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Articles

DO EXPORTS OF OIL AND GAS STILL MATTER FOR REGIONAL ECONOMIC GROWTH OF SUMATRA, INDONESIA?

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Abstract
Although Indonesia ranks as the world's 17th oil and 6th gas producing country, but its production level has been slowly declining since the last few decades. Amidst the decline of oil and gas production, thus it is important to explore how this impacts the regional economic growth. Specifically, this study attempts to empirically examine the impact of oil and gas and non-oil and gas exports on the regional economic growth of Sumatra, Indonesia over the period 2008-2017 using the generalized method of moments (GMM) approach. The study found that oil and gas exports were no longer contributed positively to regional economic growth. On the other hand, non-oil and gas exports have positively contributed to regional economic growth. This implies that to further promote the growth of the regional economy the focus should be given on the expansion, value-added creation and diversification of non-oil and gas commodities.

Keywords: Regional economic growth, Oil and gas sector, Non-oil and gas sector, GMM, Sumatra.
JEL classification: C32, F43, O11

1. Introduction

Achieving sustainable economic growth is an aspiration of every country, including Indonesia as it has a positive impact on the welfare of society. There are many ways to increase economic growth; one of them is through export. Since the last three decades, the Indonesian economy has moved its dependency from the primary sector to the secondary sector with a 5% annual economic growth (World Bank, 2015). Hitherto, Indonesia continues to conduct open trade activities so that all regions have the potential to export their goods and services to promote their regional economic growth. But in reality, the export activities do not always provide an equal level of economic growth across regions because of differences in natural resources from one region to another (Sunde, 2017). For example, the exports of Javanese region have larger contributions to the national economic growth of Indonesia as compared to the contribution from the region of Sumatra. For example, when national economic growth reached 6.44% in 2011, the regional economic growth of Java and Sumatra recorded 6.65% and 6.06%, respectively. Meanwhile, when national economic growth declined to 5.07% in 2017, the regional economic growth of Java and Sumatra declined to 5.61% and 4.30%, respectively (Central Statistics Agency of Indonesia, 2018).

As an open economy, the domestic economy of Indonesia continues to gain benefits from international trading activities. In addition, supported by abundant natural resources, Indonesia has been considered as a fairly important global business partner of foreign

countries. To date, Indonesia has established cooperative business partner with 16 countries, consisting of both developed countries such as the United States, Japan, the Netherlands, the United Kingdom, and Germany, and other developing countries such as Nigeria, India, Pakistan, Malaysia, Thailand, and China (Central Statistics Agency of Indonesia, 2018). These international business partnerships have increased the trading values of Indonesia with its major trading partners. However, the values of exports of Indonesia, including Sumatra have shown a fluctuating trend over the period 2008-2017 due to various factors such as a declining in prices of exported commodities in the global market.

The Ministry of Trade of the Republic of Indonesia divided exports into two sectors, namely the oil and gas sector and the non-oil and gas sector. Oil and gas exports are generally known as petroleum commodities such as crude oil and oil which has been processed in the form of fuel, while the non-oil and gas exports are commodities from the agricultural, mining and plantation sectors. According to the Central Statistics Agency of the Republic of Indonesia (2018), the most superior exporting commodities from the region of Sumatra were coffee, tea, and spices with total exports of USD30.50 billion. Over the last decade, the average export value of Sumatra Island was only USD48.9 billion with an average growth of 2.19%. The exports were recorded as the highest value of USD64.9 billion in 2012, but declined to the lowest value of USD 34.1 billion in 2017.

The decline in export commodities in Sumatra are contributed by various factors, one of them is the export should be done through existing ports in other provinces, such as through port of Special Territory of Jakarta, the capital city of Indonesia. The percentage of total commodity exports from Sumatra through the ports in other provinces in 2017 amounted to 33.35% or USD11.36 billion. The biggest commodity exported in 2017 through ports outside Sumatra was the commodities of coffees (*arabica* and *robusta*), tea, and spices.

