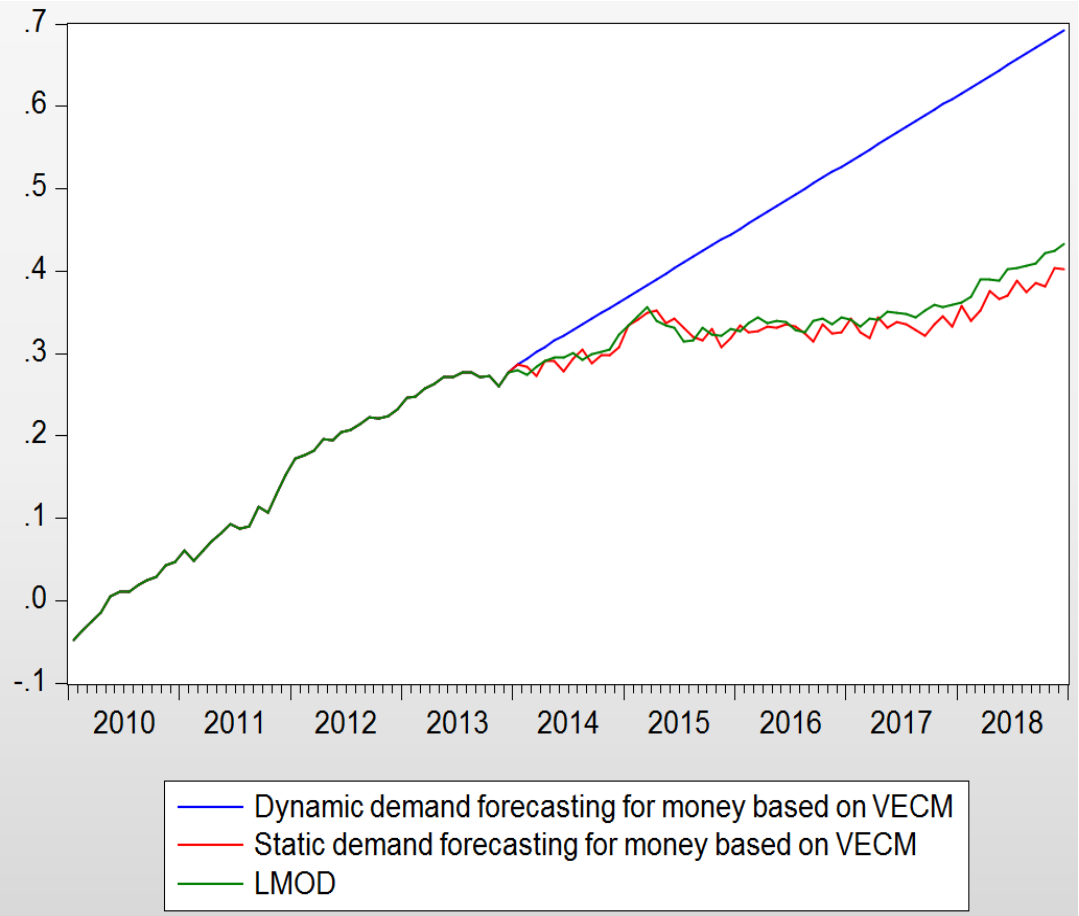
Table 11: VECM estimation output (Cointegration equation)

Cointegrating Eq:	CointEq1	CointEq2
LMOD(-1)	1.000000	0.000000
LGDP(-1)	0.000000	1.000000
RIR(-1)	-0.001125	-0.053485
	(0.00761)	(0.01465)
	[-0.14791]	[-3.65045]
LCRC(-1}	-0.019909	-0.447805
	(0.08088)	(0.15575)
	[-0.24616]	[-2.87518]
LCHC(-1)	-0.434430	0.381156
	(0.05416)	(0.10430)
	[-8.02078]	[3.65433]
LDEC(-1}	-0.073478	-0.300029
	(0.02909)	(0.05603)
	[-2.52558]	[-5.35522]
LEM0(-1)	-0.103097	0.127227
	(0.03531)	(0.06800)
	[-2.91965]	[1.87100]
c	-0.592166	-3.013661

Table 12: VECM estimation output (Error corrections)

Error Correction:	D(LMOD)	D(LGDP)	D(RIR)	D(LCRC)	D(LCHC)	D(LDEC)	D(LEMO)
CointEq1	0.121669 (0.10613) [1.14639]	-0.320621 (0.14551) [-2.20348]	18.55386 (4.72210) [3.92916]	1.239785 (0.69572) [1.78202]	2.410860 (0.56256) [4.28555]	0.369553 (0.71949) [0.51363]	1.296330 (0.96413) [1.34455]
CointEq2	-0.002695 (0.05278) [-0.05105]	-0.229032 (0.07236) [-3.16503]	7.713456 (2.34839) [3.28457]	0.954660 (0.34599) [2.75918]	0.023648 (0.27977) [0.08453]	0.557209 (0.35782) [1.55724]	-0.163906 (0.47948) [-0.34184]
D(LMOD(-1))	-0.262062 (0.18870) [-1.38876]	0.032883 (0.25871) [0.12711]	-7.878064 (8.39581) [-0.93833]	0.299714 (1.23698) [0.24230]	-1.988323 (1.00021) [-1.98790]	-0.330265 (1.27925) [-0.25817]	-3.866799 (1.71421) [-2.25573]
D(LGDP(-1))	-0.104868 (0.10311) [-1.01708]	0.652408 (0.14136) [4.61523]	-5.847686 (4.58751) [-1.27470]	0.125169 (0.67589) [0.18519]	0.952055 (0.54652) [1.74203]	-0.789085 (0.69899) [-1.12890]	0.124432 (0.93665) [0.13285]
D(RIR(-1))	0.002656 (0.00294) [0.90493]	-0.016223 (0.00402) [-4.03115]	-0.372039 (0.13060) [-2.84862]	0.067253 (0.01924) [3.49512]	0.006253 (0.01556) [0.40189]	0.063908 (0.01990) [3.21151]	-0.013054 (0.02667) [-0.48955]
D(LCRC(-1))	0.027704 (0.02897) [0.95648]	-0.062216 (0.03971) [-1.56673]	-1.541274 (1.28873) [-1.19596]	0.303438 (0.18987) [1.59812]	0.161772 (0.15353) [1.05369]	0.578834 (0.19636) [2.94782]	0.415485 (0.26313) [1.57903]
D(LCHC(-1))	0.000176 (0.02359) [0.00745]	0.037257 (0.03234) [1.15200]	3.833641 (1.04956) [3.65260]	-0.317018 (0.15463) [-2.05010]	-0.136928 (0.12504) [-1.09509]	-0.380162 (0.15992) [-2.37721]	0.421174 (0.21429) [1.96540]
D(LDEC(-1))	0.024303 (0.03589) [0.67720]	-0.196857 (0.04920) [-4.00111]	3.886109 (1.59670) [2.43384]	-0.323921 (0.23525) [-1.37695]	-0.008500 (0.19022) [-0.04469]	-0.720520 (0.24328) [-2.96164]	-0.425430 (0.32601) [-1.30498]
D(LEMO(-1))	0.010797 (0.01545) [0.69868]	-0.017842 (0.02119) [-0.84211]	0.375014 (0.68758) [0.54541]	0.087029 (0.10130) [0.85910]	-0.072407 (0.08191) [-0.88396]	-0.026883 (0.10476) [-0.25660]	-0.323613 (0.14039) [-2.30516]
C	0.008368 (0.00201) [4.16815]	0.005196 (0.00275) [1.88799]	-0.028106 (0.08932) [-0.31467]	0.012654 (0.01316) [0.96158]	0.022936 (0.01064) [2.15546]	0.045914 (0.01361) [3.37368]	0.049877 (0.01824) [2.73493]

Figure 4: Comparing dynamic and static forecasts based on VECM Estimation



Again, superiority of static forecast to dynamic forecast is proven by looking at Figure 4. The last two method we are going to investigate are ARIMA and ETS Smoothing models which are non-structural and non-cointegration based models that are specially designed for the purpose of forecasting. This kind of model does not rely on any structural functions or specifications. In another words, we aim at comparing the forecasting performance of co-

integration based technique with another forecasting technique which do not impose co-integration restrictions (ARIMA and ETS Smoothing). Since the purpose of this study is mainly to forecast future movements of the money demand, we examine and compare the forecasting technique that rely on a structural relationship between money and other real variables (DOLS, FMOLS, ARDL and VECM) with that of a model that does not (ARIMA). Therefore, we first proceed to Automatic ARIMA forecasting.