There have been many previous studies investigated the contribution of export to economic growth. Hesse (2008) found that a more diversified export positively related to economic growth. Export affected economic growth both in short-run (Siregar and Daryanto, 2005; Herzer and Nowak-Lehnmann, 2006; and Aditya and Acharyya, 2013) and long-run (Gokmenoglu *et al*., 2015; and Shafiullah *et al*., 2017). Using the Harrod-Domar model of an open economy, Aditya and Acharyya (2013) revealed that the export sector of goods and services and the level of export technology could boost economic growth. In the context of Indonesia, Siregar and Daryanto (2005) found that exports only have an effect on economic growth in the short-run, suggesting the need to expand the development of oil and gas sector and non-oil and gas sector for further enhancing the economic growth of Indonesia. Finally, evidence of export-led growth is also found by Shafiullah *et al*. (2017) for the Indonesian case.

Unlike previous studies on the export-growth nexus in Indonesia that focused on the national economy and aggregate national export, this study investigates the impact of exports on the regional economy of 10 provinces in Sumatra Island, Indonesia. In addition, this study divides the exports into the oil and gas sector and the non-oil and gas sector using the GMM panel dynamic approach. Focusing on the impacts of exports of both oil and gas sector and non-oil and gas sector for the case of regional economy of Sumatra, this study hopes to provide a clear nature of exports-economic growth nexus that could be referred by the policy-makers in designing a proper and comprehensive economic policy to promote the regional economic growth through exports.

The rest of the study is organized in the following manner. Section 2 reviews relevant literature on export-economic growth nexus. Section 3 provides the empirical framework and data as the basis for further analysis. Section 4 discusses the findings and implication, and finally, Section 5 concludes the study.

2. Literature Review

Export has been viewed as an important engine of economic growth for several reasons. First, export expansion due to an increase in foreign demand for domestic products causes economic growth through an increase in employment and income in the export sector (Awokuse, 2008). Second, export growth indirectly affects economic growth through resource allocation efficiency, enhanced capacity utilization, economies of scale utilization, and

stimulation of technological advancement driven by global market competition (Helpman and Krugman, 1985). Finally, exports expansion provides international trading activities that allow for the rising number of imported intermediate goods that consequently increase capital formation and thus promote economic growth (Esfahani, 1991).

Previous studies on the export-economic growth nexus have been conducted both in advanced and developing economies. Previous studies found mixed empirical findings, where some studies found significant export-led growth, insignificant export-growth relation, and significant growth-driven export hypothesis. For example, Jin and Yu (1996) examined the export-led growth hypothesis in the US using vector autoregressive framework and found no significant influence of exports on the US economy. Testing similar export-led growth hypothesis using cointegration and Granger causality tests, Gokmenoglu *et al*. (2015) found a long-run equilibrium relationship between exports and economic growth and a unidirectional causality running from economic growth to export for the case of Costa Rica, finding contradicted to the export-led hypothesis.

Borgensen and King (2015) analyzed endogenous boundaries for economic growth in transition economies related to exports from the supply side perspective. A slowing down of non-tradable sector productivity growth is found as the major cause of lower level of export that in turns adversely influenced economic growth in the transition economies. Idris *et al*. (2016) investigated the impact of trade openness on economic growth in 87 selected countries including the Organization for Economic Cooperation and Development (OECD) and developing countries for the period 1977-2011 using the GMM. The study revealed a bidirectional causal relationship between export and economic growth. This finding is similar to those of Aktar *et al*. (2008) who found a bidirectional causal relationship between export and economic growth for the case of Turkey over the period 1980-2007. Using a gravity model, Warr and Ayres (2010) explored the flow of trade between the countries and trade blocks within the Asia-Pacific Economic Cooperation (APEC) members. The study found that each country has a different level of export, thus the effect of export to their economies was different from one to other APEC member countries. The flow of exports is also found to highly correlate with previous years of export values. For the case of the Australian economy, using the autoregressive distributed lag (ARDL) approach, Shaifullah *et al*. (2017) found a positive contribution of exports of mining and oil, agricultural, and manufacturing commodities to economic growth both in the long run and short run.

There have also been many previous studies on export-growth nexus in African countries. For example, Adekokun (2012) found that oil and gas export has a long-run equilibrium between export and economic growth and a positive effect of export on the Nigerian economic growth using an error correction model. Similar findings are found by Ee (2016) and Zahonogo (2018) where export positively affected the economy in the Sub-Saharan African region. Using an ARDL approach, Ojide *et al*. (2014) found a bidirectional causal relationship between export of non-oil and gas and the Nigerian economy. Furthermore, Allaro (2012) found that export is an engine for economic growth in Ethiopia; finding supported the export-led growth hypothesis. On contrary, Bosupeng (2015) found a unidirectional causality running from economic growth to export in Botswana; finding supported the growth-driven export hypothesis.

In a similar vein, Daoud and Basha (2015) explored the export-led growth hypothesis for the Jordanian, Kuwaiti, and Egyptian countries over the period 1976-2013. They found bidirectional causality between export and economic growth in Jordan, while a unidirectional causality running from exports to economic growth were found for the economies of Kuwait and Egypt, findings in harmony with the export-led growth hypothesis. The finding of the export-led growth hypothesis is also rejected by Love and Chandra (2005) for the case of Bangladesh, where economic growth is found to Granger cause exports. Unlike Daoud and Basha (2015) and Love and Chandra (2005), Storm (1997) assessed the feasibility of export-led manufacturing strategies for the Indian economy using a nine-sector general equilibrium model and found that industrial growth raised the relative price of domestic goods that in turns caused demand-export barriers.

Furthermore, Tang *et al*. (2015) re-investigated the export-led growth hypothesis for four small dragons' economies of Asia (i.e., Hong Kong, Taiwan, Singapore, and South Korea) using the analyses of cointegration and rolling causality. The study found that a long-run

relationship between variables and a unidirectional causality running from growth to export, finding supported the growth-led export hypothesis. These findings imply that to promote further the economies, instead of export, policymakers should look for alternative sources of economic growth.

Mahadevan and Suardi (2008) re-examined the stability of the trade-growth nexus for Japan and the Asian Tigers in a dynamic framework. They found that in turbulent environments, Japanese growth is only driven by imports, the Hong Kong's growth is driven both by exports and imports, but the economic growth of Taiwan was independent of exports and imports. The finding of independence between export and growth for Taiwanese economy contradicted both the export-led growth and growth-driven export hypotheses.

Finally, for the case of Indonesia, Aliman and Purnomo (2001) found a unidirectional causal relationship running from economic growth to export; a finding supported the growth-driven export hypothesis. This finding is also supported by Badikenita (2004) who studies the export-growth nexus in the ASEAN economies. Similar to Malaysia, the economic growth of Indonesia has Granger caused the exports. On contrary, Puspadilla (2009) found that export influences the growth of the Indonesian economy over the period 1996-2007; a finding supported the export-led growth hypothesis. However, Oiconita (2006) found bidirectional causality between export and economic growth; findings supported both the export-led growth and growth-driven export hypotheses. Finally, the insignificant export-growth nexus is found by Sulistyawati (2017) for the case of East Java, Indonesia over the period 1984-2000, findings contradicted both the export-led growth and growth-driven export hypotheses.

The above-reviewed studies documented mixed findings for the export-growth nexus both in advanced and developing economies. To provide a shred of clearer empirical evidence on the importance of export on the regional economic growth, unlike the previous study, our study divides export into two sectors, namely: oil and gas sector and non-oil and gas sector and explores their effects on the regional economic growth of 10 provinces in Sumatra, Indonesia.