Table 13: Estimation method: ARMA Maximum Likelihood (BFGS)

Variable	Coefficient	Std. Error	!-Statistic	Prob.
c	0.197935	0.259290	0.763374	0.4508
LGDP	-0.084927	0.058439	-1.453246	0.1559
RIR	0.005972	0.002236	2.670612	0.0118
LCRC	0.073017	0.018964	3.850179	0.0005
LCHC	0.014008	0.023907	0.585939	0.5620
LDEC	0.002893	0.011127	0.259959	0.7966
LEMO	-0.023436	0.024089	-0.972908	0.3379
AR(1)	0.337635	0.527763	0.639748	0.5269
AR(2)	0.904038	0.418247	2.161496	0.0382
AR(3)	-0.213961	0.247987	-0.862794	0.3947
AR(4)	-0.441341	0.171205	-2.577857	0.0148
MA(1)	-1.148590	1242.783	-0.000924	0.9993
MA(2)	-0.682495	785.6358	-0.000869	0.9993
MA(3)	0.844255	2044.015	0.000413	0.9997
SIGMASQ	2.29E-05	0.011784	0.001944	0.9985

R-squared	0.658893	Mean dependent var	0.006906
Adjusted R-squared	0.509659	S.D.dependent var	0.008283
S.E. of regression	0.005800	Akaike info criterion	-7.030522
Sum squared resid	0.001076	Schwarz criterion	-6.440050
Log likelihood	180.2173	Hannan-Quinn criter.	-6.808324
F-statistic	4.415156	Durbin-Watson stat	1.979995
Prob(F-statistic)	0.000249		
Inverted AR Roots	.84+.34i	.84-.34i -.67+.28i	-.67-.28i
Inverted MA Roots	1.00+.08i	1.00-.08i -.84	

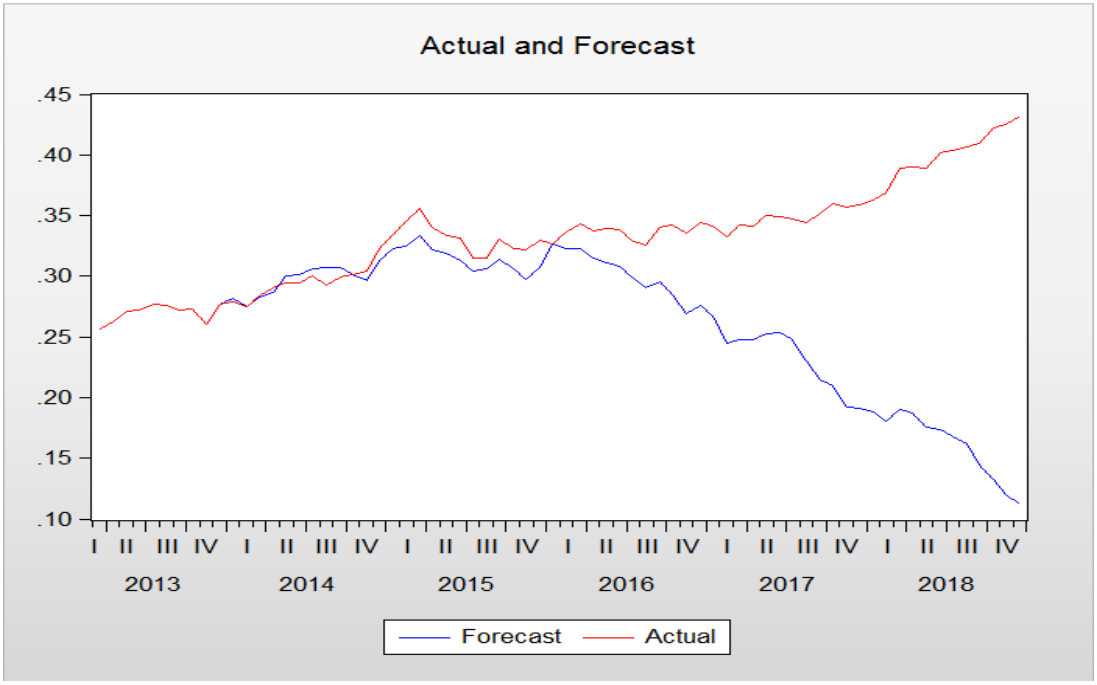
These estimates are based on a model that has the lowest AIC value which is ARDL (4,3)(0,0). In another words, an ARIMA model consisting of an autoregressive model of order 4 and a moving average model of order 3 provides the minimum AIC and therefore is chosen as the best ARIMA model.

Table 14: Model selection criteria table

Model	Logl	A1C*	BIC	HQ
(4,3)(0,0)	180.217278	-6.884053	-6.299303	-6.663075
(0,3)(0,0)	175.710100	-6.862921	-6.434104	-6.700870
(2,1)(0,0)	175.376312	-6.849013	-6.420196	-6.686962
(4,4)(0,0)	180.245767	-6.843574	-6.219840	-6.607864
(0,4)(0,0)	175.925835	-6.830243	-6.362443	-6.653461
(1,3)(0,0)	175.878002	-6.828250	-6.360450	-6.651468
(3,1)(0,0)	175.606033	-6.816918	-6.349118	-6.640136
(1,4)(0,0)	176.554772	-6.814782	-6.307999	-6.623268
(1,0)(0,0)	172.455835	-6.810660	-6.459810	-6.678073
(0,1)(0,0)	172.370306	-6.807096	-6.456246	-6.674509
(4,2)(0,0)	177.356625	-6.806526	-6.260759	-6.600280
(2,3)(0,0)	176.135487	-6.797312	-6.290528	-6.605798
(3,3)(0,0)	176.917228	-6.788218	-6.242451	-6.581972
(3,2)(0,0)	175.873895	-6.786412	-6.279629	-6.594898
(2,2)(0,0)	174.679236	-6.778302	-6.310501	-6.601519
(2,4)(0,0)	176.610278	-6.775428	-6.229661	-6.569182
(2,0)(0,0)	172.514331	-6.771430	-6.381597	-6.624112
(1,1)(0,0)	172.513491	-6.771395	-6.381562	-6.624077
(0,2)(0,0)	172.413293	-6.767221	-6.377387	-6.619902
(3,4)(0,0)	177.120998	-6.755042	-6.170291	-6.534064
(4,0)(0,0)	173.663002	-6.735958	-6.268158	-6.559176
(3,0)(0,0)	172.530423	-6.730434	-6.301617	-6.568384
(1,2)(0,0)	172.518080	-6.729920	-6.301103	-6.567869
(4,1)(0,0)	174.035300	-6.709804	-6.203021	-6.518290
(0,0)(0,0)	168.854722	-6.702280	-6.390413	-6.584425

25 ARIMA models have been estimated. A model with the lowest AIC value (-6.8840) has been selected as the best one, that is, ARIMA(4,3)(0,0). This one will be used for forecasting.

Figure 5: Comparing forecasts values and actual values based on ARIMA estimation



According to Figure 5, beginning with 2016, the gap between actual and forecasted values becomes unusually wide while it was quiet narrow during 2014-2015. We can probably conclude that ARIMA model is fairly good for a short time horizon (1 year, 2 at most) but its forecasting performance gets deteriorated by longer time horizon.

It is time to do forecasting in the context of ETS exponential smoothing. Exponential smoothing is a rule of thumb technique for smoothing time series data using the exponential window function. Exponential smoothing is a time series forecasting method for univariate data that can be extended to support data with a systematic trend or seasonal component. It is

a powerful forecasting method that may be used as an alternative to the popular Box-Jenkins ARIMA family of methods.

Table 15: Model selection

Parameters	
Alpha:	0.851646
Beta:	0.000000
Phi:	0.980836
Initial Parameters	
Initial level:	-0.058142
Initial trend:	0.010834
Compact Log-likelihood	140.1318
Log-likelihood	164.9316
Akaike Information Criterion	-270.2637
Schwarz Criterion	-260.9077
Hannan-Quinn Criterion	-266.7280
Sum of Squared Residuals	0.002912
Root Mean Squared Error	0.007789
Average Mean Squared Error	0.000105

Model: A,AD,N - Additive Error, Additive-Dampened Trend, No Season (Auto E=', T= ', S='). Model selection:Akaike Information Criterion. Convergence achieved after 1 iteration.

We see that we have estimated an (A, AD, N) model using data from 2010M1 to 2013M12, and that the estimator converged, but with some parameters at boundary values. The next section of the table shows the smoothing parameters (α, β, φ) and initial parameters. Note the presence of the boundary zero values for β which indicate that the trend components do not change from their initial values.

Hyperparameters are: Alpha: Smoothing factor for the level, Beta: Smoothing factor for the trend, Trend Type: Additive or multiplicative, Dampen Type: Additive or multiplicative and Phi: Damping coefficient.

The top portion of the output, shows that the Akaike information criterion selected ETS model is an (M, N, M) specification, with level smoothing parameter estimate $\hat{\alpha}$ = 0.85, and the trend parameter $\hat{\beta}$ = 0 estimated on the boundary.

The bottom portion of the table output contains summary statistics for the estimation procedure. Most of these statistics are self-explanatory. The reported "Compact Log-likelihood" is simply the log-likelihood value absent inessential constants, and is provided to facilitate comparison with results obtained from other sources. The spool contains a multiple graph containing the actual and forecasted values of HS over the estimation and forecast period, along with the decomposition of the series into the level and trend components.