3. Empirical Framework

3.1. Data

This study empirically explores the extent to which the exports of oil and gas and non-oil and gas on the regional economic growth of 10 provinces in Sumatra, Indonesia over the period 2008-2017. These provinces include Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Riau Islands, Bangka Belitung, Jambi, Bengkulu, and Lampung. The export is measured by the total values of exporting oil and gas and non-oil and gas commodities in the US dollar. Export of oil and gas sector includes the excavation, drilling, washing, retrieval, and utilization of all kinds of mining goods, minerals and excavated goods available in the soil, both in the form of solid objects, liquids, and gases, while the export of non-oil and gas sector includes all exploitation and utilization of biological creatures and processing of organic or non-organic materials into new products of higher quality either produced by hand, machinery or chemical processes and agricultural products to meet living needs or as raw materials in the production. The data of exports are transformed into a natural logarithm. Meanwhile, the economic growth is measured by the changes in provincial Gross Regional Domestic Product (GDP) using 2010 as the base year. The data of exports were gathered from the 10-Provincial Trade and Industry Service Offices in Sumatra, while the data of GDP was collected from the reports of the Provincial Central Bureau of Statistics and the Representative of Central Bank of Indonesia within the region of Sumatra, Indonesia.

3.2. Model of analysis

This study investigates the effects of exports on the regional economy of 10-provinces in Sumatra, Indonesia. Considering the decline of oil and gas production and its export, apart from the oil and gas sector, this study includes non-oil and gas sector into the following panel model of analysis:

$$EG_{it} = \beta_0 + \beta_1 EOG_{it} + \beta_2 NEOG_{it} + \varepsilon_{it} \qquad (1)$$

where *EG* is the economic growth, EOG is the export of oil and gas, NEOG is the export of non-oil and gas, *it* is the *i* province for *t* period; β_0 is the constant term, β_1 and β_2 are the estimated coefficients for exports of oil and gas and non-oil and gas sectors, respectively, and ε is the error term.

Since the study investigates export-growth nexus in 10-province in Sumatra region over 10 years, thus the panel model of analysis is adopted. Two models of panel data have been commonly used, namely the static panel model and dynamic panel model. The static panel model consists of pooled least square, fixed effect, and random effect models, while the dynamic panel model comprises a generalized method of moments (GMM) technique. Due to the shortcomings of the static panel models, this study adopts the dynamic panel model of the GMM. The GMM could solve the problem of endogeneity as found in the fixed effect model of static panel model (Verbeek, 2008), thus the uses of the GMM in this study could provide unbiased and consistent empirical findings. Additionally, the GMM is a common estimator that provides a more useful framework for comparison and assessment. The GMM approach is a simple alternative to other estimators such as maximum likelihood approach. Finally, the potential estimator bias could be easily removed by the use of instrument variables within the GMM even though there are endogenous variables in the estimated model. In short, the use of instrumental variables ensures the consistent estimator irrespective of existing measurement error variable in the model (Baum *et al*., 2003).

In this study, the lagging and leading values of exports of oil and gas and non-oil and gas, and exchange rate are included as the instrumental variables. The Hansen J-statistics is used to ensure the validity of the instrumental variables included in the model. If the probability value of the J-stats is lesser than 5%, thus the instrumental variable is valid in the model. On the other hand, the instrumental variable is found to be invalid in the model when the probability value of J-statistics is greater than 5%.

4. Findings and Discussion

4.1. Descriptive statistics

Achieving high economic growth has a significant impact on the future economy. Economic growth is often associated with increases in the overall production of goods and services in a country in a certain period. The higher the increase in the production of goods and services indicates a higher increase in economic growth and vice versa. Table 1 illustrates the economic growth of 10-province in the region of Sumatra, Indonesia during the years 2010 and 2017.

Table 1. Regional economic growth in Sumatra, Indonesia (in percentage)

Province	Year		Average
	2010	2017	Growth
Aceh	-6.24	4.19	0.70
North Sumatra	5.39	5.12	5.47
West Sumatra	4.65	2.71	5.48
Riau	5.88	5.29	2.95
Jambi	5.63	2.01	6.02
South Sumatra	6.16	4.64	5.01
Bengkulu	4.75	4.99	5.51
Lampung	4.07	5.51	5.28
Bangka Belitung	4.35	5.17	4.63
Riau Island	3.6	4.51	5.58
Sumatera	3.82	4.41	4.66

Source: Adapted from the Central Statistics Agency of Indonesia (2018).

As illustrated in Table 1, the economic growth of each province fluctuated across the period. The economic growth of Aceh Province was recorded to be the lowest at -6.24%, while the economic growth of South Sumatra was recorded to be the highest by 6.16% in 2010. However, in 2017, the province of Lampung is found to be the highest economic

growth rate by 5.51%, while the province of Jambi was recorded to be the lowest economic growth rate by 2.01%. Overall, the regional economic growth of Sumatra, Indonesia has increased by 4.66% from 3.82% in 2010 to 4.41% in 2017. With the exception of the three provinces of Aceh, Riau, and Bangka Belitung, the other provinces recorded economic growth above the regional economic growth of Sumatra.

Table 2 provides the figures for exports of oil and gas and non-oil and gas for the years 2008 and 2017. The values of exports are very much depending on the number of the existing port in the provinces. The province of North Sumatra has 6 ports, Riau 12 ports, and Riau Islands has 14 ports.

Table 2. Exports of oil and gas and non-oil and gas by the province in Sumatra, Indonesia

Province	Oil and Gas (USD000)			Non-Oil and Gas (USD000)		
	2008	2017	Growth (%)	2008	2017	Growth (%)
Aceh	2,104,395	66,757	-96.83	129,735	10,921	-91.58
North Sumatra	-	-	-	9,261,977	9,225,286	-0.40
Riau	7,921,099	2,349,214	-70.34	12,834,732	13,814,303	7.63
West Sumatra	-	-	-	2,384,568	2,046,269	-14.19
Riau Island	-	-	-	-	-	-
Jambi	332,907	201,125	-39.59	857,018	1,022,343	19.29
Bengkulu	-	-	-	153,003	275,250	79.90
South Sumatra	851,838	798,281	-6.29	2,619,997	2,509,412	-4.22
Lampung	-	-	-	4,080,522	-	-100
Bangka Belitung	223,339	190,876	-14.54	1,812,618	1,593,262	-12.10
Sumatera	11,433,579	3,606,255	-68.46	34,134,172	30,497,046	-10.66

Source: Adapted from the Central Statistics Agency of Indonesia (2018).

As illustrated in Table 2, half of 10-province in Sumatra exported no oil and gas during the period 2008-2017. Of 5-province exported oil and gas, the highest oil and gas exports are dominated by the province of Riau (USD7.92 billion), followed by the province of Aceh (USD2.10 billion) in 2008. Meanwhile, the lowest oil and gas exports were the province of Jambi amounted to USD332 million. Overall, the values of oil and gas exports in 2017 experienced a significant decline. The exports of oil and gas by the provinces of Aceh declined by 96%, Riau by 70.3%, Bangka Belitung and South Sumatra by lesser than 15%. The decline in oil and gas exports is partly caused by an increasing needs of domestic energy for the electrical, automotive, and communication industries. As for the exports of non-oil and gas, the province of Riau recorded the highest values of export by USD12 billion and USD13 billion in 2008 and 2017, respectively, showing an average increase by 7.63%. Meanwhile, the lowest values of non-oil and gas exports were experienced by the province of Aceh amounting only USD129 million and USD10.9 million in 2008 and 2017, respectively, showing an average decline by -91.58%. However, the province of Bengkulu recorded the highest average increase by 79.9% over the period 2008-2017.

Furthermore, Table 3 reports the descriptive statistics of the economic growth and both oil and gas and non-oil and gas exports in the region of Sumatra over the period 2008-2017. Table 3 illustrates that the average of regional economic growth, the value of oil and gas exports, and value of non-oil and gas exports of the 10 provinces in Sumatra, Indonesia was 4.66%, USD1,048 billion, and 3,803 billion respectively. This indicates that the economic growth of the region relied most on the exported of non-oil and gas commodities compared to the oil and gas commodities. The economic growth and the values of exports of oil and gas, and exports non-oil and gas have been relatively volatile as indicated by their standard deviation values of -2.59%, USD1,896 billion and USD4,189 billion.