Figure 6: The structure of decomposing money demand into level and trend

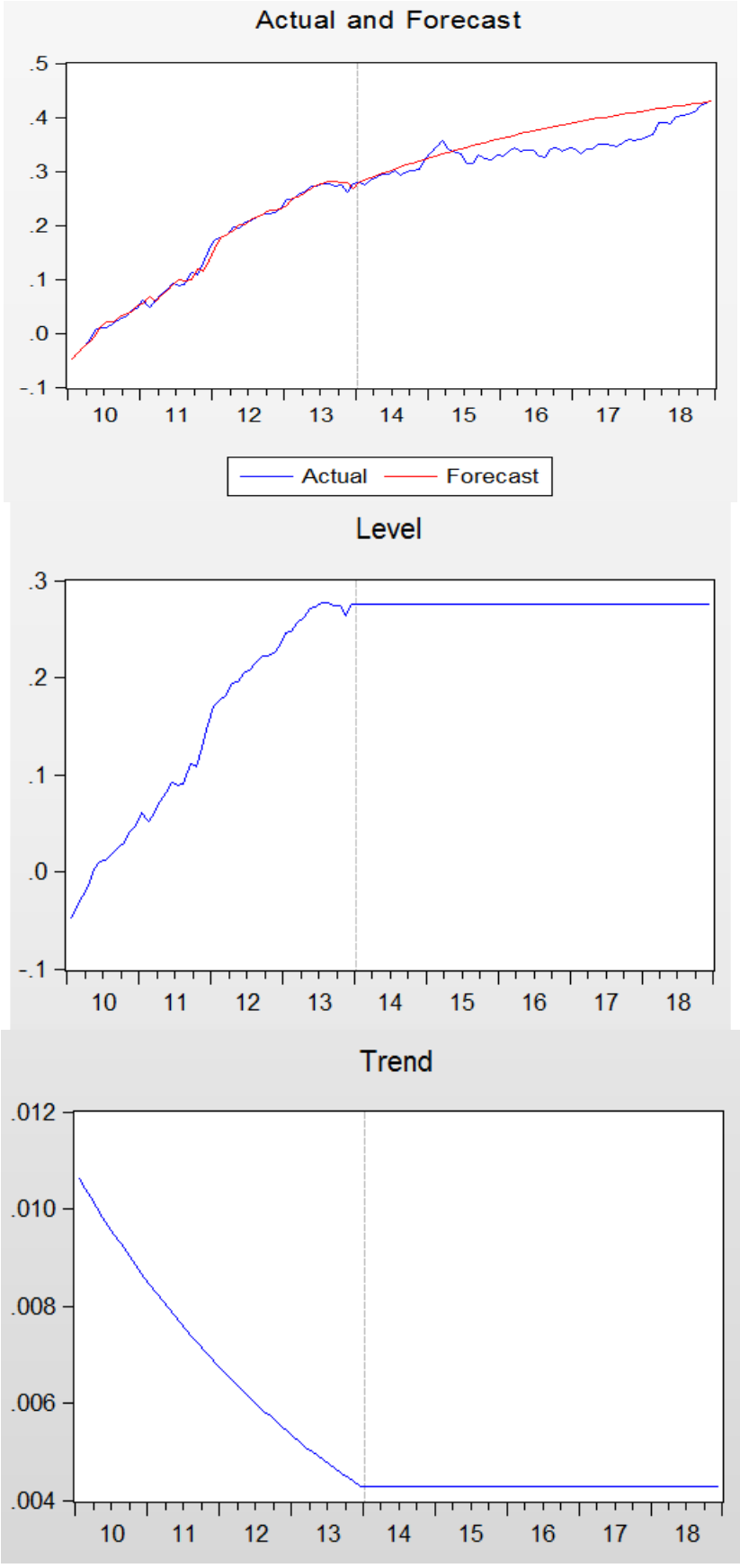


Figure 6 shows the structure of decomposing money demand (in logarithm form) into level and trend (there is no seasonality in this decomposition) and how to automatically split it into its components. These components are defined as follows: 1) Level: The average value in the

money demand series, 2) Trend: The increasing or decreasing value in the money demand series, and 3) Seasonality: The repeating short-term cycle in the money demand series.

Decomposition provides a structured way of how to best capture each of these components in a given model. Automatic decomposition (as we used to decompose money demand in our analysis) requires that we need to specify whether the model is additive or multiplicative. This is to be decided according to Table 16 which is A, AD, N (Additive Error, Additive-Dampened Trend, No Season).

Additive decomposition is to create a time series (money demand) comprised of a linearly increasing trend and some random noise and decompose it as an additive model. This is so called Additive decomposition. Multiplicative decomposition is to arrange a quadratic time series (here, money demand) as a square of the time step and then decompose it assuming a multiplicative model.

An additive model is a model that the components are added together:

y(t) = Level + Trend + Seasonality

A multiplicative model is a model that the components are multiplied together:

y(t) = Level * Trend * Seasonality

Our chosen ETS display settings produced both the likelihood table which contains the actual likelihood and Akaike values for each specification, and the forecast comparison table, which presents a subset of the values displayed in the graph.

Table 16: LL-based comparison table

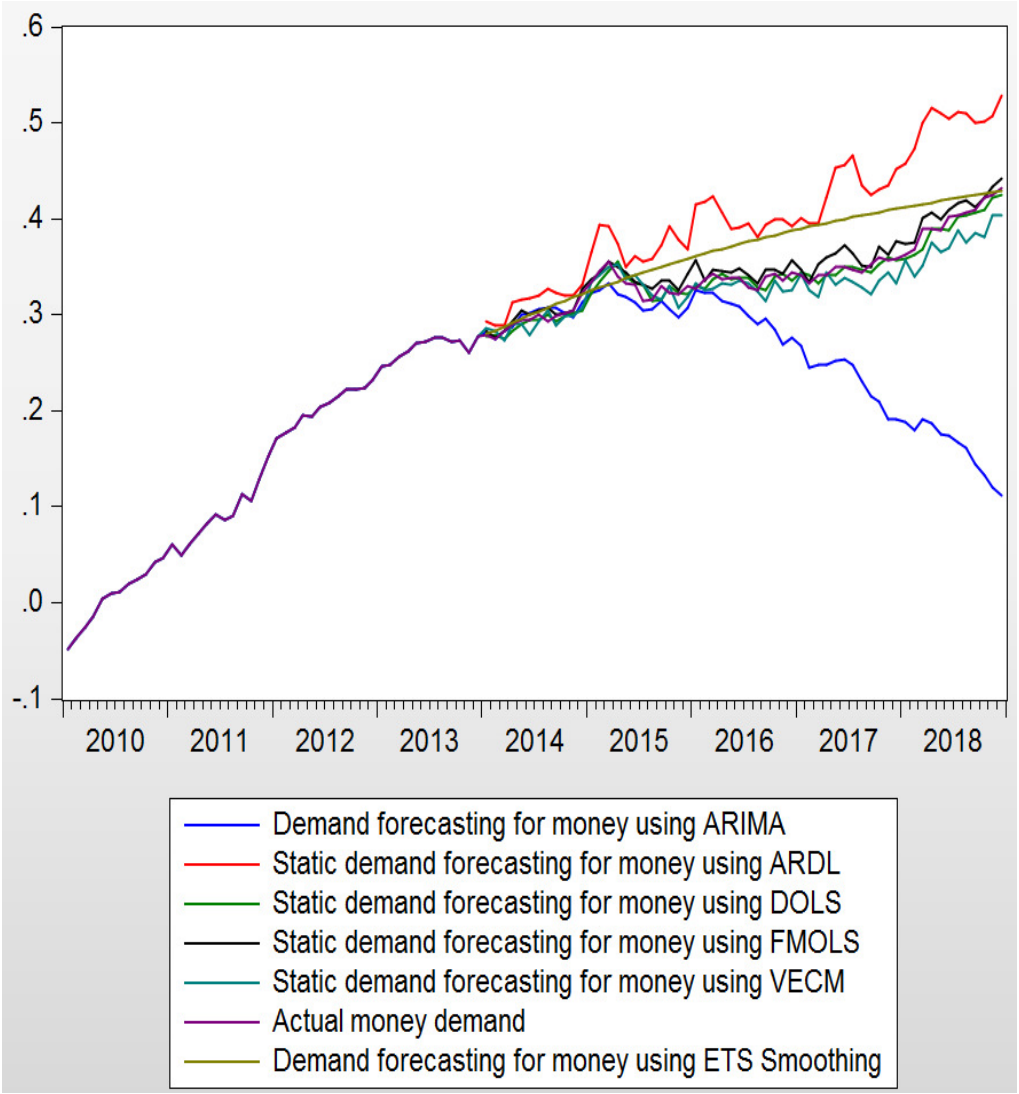
Model	Compact	Likelihood	A1C*	BIC	HQ	AMSE
A,AD,N	140.132	164.932	-270.264	-260.908	-266.728	0.00010
A,A,N	138.044	162.844	-268.089	-260.604	-265.260	0.00013
A,AD,A	150.252	175.052	-266.504	-234.694	-254.483	1.E+100
A,A,A	148.857	173.657	-265.714	-235.775	-254.400	0.00011
A,N,N	125.326	150.126	-246.652	-242 .910	-245.238	0.00033
A,N,A	129.762	154.561	-231.523	-205.326	-221.623	0.00029
M,A,A*	98.8532	123.653	-165.706	-135.767	-154.392	0.00032
M,AD,A	98.9392	123.739	-163.878	-132.068	-151.857	0.00029
M,A,N	85.7370	110.537	-163.474	-155.989	-160.645	0.00015
M,AD,N	85.8037	110.603	-161.607	-152.251	-158.072	0.00016
M,N,N	47.1637	71.9634	-90.3273	-86.5849	-88.9131	0.00047
M,N,A*	51.6077	76.4075	-75.2154	-49.0185	-65.3155	0.00169

2 models fail to converge. Model: M, AD, M – Multiplicative Error, Additive-Dampened Trend, Multiplicative Season (Auto E=, S=*). Model selection: Akaike Information Criterion

According to Table 16, 12 ETS smoothing models have been estimated. A model with the lowest AIC value (-270.264) has been selected as the best one, that is, A,AD,N.

Now, it is time to compare the static forecasts obtained from all of the model estimates along with forecasts from ARIMA and ETS Smoothing to determine which model provides the most accurate forecast among these estimators.

Figure 7: Comparing forecasts using different estimation methods



The models from strongest to weakest predictive powers are: 1) DOLS, 2) FMOLS, 3) VECM, 4) ETS Smoothing, 5) ARDL and 6) ARIMA. Therefore, we proceed to estimate the model including payment instruments using the model that provides the most accurate forecast which is DOLS. Then, we will obtain out-of-sample static forecast (as a superior forecast to dynamic forecast) for the period 2019M1-2023M12.