Table 3. Descriptive statistics

Variable	Economic Growth (%)	Value of Exports (USD000)	
		Oil and Gas	Non-Oil and Gas
Mean	4.66	1,048,141	3,803,641
Maximum	7.86	7,921,099	15,268,962

Minimum	-6.51	0	0
Standard Deviation	-2.59	1,896,464	4,189,156

4.2. Correlation Coefficients

Table 4 illustrates the coefficients of correlation between economic growth, values of exports of oil and gas, and non-oil and gas. The exports from the oil and gas sector are found to be strongly correlated to the exports from the non-oil and gas sector. In the view of exports, only exports of non-oil and gas are found to be correlated with the economic growth by 0.073 at the 5% significance level, while the oil and gas exports are found to be non-correlated to the regional economic growth of Sumatra, Indonesia. These findings support our earlier finding that indicates an important role of non-oil and gas sector in the growth of the regional economy of Sumatra. However, to further confirm these initial findings, the relationship between oil and gas and non-oil and gas sectors and regional economic growth is examined in the next section using the dynamic GMM panel model.

Table 4. Correlation coefficients

Variable	Economic growth	Oil and gas exports	Non-oil and gas exports
Economic growth	1.000	-	-
Oil andgas exports	-0.089	1.000	-
Non-oil and gas exports	0.073**	0.664***	1.000

Note: *** and ** indicate significance at the 1% and 5% levels.

4.3. The role of exports in the regional economy of Sumatra, Indonesia

As mentioned earlier, the dynamic GMM model is adopted to empirically assess the impacts of exports of oil and gas and non-oil and gas on the regional economic growth of 10 provinces in Sumatra Island, Indonesia over the period from 2008 to 2017. The findings from the GMM estimation are reported in Table 5.

Table 5. Findings from the dynamic GMM panel model

Variable	Estimated coefficient	t-Statistics	Prob.
Economic growth(-1)	0.1761***	7.080	0.000
Exports of oil and gas	1.22E-07	0.531	0.596
Exports of non-oil and gas	3.79E-07***	2.870	0.005
J-stat = 8.75; Prob. J-stats = 0.27; AR(1) = - ; AR(2) = 0.917			

Note: *** indicates significance at the 1% level. Instrumental variables: one-lagging and one-leading values of exports of oil and gas and exports of non-oil and gas, and contemporaneous values of exchange rate.

As observed from Table 5, the study found that the oil and gas exports have no significant effect on the regional economic growth, while the non-oil and gas exports have a positive and significant effect on the regional economic growth of Sumatra, Indonesia over the period 2008-2017. Specifically, an increase in the non-oil exports by USD1 million caused an increase in regional economic growth by 0.38%. Additionally, the trend of the regional economic growth is determined positively by the previous level of regional economic growth, as indicated by the significance of last year regional economic growth at the 1% significance level. If the last year of economic growth in the region of Sumatra is increased by 1%, the 10 provinces in the region would enjoy a continued trend of an increase in their economic growth by 0.18%.

Our finding of the insignificant effect of oil and gas exports to regional economic growth is mainly due to the following reasons. First, the decline in oil and gas production in the region of Sumatra caused a decline in exports and thus provides no contribution to economic growth. Second, the fluctuations in the world prices of oil and gas prices due to changes in supply and demand for oil and gas in international markets resulted in uncertainties of revenues from exporting activities. An unstable international market adversely affected the national economy both in short- and long-run. Fourth, an increase in the domestic demand for oil and gas for the electricity generation, especially in developing countries, including

Indonesia caused a decline in oil and gas exports. Finally, only half of the 10 provinces in Sumatra region have the potential reserves of oil and gas for exports and for their domestic consumption as well as the consumption of the other provinces that produced no oil and gas. The finding of the insignificant contribution of oil and gas sector on the regional economic growth is supported by those of Jin and Yu (1996) for the US economy and Sulistyawati (2017) for the provincial economy of East Java, Indonesia over the period 1984-2000. This finding contradicted both export-led growth and growth-driven export hypotheses.