Table 17: DOLS estimation using selected model for ETS smoothing

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LMOD(-1)	1.000000	3.37E-14	2.97E+13	0.0000
LGDP	1.76E-13	3.09E-14	5.685733	0.0000
RIR	-5.04E-15	2.46E-15	-2.050229	0.0437
LCRC	-3.65E-13	6.59E-14	-5.533128	0.0000
LCHC	-1.70E-14	2.60E-14	-0.653064	0.5157
LDEC	-1.55E-14	1.25E-14	-1.240550	0.2185
LEMO	5.05E-14	1.48E-14	3.414925	0.0010
R-squared	1.000000	Mean dependent var		0.261371
Adjusted R-squared	1.000000	S.D.dependent var		0.116142
S.E. of regression	5.67E-15	Sum squared resid		2.48E-27
Long-run variance	7.33E-29			

Figure 8: Actual money demand and static demand forecasting using DOLS for the period 2019M1-2023M12

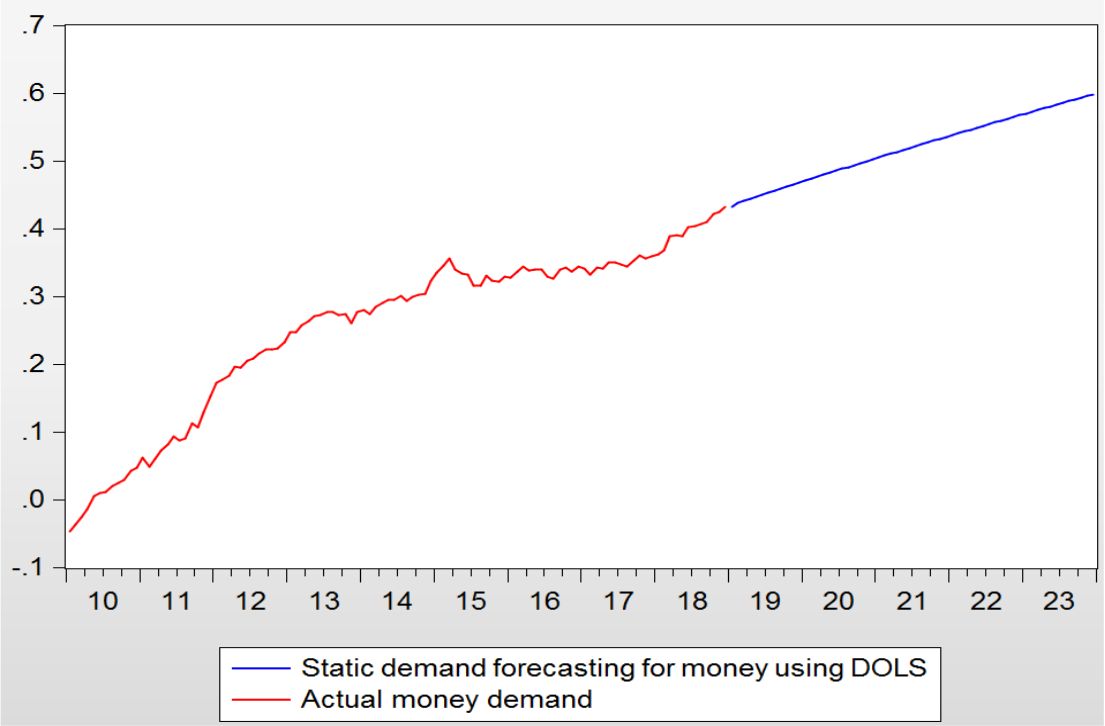


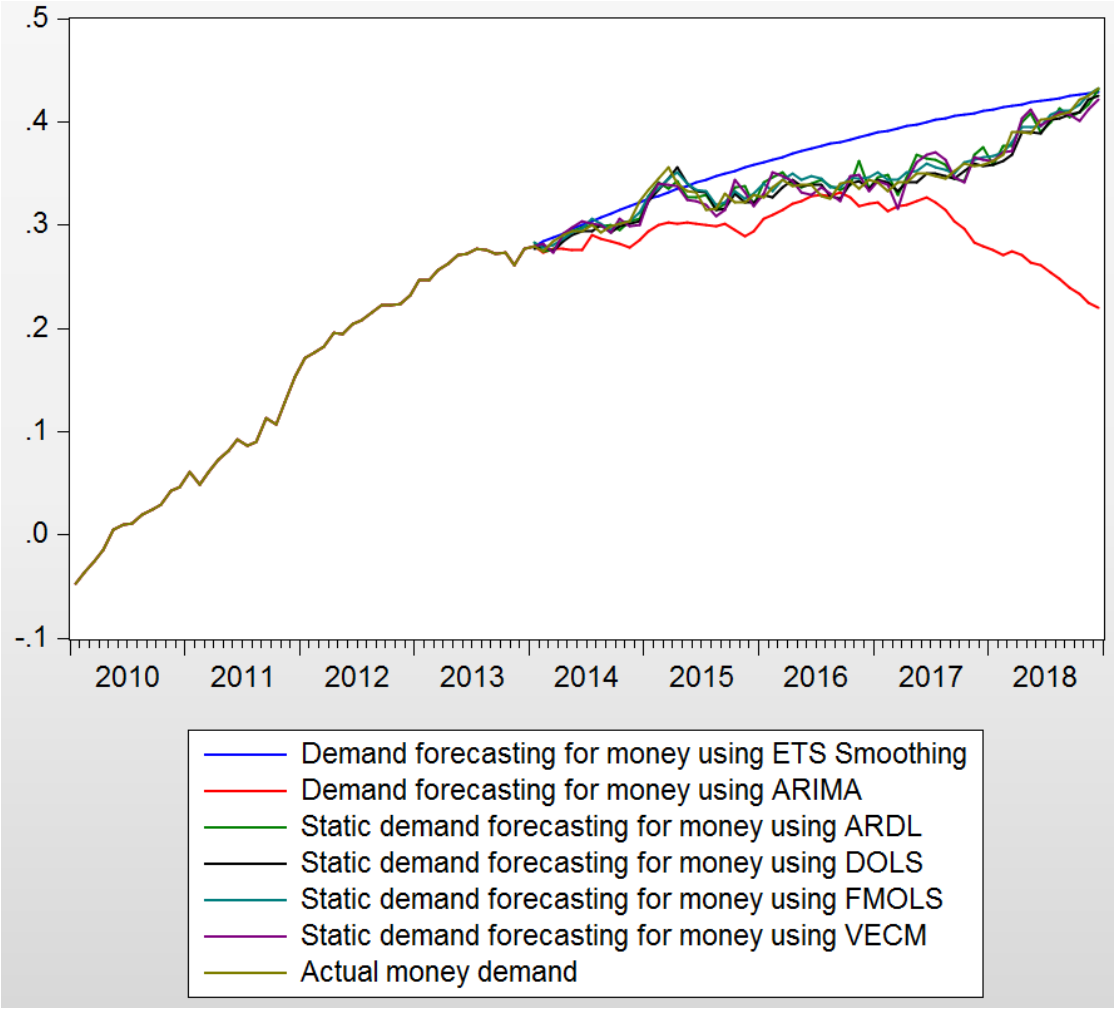
Figure 8 provides the final step in forecasting analysis for the models including payment instruments. The red line in this figure is the actual value of money demand up to 2018M12. After this point, static forecast will be done using the best fitted model for forecasting (DOLS method). It shows that money demand (in logarithm form) continues to growth at a steady rate during the forecast period.

4.2. Payment Systems (PS)

Now, we repeat the same process for model that include payment instruments. Payment instruments include: RENTAS (REN), Interbank GIRO (IBG) and FPX & Direct Debit (FDD)

Again, for all of the model estimates, static forecasts are superior to dynamic forecasts. In order to be compendious, we avoid repeating the same process for the models that include payment systems. We only confine ourselves to the final graphs and tables showing the comparison of static forecasts for all of the models and doing out-of sample forecast based on the chosen model which provides the most accurate forecast.

Figure 9: Comparing static forecasts using different estimation methods



According to Figure 9, DOLS, FMOLS, VECM, and ARDL are almost the same as to predictive power and they can be considered equally powerful for forecasting. Fifth best model is ETS Smoothing followed by ARIMA as the worth model for forecasting. Table 24 offers another way of looking at this comparison between DOLS, FMOLS and ARDL using different forecasting measures and RMSE as the most important of all and the benchmark to decide on the best model.

Table 24: Forecast measures based on static forecast using different methods

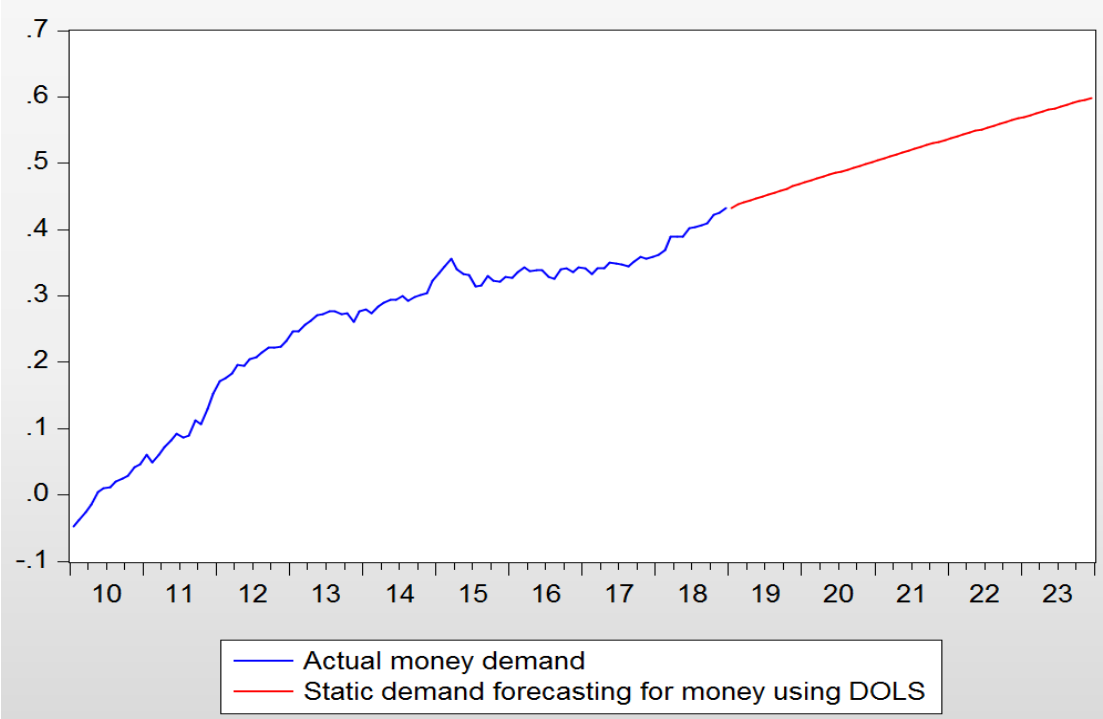
Forecast Measures/Methods	DOLS	FMOLS	ARDL
RMSE	0.0080	0.0216	0.0358
MAE	0.0063	0.0195	0.0307
MAPE	1.8611	5.6564	9.0115
TIC	0.0117	0.0305	0.0498
BP	0.1036	0.8062	0.7361
VP	0.0154	0.0487	0.0236
CP	0.8809	0.1449	0.2402
TUC	1.0000	2.5961	4.3840
SM	1.8732	5.4700	8.4999

This table confirms the fact that DOLS is marginally superior to other methods so as before, we obtain forecast for out-of-sample period using the estimates from DOLS.

Table 25: DOLS estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LMOD(-1)	1.000000	4.32E-14	2.32E+13	0.0000
LGDP	2.87E-13	5.56E-14	5.160729	0.0000
RIR	4.76E-15	4.36E-15	1.092145	0.2780
LREN	-1.57E-13	3.15E-14	-5.005287	0.0000
LIBG	3.55E-15	1.75E-14	0.202947	0.8397
LFDD	-4.51E-14	1.53E-14	-2.944816	0.0042
R-squared	1.000000	Mean dependent var		0.261371
Adjusted R-squared	1.000000	S.D.dependent var		0.116142
S.E. of regression	9.31E-15	Sum squared resid		7.02E-27
Long-run variance	2.63E-28			

Figure 10: Actual money demand and static demand forecasting using DOLS for the period 2019M1-2023M12



4.3. Payment Channels (PC)

Now, we repeat the same process for model that include payment instruments. Payment instruments include: Automated Teller Machines (ATM) and Mobile Banking (MOB).

Figure 11: Comparing static forecasts using different estimation methods

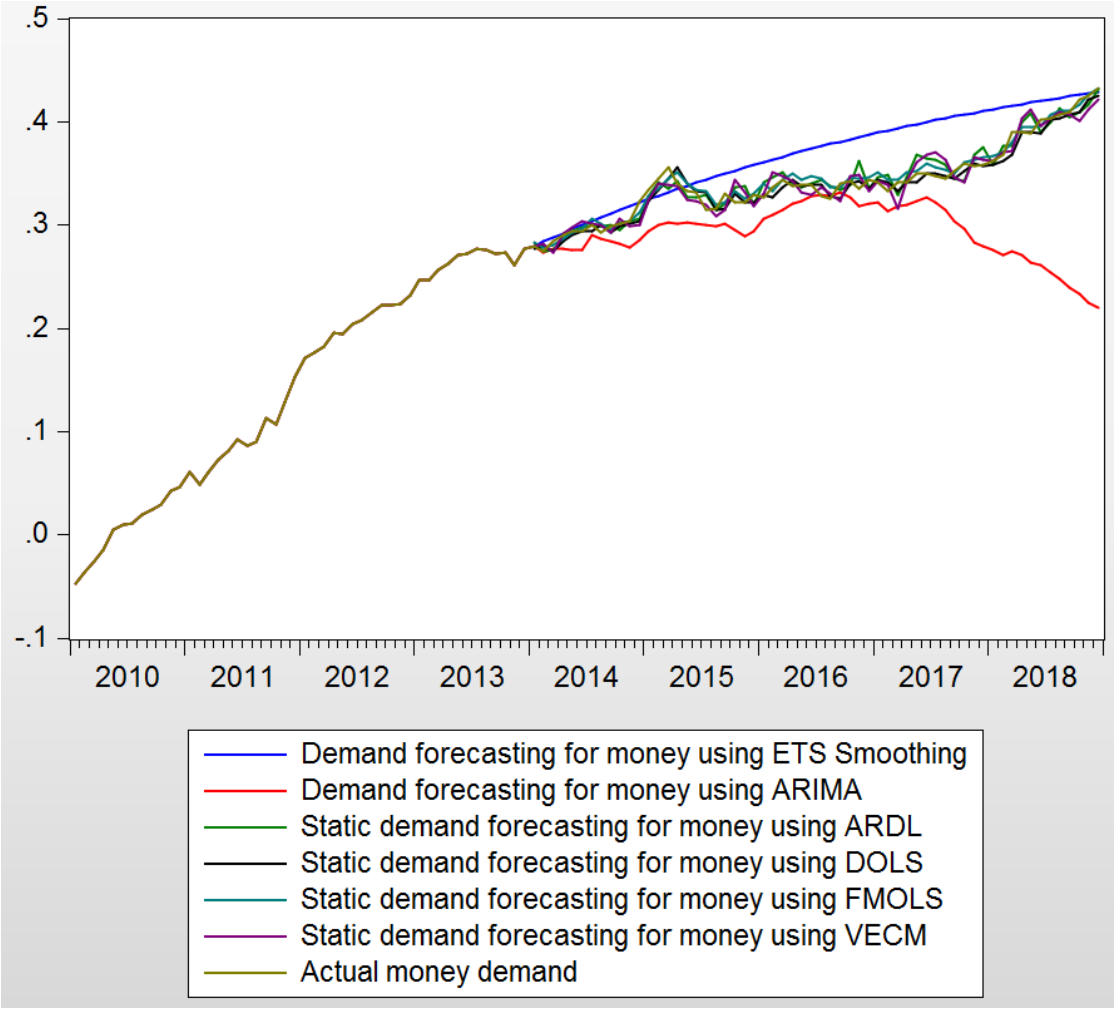


Figure 11 indicates that forecasts from FMOLS, DOLS, VECM and ARDL are all closely following the actual values of the dependent variable (money demand). ETS Smoothing and ARIMA provides the fifths and sixth best models to forecast money demand for the period 2019M1-2023M12.

Table 32: Forecast measures based on static forecast using different methods

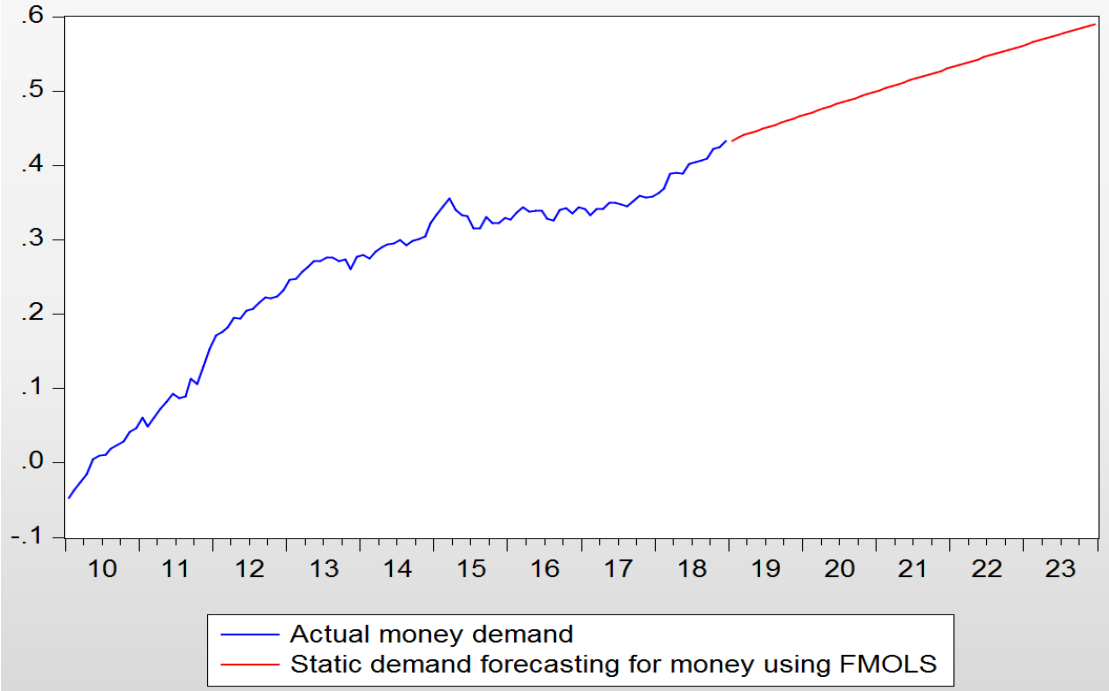
Forecast Measures/Methods	DOLS	FMOLS	ARDL
RMSE	0.0080	0.0073	0.0106
MAE	0.0063	0.0059	0.0088
MAPE	1.8611	1.7791	2.5658
TIC	0.0117	0.0105	0.0154
BP	0.1036	0.1773	0.0228
VP	0.0154	0.0010	0.0009
CP	0.8809	0.8215	0.9762
TUC	1.0000	0.9024	1.2978
SM	1.8732	1.7674	2.5509

Table 32 provides a closer and more precise way of comparing the predictive powers of the 3 models (DOLS, FMOLS and ARDL). According to this table, FMOLS has the best forecasting performance among these three models and definitely among all the estimated models. Therefore, we proceed further to do forecast based on the estimation of FMOLS model.

Table 33: FMOLS estimation using selected model for ETS smoothing

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LMOD(-1)	0.911081	0.032921	27.67491	0.0000
LGDP	-0.005210	0.006278	-0.829929	0.4085
RIR	0.003240	0.000769	4.215760	0.0001
LATM	0.012916	0.007779	1.660327	0.1000
LMOB	0.003976	0.001963	2.026104	0.0454
R-squared	0.996871	Mean dependent var		0.258662
Adjusted R-squared	0.996747	S.D.dependent var		0.118904
S.E. of regression	0.006782	Sum squared resid		0.004645
Long-run variance	3.63E-05			

Figure 12: Actual money demand and static demand forecasting using FMOLS for the period 2019M1-2023M12



4.4. Overall Conclusion

So far, the results indicate that DOLS method has the most predictive power when it includes PI and PS for 5-years forecasting ahead (2019M1-2023M12). However, its forecasting power is closely followed by FMOLS as the second best forecasting ability. When the model includes PC, FMOLS has the best forecasting performance.

We repeat the same process to do out-of-sample forecast for 1 year (12 months) ahead which is 2019. In this case, FMOLS proves to be superior as to forecasting accuracy when the model includes PI and PC. For the model including PS, it is ARDL that provides the most accurate forecast. Again, it is closely followed by FMOLS. Overall, we recognize FMOLS as the best estimator for forecasting purpose either in short horizon (1 year) or long horizon (5 years).

Table 34: Overall assessment

FI/TH	1-YEAR	5-YEAR
PI	FMOLS	DOLS/FMOLS
PS	ARDL/FMOLS	DOLS/FMOLS
PC	FMOLS	FMOLS

According to the final results provided in Table 34, we conclude that FMOLS can be selected as the best model for either short time or long time horizon out-of-sample forecasting

with minor consideration. Regarding this fact, we will estimate FMOLS model with the inclusion of financial variables (PI, PS and PC) and conduct test of serial correlation to rest assured that the estimated models are free from statistical issues.

4.5. Effects of financial innovation on the demand for money in the context of FMOLS model

Table 35: FMOLS estimation for model including PI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LMOD(-1)	0.962852	0.014244	67.59780	0.0000
LGDP	-0.026839	0.004416	-6.077318	0.0000
RIR	0.004205	0.000618	6.803918	0.0000
LCRC	0.057116	0.008673	6.585661	0.0000
LCHC	0.004518	0.007350	0.614639	0.5402
LDEC	0.001361	0.005248	0.259349	0.7959
LEMO	-0.006367	0.006207	-1.025715	0.3075
R-squared	0.997219	Mean dependent var		0.258662
Adjusted R-squared	0.997050	S.D. dependent var		0.118904
S.E. of regression	0.006458	Sum squared resid		0.004129
Long-run variance	2.53E-05			

Note: Fixed leads and lags specification (lead=1, lag=1). Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth. Endogeneity is being taken care of by adding the leads and lags. Since the omitted dynamics are captured by the residual in OLS estimation, serial correlation, heteroskedasticity is inheriting in this estimation while DOLS and FMOLS address these issues using a nonparametric approach.

Table 36: Test of serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.110	-0.110	1.3134	0.252
		2	-0.019	-0.031	1.3526	0.509
		3	0.060	0.055	1.7493	0.626
		4	-0.132	-0.121	3.6956	0.449
		5	0.069	0.046	4.2362	0.516
		6	-0.036	-0.034	4.3834	0.625
		7	0.106	0.119	5.6832	0.577
		8	-0.018	-0.021	5.7207	0.678
		9	0.010	0.033	5.7336	0.766
		10	-0.091	-0.118	6.7264	0.751
		11	0.004	0.023	6.7281	0.821
		12	0.218	0.203	12.530	0.404
		13	0.012	0.086	12.548	0.483
		14	-0.097	-0.135	13.709	0.472
		15	-0.095	-0.142	14.844	0.463
		16	0.009	0.023	14.853	0.535
		17	0.071	0.131	15.502	0.559
		18	0.047	0.070	15.785	0.608
		19	-0.070	-0.159	16.437	0.628
		20	0.125	0.075	18.515	0.554
		21	-0.031	0.043	18.648	0.608
		22	-0.091	0.019	19.780	0.597
		23	0.094	0.033	20.996	0.581
		24	0.074	0.033	21.766	0.593
		25	0.071	0.030	22.474	0.608
		26	-0.147	-0.087	25.566	0.487
		27	-0.018	0.020	25.615	0.540
		28	-0.020	-0.021	25.676	0.591
		29	-0.076	-0.147	26.534	0.597
		30	0.000	-0.104	26.534	0.648
		31	-0.053	0.010	26.962	0.674
		32	-0.027	-0.059	27.078	0.714
		33	-0.039	-0.064	27.317	0.746
		34	0.001	0.008	27.317	0.785
		35	-0.016	0.005	27.357	0.818
		36	0.077	0.041	28.337	0.815

Table 37: FMOLS estimation for model including PS

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob.**
LMOD(-1)	0.977759	0.013501	72.42025	0.0000
LGDP	-0 031158	0.010724	-2.905457	0.0045
RIR	0.003885	0.000718	5.411615	0.0000
LREN	0.019625	0.006053	3.242091	0.0016
LIBG	-0 007782	0.005006	-1.554453	0.1232
LFDD	0.009591	0.003688	2.600957	0.0107
R-squared	0.996727	Mean dependent var		0.258662
Adjusted R-squared	0.996563	S.D. dependent var		0.118904
S.E. of regression	0.006971	Sum squared resid		0.004859
Long-run variance	3.42E-05			

Table 38: Test of serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.028	-0.028	0.0829	0.773
		2	-0.007	-0.008	0.0887	0.957
		3	0.192	0.192	4.1984	0.241
		4	-0.152	-0.148	6.8064	0.146
		5	-0.089	-0.097	7.7094	0.173
		6	-0.109	-0.158	9.0676	0.170
		7	-0.098	-0.050	10.176	0.179
		8	-0.031	-0.023	10.290	0.245
		9	0.040	0.069	10.477	0.313
		10	-0.087	-0.112	11.375	0.329
		11	-0.002	-0.046	11.375	0.412
		12	0.253	0.212	19.195	0.084
		13	0.056	0.115	19.581	0.106
		14	-0.100	-0.138	20.830	0.106
		15	0.049	-0.083	21.132	0.133
		16	-0.070	-0.065	21.761	0.151
		17	-0.092	0.006	22.855	0.154
		18	0.001	0.050	22.855	0.196
		19	-0.103	-0.059	24.241	0.187
		20	0.101	0.076	25.611	0.179
		21	0.047	-0.002	25.903	0.210
		22	-0.009	0.056	25.913	0.255
		23	0.095	0.061	27.165	0.249
		24	0.123	0.065	29.282	0.210
		25	0.067	0.028	29.908	0.228
		26	-0.057	-0.033	30.373	0.252
		27	-0.027	-0.031	30.474	0.293
		28	-0.047	-0.002	30.800	0.326
		29	-0.196	-0.148	36.525	0.159
		30	-0.020	0.014	36.587	0.189
		31	-0.095	-0.059	37.955	0.182
		32	-0.041	-0.034	38.218	0.208
		33	0.076	-0.015	39.118	0.214
		34	-0.038	-0.013	39.343	0.243
		35	0.029	-0.041	39.477	0.277
		36	0.142	0.061	42.770	0.203

Table 39: FMOLS estimation for model including PC

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob.**
LMOD(-1)	0.911081	0.032921	27.67491	0.0000
LGDP	-0.005210	0.006278	-0.829929	0.4085
RIR	0.003240	0.000769	4.215760	0.0001
LATM	0.012916	0.007779	1.660327	0.1000
LMOB	0.003976	0.001963	2.026104	0.0454
R-squared	0.996871	Mean dependent var		0.258662
Adjusted R-squared	0.996747	S.D.dependent var		0.118904
S.E. of regression	0.006782	Sum squared resid		0.004645
Long-run variance	3.63E-05			

Table 40: Test of serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.049	-0.049	0.2636	0.608
		2	0.036	0.033	0.4044	0.817
		3	0.219	0.223	5.7110	0.127
		4	-0.124	-0.108	7.4271	0.115
		5	-0.027	-0.059	7.5116	0.185
		6	0.020	-0.021	7.5593	0.272
		7	-0.052	0.003	7.8742	0.344
		8	0.035	0.042	8.0208	0.431
		9	0.110	0.113	9.4465	0.397
		10	-0.064	-0.055	9.9276	0.447
		11	0.025	-0.016	10.001	0.530
		12	0.262	0.248	18.391	0.104
		13	0.037	0.123	18.561	0.137
		14	-0.077	-0.128	19.300	0.154
		15	0.048	-0.095	19.593	0.188
		16	-0.075	-0.039	20.318	0.206
		17	-0.080	-0.010	21.141	0.220
		18	0.021	0.026	21.198	0.270
		19	-0.125	-0.103	23.268	0.226
		20	0.081	0.044	24.149	0.236
		21	0.040	-0.008	24.363	0.276
		22	-0.058	0.016	24.819	0.306
		23	0.050	0.017	25.161	0.342
		24	0.071	0.003	25.867	0.360
		25	0.013	-0.000	25.889	0.414
		26	-0.110	-0.105	27.630	0.377
		27	-0.055	-0.064	28.063	0.408
		28	-0.064	-0.021	28.669	0.429
		29	-0.172	-0.133	33.045	0.276
		30	-0.039	-0.047	33.273	0.311
		31	-0.118	-0.080	35.381	0.269
		32	-0.038	-0.039	35.600	0.303
		33	0.035	-0.018	35.789	0.339
		34	-0.076	-0.024	36.709	0.344
		35	-0.000	-0.011	36.709	0.390
		36	0.107	0.072	38.589	0.353

Table 41: Estimated coefficients of the model with the inclusion of financial variables in three different aspects using selected estimator (FMOLS)

Model	**PI**	**PS**	**PC**
Variable	**Coefficient (Prob.)**	**Coefficient (Prob.)**	**Coefficient (Prob.)**
LMOD(-1)	0.962852 (0.0000)	0.977759 (0.0000)	0.911081 (0.0000)
LGDP	-0.026839 (0.0000)	-0.031158 (0.0045)	-0.005210 (0.4085)
RIR	0.004205 (0.0000)	0.003885 (0.0000)	0.003240 (0.0001)
LCRC	0.057116 (0.0000)		
LCHC	0.004518 (0.0000)		
LDEC	0.001361 (0.5402)		
LEMO	-0.006367 (0.3075)		
LREN		0.019625 (0.0016)	
LIBG		-0.007782 (0.1232)	
LFDD		0.009591 (0.0107)	
LATM			0.012916 (0.1000)
LMOB			0.003976 (0.0454)

For the model including PI: CRC and CHC have positive and significant impact on money demand, yet the impact is small.

For the model including PS: REN and FDD have positive and significant impact on money demand, yet the impact is small.

For the model including PC: ATM and MOB have positive and significant impact on money demand, yet the impact is small.

5. Conclusion

Here, we used cointegration/structural based techniques (ARDL/VECM/DOLS/FMOLS) to investigate the effect of financial innovation on the demand for money. Non-stationary time series data may provide spurious regression analysis. That is why co-integration based techniques are so popular. Cointegration (also referred to as a long-run equilibrium relationship) provides a solution to this problem by transforming the linear combination of non-stationary time series into a stationary one. However, the models of this kind need a convenient framework (structural function based on economic theory) for estimation, testing and forecasting.

Appropriateness of model specification and lagged data availability for variables is considered an issue in a structural specification. Therefore, ARMA and ETS Smoothing models are considered as a good alternative to structural based models for the purpose of forecasting money demand for short term horizon.

First, we compared static and dynamic forecasts for each model consisting payment instruments. The results indicated that for all of the structural based models, static forecast is superior to dynamic forecast. Therefore, dynamic forecasts were ruled out and the comparison were made among static forecasts obtained from the models. Second, we compared the forecasting accuracy of dynamic forecasts of different models. All of the forecasts were done in short-time dimension (1-year or 12-months) and long-time dimension (5-years or 60 months) to determine how forecasting performances varies over time. While DOLS proved to be the best model for 5-years forecasting, FMOLS turned out to be the best for 1-year forecasting. We did the same analysis to determine the best model with regards to forecasting when they include payment systems and payment channels as financial variables. The overall result indicates that FMOLS is the model with the most predictive power for both short and long terms (with minor consideration). Then, this chosen model was used for out of sample forecasting (again for 1-year and 5 years-time horizons). Finally, we obtained and compared the estimated coefficients of the financial variables with the conclusion that those financial variable whose coefficients are significant, have positive yet small impact on money demand in Malaysia.

It seems from comparison graphs that cointegration/structural based models (DOLS, FMOLS, ARDL and VECM) do better in forecasting as compared to non-cointegration/structural based models (ARMA and Exponential Smoothing). However, the forecasting performance of these models are fairly good and comparable with structural based models but it gets deteriorated as we approach the end of the forecasting period meaning that non-structural based models do more accurate forecasting for a short time dimension than they does for long time dimension. Another fact is that while FMOLS has the most predictive power among cointegration/structural based models, Exponential Smoothing proves better than ARIMA for forecasting purpose.

This because, restrictions on the low-frequency dynamic behavior of multivariate time series as implied by cointgration, will produce superior long-horizon forecasts. Cointegraton enhances the accuracy of long-horizon forecasts relative to those from systems estimated in levels provided the univariate representations of all variables contain unit roots.

The Auto-Regressive Integrated Moving Average (ARIMA) technique developed by Box and Jenkins (1970) are independent of any particular economic theory and generates forecasts that are based purely on the past behaviour of money demand (in our case). In order to apply this technique, time series (money demand) should be stationary (the property of the variable to return to its mean value after an increase or decrease). If not, ARIMA uses variable in its first-differenced form.

We expect that innovations in payments technology will have a strong impact on money demand in the long term. Structural models such as ECM/VECM and other cointegration based models are most appropriate to reveal the impact of these innovation in the long term. Therefore, we conclude that structural models are better for longer term forecasting. ARIMA will probably have better performance for short term horizons such as one year. However, our findings indicate that even for short term horizons, structural models do better than non-

structural models but the gap between forecasting accuracy for these two kinds of models is much narrower in the short term horizon compared to long term horizon.

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Book Reviews

Regional Development, 2nd Edition(2019)
Serafeim Polyzos
Athens, Greece, Kritiki Publications [in Greek]

Regional Development, is a book authored by Prof. Serafeim Polyzos, which is written in Greek and consists of 14 chapters covering 808 pages. The book deals with issues concerning the specialists in the field of Regional Science. The first two chapters present the conceptual framework of Regional Science, as it is configured by the concepts of space and development, by the conceptualization of the regional problem (presented both for the international case and for Greece), and by the economic concepts that contribute to its modeling and interpretation. Chapter 3 introduces to the quantitative analysis of regional science, presenting a series of indices and measures used to quantify the structure and the functionality of regional economic systems. The next two chapters (4th and 5th) describe the regional disparities in Greece and in the European Union (EU), respectively, through a variety of descriptive statistics and regional indicators related to growth and prosperity, to demographic characteristics, to the educational level and the productive dynamism. Chapters 6 and 7h outline the theoretical framework of epistemological regional development. Chapter 6 deals extensively with theories of regional development and it examines the issue of development's diffusion between regions, in the light of the long-term convergence or divergence in the levels of regional development. Chapter 7 presents the theories and factors of business location planning and it analyzes the policies for attracting businesses to the Greek prefectures (developmental laws, EU support frameworks). Chapter 8 discusses how multipliers are calculated and about their use in economic and regional planning, aiming to highlight the importance of the multiplier's concept for the evaluation of the developmental programs and for the design of the appropriate policies. Chapter 9 examines the interregional labor market at the macroeconomic level, focusing on the labor mobility (commuting) and on its effects and on how it can be evaluated in terms of regional policy. Chapter 10 analyzes the phenomenon of migration, by presenting its theoretical approaches (sociological, economic, geographical, and integrated) and the determinants of migration flows, with an emphasis on the Greek case. Chapter 11 discusses the role of infrastructures in the regional development, in the endogenous development, in the diffusion of development and in social prosperity, as well as the relation of infrastructure with productivity and income. Chapter 12 analyzes the role of natural resources in the economic and tourism development, focusing on their spatial distribution, their classification and their contribution to the development of Greece, and on their impact on regional inequalities. Further examples from the international literature could be also included in this chapter for completeness, since currently it focuses on the case of Greece. Chapter 13 discusses the two main processes leading to regional development, the general diffusion of regional development and the polar development, and it extensively discuss the role of technology, innovation, entrepreneurship, and human capital in the development of regions. Finally, chapter 14 presents methods and tools for the quantitative analysis of regional problems, including descriptive, conceptual, and predictive models, the data envelopment analysis (DEA), the input-output (I-O) analysis, and the SWOT analysis.

Overall, the book of S. Polyzos is a modern handbook, described by thematic coherence and integration, as it presents all the key issues (both theoretical and applied) related to the regional development and analysis. In each chapter, the issues are studied in depth, with particular emphasis on the quantitative analysis, supported by rich literature, analytical data, and graph presentation. The book can suggest an excellent textbook for academic institutions, because it contains conclusions and questions at the end of each chapter, as well as a reference handbook for researchers and policy makers in regional science, because it covers a wide range of regional science topics and it solves practical issues and problems related to the regional and spatial planning, infrastructure planning, and development. The contribution of the book to the literature lies in its synthetic approach, which is equivalent to the interdisciplinary nature of the regional science, as well as in broad framework and modern perspective of the topics it deals with. The book of S. Polyzos is of high quality, competitive to the international textbooks dealing with regional and local development, a fact that motivates to be translated in English to claim a place in the international market, since currently no other international textbook covers regional development in the extend that the book of S. Polyzos does.

Book Review by DIMITRIOS TSIOTAS, PhD in Planning and Regional Development, University of Thessaly, Greece

GUIDELINES

for the Writers & a format model for the articles submitted to be reviewed & published in the journal

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Regional Science Inquiry Journal

(EconLit, Scopus, RSA I) – www.rsijournal.eu

Guidelines for the Writers & a format model for the articles submitted to be reviewed & published in the journal

The Title of the paper must be centered, and the font must be Times New Roman, size 12, in Uppercase, in Bold

For the writers' personal information use the Times New Roman font, size 11, in bold, and centered. Use lowercase for the first name and uppercase for the last name. The line below the name includes the professional title and workplace; use the Times New Roman font, size 10, centered. In the third line write only the contact e-mail address in Times New Roman 10, centered.

Name LAST NAME
Professional Title, Workplace
E-mail Address

Name LAST NAME
Professional Title, Workplace
E-mail Address

Abstract

The abstract consists of a single paragraph, no longer than 250 words. The font must be Times New Roman, size 11. The text must be justified. The title "Abstract" must be aligned left, in Times New Roman, size 11, in bold. A space of one line must be left between the title and the text of the abstract. The abstract must contain sufficient information, be factual, and include the basic data of the paper.

Keywords: Use 3 to 5 keywords, separated by commas

JEL classification: We kindly request that you classify your paper according to the JEL system, which is used to classify articles, dissertations, books, book reviews, and a variety of other applications. The use of the JEL classification is necessary so that your paper be properly indexed in databases such as EconLit. Select the codes that represent your article and separate them by commas. You can find information on the JEL system here: https://www.aeaweb.org/jel/guide/jel.php

1. Introduction

All articles must begin with an introduction, a section which demarcates the theoretical background and the goals of the paper.

The present document provides the necessary information and formatting guidelines for you to write your article. We recommend that you copy this file to your computer and insert your own text in it, keeping the format that has already been set. All the different parts of the article (title, main text, headers, titles, etc.) have already been set, as in the present document-model. The main text must be written in regular Times New Roman font, size 11, justified, with a 0.5 cm indent for the first line of each paragraph.

We recommend that you save this document to your computer as a Word document model. Therefore, it will be easy for you to have your article in the correct format and ready to be submitted. **The only form in which the file will be accepted is MS Word 2003**. If you have a later version of Microsoft Office / Word, you can edit it as follows:

- Once you have finished formatting your text, create a pdf file, and then save your file as a Word "97-2003" (.doc) file.

- Compare the two files – the pdf one and the Word "97-2003" (.doc) one.
- If you do not note any significant differences between the two, then – and only then – you can submit your article to us, **sending both the pdf and the Word "97-2003" (.doc) files** to our e-mail address.

If you use a word processor other than Microsoft Word, we recommend that you follow the same procedure as above, creating a pdf file and using the appropriate add-on in order to save your document in MS Word "97-2003" (.doc) form. Once you compare the two files (and find no significant differences), send us both.

2. General Guidelines on Paper Formatting

2.1. Body

The body of the text consists of different sections which describe the content of the article (for example: Method, Findings, Analysis, Discussion, etc.). You can use up to three levels of sections – sub-sections. For the Body of the text, use the default format style in Word, selecting the Times New Roman font, size 11, justified, with a 0.5 cm indent for the first line of each paragraph (this is further detailed in the section "Paragraphs").

2.2. References

The references included in the paper must be cited at the end of the text. All references used in the body of the paper must be listed alphabetically (this is further detailed in the section "References").

2.3. Appendices

The section "Appendices" follows the section "References".

3. Page formatting

3.1. Page size

The page size must be A4 (21 x 29,7 cm), and its orientation must be "portrait". This stands for all the pages of the paper. "Landscape" orientation is inadmissible.

3.2. Margins

Top margin: 2,54cm
Bottom margin: 1,5cm
Left and right margins: 3,17cm
Gutter margin: 0cm

3.3. Headers and Footers

Go to "Format" → "Page", and select a 1,25cm margin for the header and a 1,25cm margin for the footer. Do not write inside the headers and footers, and do not insert page numbers.

3.4. Footnotes

The use of footnotes or endnotes is expressly prohibited. In case further explanation is deemed necessary, you must integrate it in the body of the paper.

3.5. Abbreviations and Acronyms

Abbreviations and acronyms must be defined in the abstract, as well as the first time each one is used in the body of the text.

3.6. Section headers

We recommend that you use up to three sections – sub-sections. Select a simple numbering for the sections – sub-sections according to the present model.

3.7. First level header format

For the headers of the main sections use the Times New Roman font, size 11, in bold and underlined, and leave a size 12 spacing before the paragraph and a size 6 spacing after the paragraph. The header must be aligned left. Use a capital letter only for the first letter of the header.

3.8. Second level header format

For second level headers, follow this model. Use the Times New Roman font, size 11, in bold, and leave a size 12 spacing before the paragraph and a size 3 spacing after the paragraph. Select a 0.5 cm indent. The header must be aligned left. Use a capital letter only for the first letter of the header.

3.8.1. Third level header

For third level headers, follow this model. Use the Times New Roman font, size 11, in bold and italics, and leave a size 6 spacing before the paragraph and a size 0 spacing after the paragraph. The header must be aligned left, with a left indent of 1 cm. Use a capital letter only for the first letter of the header.

4. Paragraphs

In every paragraph, use the Times New Roman font, size 11, with single line spacing. We recommend you modify the default (normal) format style in Word and use that in your text. For all paragraphs, the spacings before and after the paragraph must be size 0, and the line spacing single. Use a 0,5cm indent only for the first line of each paragraph. Leave no spacings nor lines between paragraphs.

4.1. Lists

In case you need to present data in the form of a list, use the following format:

- Bullet indent: 1,14cm
- Text:
    - Following tab at: 1,5 cm
    - Indent at: 1,5cm

Use the same format (the above values) if you use numbering for your list.

1. Example of numbered list 1
2. Example of numbered list 1

5. Figures, images, and tables

5.1. Figures and images

Insert your figures and images directly after the part where they are mentioned in the body of text. They must be centered, numbered, and have a short descriptive title.

Figures put together “as they are”, using Office tools, are absolutely inadmissible. The figures used must have been exclusively inserted as images in Word, in gif, jpg, or png form (with an analysis of at least 200dpi), and in line with the text. The width of an image must not exceed 14,5cm so that it does not exceed the margins set above.

The images, figures, and tables must be inserted “as they are” in the text, in line with it. **Figures and images which have been inserted in a text box are absolutely inadmissible.**

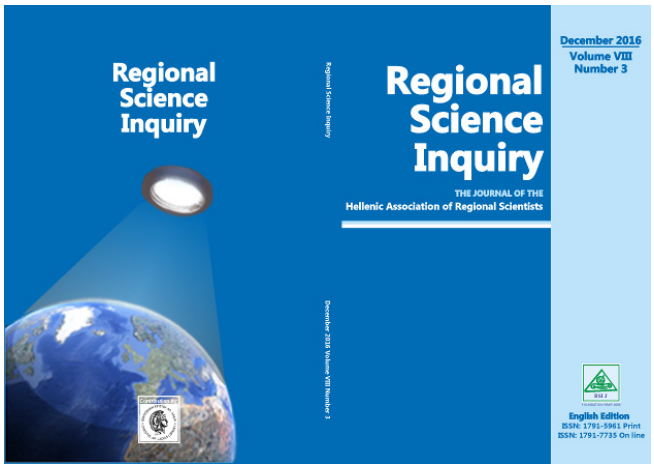
5.1.1. Reference inside the text

Avoid phrases such as “the table above” or the “figure below” when citing figures and images. Use instead “in Table 1”, “in Figure 2”, etc.

5.1.2. Examples

A model of how to format figures/images follows. For the title, use the Times New Roman font, size 10, in bold. Write the title above the figure, and set a size 6 spacing before the title and a size 0 spacing after it. The line spacing of the title must be 1.5 line. Both the image and its title must be centered.

Image 1: Title



Source: cite the source

Directly below the figure you must cite the source from which you took the image, or any note regarding the figure, written in Times New Roman, size 10. Write it below the figure, leaving a size 0 spacing before and after it, use a line spacing of 1.5 line, and make it centered.

5.2. Tables

For the title, use the Times New Roman font, size 10, in bold. Write the title above the table, and set a size 6 spacing before the title and a size 0 spacing after it. The line spacing of the title must be 1.5 line. Both the table and its title must be centered. The width of the table must not exceed 14,5cm so that it does not exceed the page margins set.

Table 1. Example of how a table must be formatted

Age	Frequency	Percentage %
Under 40	44	32.1
40 - 49	68	49.6
Over 50	25	18.2
Total	**137**	**100.0**

Source: cite the source

If the table needs to continue on the next page, select in the “Table properties” that the first line be repeated as a header in every page, as in the above example of Table 1. **Tables (or figures or images) which are included in pages with a “Landscape” orientation are absolutely inadmissible.**

Every table must have horizontal lines 1 pt. wide at the top and bottom, as shown in the example. The use of vertical lines and color fill at the background of the cells is strictly prohibited.

Directly below the table you must cite the source or any note regarding the table, written in Times New Roman, size 10. Write it below the table, leaving a size 0 spacing before and a size 6 spacing after it, and make it centered.

6. Mathematical formulas

There is a variety of tools in order to insert and process mathematical formulas, such as the "Mathematics", found in the most recent editions of Word, "Math Type", "Fast Math Formula Editor", "MathCast Equation Editor", "Math Editor". Since it is impossible for us to provide you with compatibility with all these tools in all their editions, **we can only admit your paper if it contains mathematical formulas solely in the form of images.**

Keep a continuous numbering for the mathematical formulas and center them in the page, as shown in the following example:

$$y = ax^2 + bx + c \tag{1}$$

The same stands for formulas or particular mathematical symbols you may have integrated in your text. For instance, if you want to use the term ax^2 in your text, you must insert it as an imaged, in line with the text. The images containing the mathematical formulas must be legible (at least 300dpi).

In the exceptional case of a text which may contain a great number of mathematical formulas, the writer may send it to us in TeX form if they so wish.

7. References

We recommend that you use the Chicago Manual of Style Author-Date system, as it is recommended by the AEA (American Economic Association) for the journals included in the EconLit database, and it is the dominant style of bibliography in the field of Economics. For more information you can go to the following links:

- https://www.aeaweb.org/journals/policies/sample-references
- http://www.chicagomanualofstyle.org/tools_citationguide.html
- http://libguides.williams.edu/citing/chicago-author-date#s-lg-box-12037253

7.1. Online references (internet citations)

Check your links again before sending your file, to confirm that they are active.

Avoid long internet links. Where possible, also cite the title of the website operator-owner. Return the font color to black, and remove the hyperlink. Links such as the following are impractical and distasteful, therefore should be avoided.

Example of an inadmissible hyperlink

https://el.wikipedia.org/wiki/%CE%9F%CE%B9%CE%BA%CE%BF%CE%BD%CE%BF%CE%BC%CE%B9%CE%BA%CE%AC

7.2. References Formatting

For your list of references, use the Times New Roman font, size 10, with single line spacing. The paragraph format must include a size 0 spacing before the paragraph and a size 0 spacing after it, aligned left. Use a 0,5 cm indent only for the first line of each paragraph. Leave no spacings or lines between paragraphs.

7.3. Example of how References must be formatted

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