On the other hand, an increasing trend of non-oil and gas exports in the region of Sumatra has contributed towards the promotion of regional economic growth in the Sumatran region. This finding is in line with those of Puspadilla (2009) and Shaifullah (2017). In their studies on export-growth nexus, Puspadilla (2009) found a positive influence of exports on the national economic growth of Indonesia over the period 1996-2007. Similarly, Shaifullah *et al*. (2017) found a positive contribution of exports of non-oil and gas of agricultural and manufacturing commodities to the Australian economy both in the long run and short run. This finding further supported the export-led growth hypothesis.

Referring to the above findings, several important implications could be derived. The oil and gas production in the region of Sumatra is still dominated by the province of Riau, followed by the province of Aceh. However, since the shutdown of PT. Arun Natural Gas Liquefaction Co. located in the Aceh province in 2014, the oil and gas production in the province sharply declined. The oil and gas is an economic resource that is non-renewable and only can be used up at a certain period depending on the scale of exploration. Realizing these facts, thus to further promote the economic growth, the province should further promote the non-oil and gas sector as it has greater potential to be expanded and diversified in the long-run. This is as viewed by Aladejare and Saidi (2014) and Seraphin and Yinguo (2015), where the non-oil and gas commodities become an important engine for economic growth globally.

In the last few decades, the diversification and increased value added of non-oil and gas products become the leading world exports (Hesse, 2008; Herzer and Nowak-Lehnmann, 2006; and Aditya and Acharyya, 2013). The non-oil and gas products and derivations are more varied than oil-gas products and thus have greater potentials to be marketed in the global arena. For example, as a rich wood plantation country, the wood industry in Indonesia could process it into many furniture-based products. Nonetheless, the contribution of the non-oil and gas sector to the national economic growth of Indonesia has been smaller as compared to the other emerging economies. The non-oil and gas sector only contributed 1-2% of the Indonesian economy, while the other countries their non-oil and gas sector have contributed more than 5% to their economies. The government of Indonesia should expand and diversified the non-oil and gas products, supported by advanced technology, sufficient development budget, and good governance principles. This is believed among the strategic ways to accelerate the economic growth both at the regional and national levels of Indonesia.

Finally, our estimated GMM model has produced unbiased and consistent estimators. The J-statistics is found to be insignificance, indicating the instrumental variables included in the model were valid. Apart from lagging and leading values of the variables of oil and gas exports and non-oil and gas exports, the exchange rate is also included in the model as one of the instrumental variables as it plays an important role in determining export activities. The depreciation in the Indonesian Rupiah (IDR) will cause an increase in exports as the domestic products, including oil and gas becomes cheaper and more competitive in the international markets. Conversely, the appreciation of the IDR against other foreign currencies will cause the exports to decline as the oil and gas from Indonesia become more expensive and thus less competitive in the global markets. As for the autocorrelation problem, our model is found to be non-autocorrelated, as indicated by the value of the AR(2) that is greater than 5%.

5. Conclusion

Amidst the decline of oil and gas production in the last decade in the region of Sumatra, Indonesia, it is important for our study to explore how this impacts the regional economic growth in Indonesia. Specifically, this study attempts to empirically examine the impact of exports of oil and gas and non-oil and gas on the regional economic growth of 10 provinces

(i.e., Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Riau Islands, Bangka Belitung, Jambi, Bengkulu, and Lampung) in Sumatra, Indonesia over the period 2008-2017.

Using the dynamic generalized method of moments (GMM) panel model, the study found that the oil and gas exports were no longer contributed positively to the regional economic growth, finding contradicted to both export-led growth and growth-driven export hypotheses. On the other hand, the non-oil and gas exports have positively contributed to the regional economic growth of Sumatra, Indonesia, finding supported the export-led growth hypothesis.

These findings implied that to further promote the growth of the regional economy the focus should be given on the enhancing the non-oil and gas sectors. The expansion, creation more value-added and diversification of non-oil and gas products could increase the exports potentials and thus promote the regional economy of the 10-provinces in Sumatra Island, Indonesia. In its effort to expand and diversify the non-oil and gas products, the government of Indonesia should support it by providing advanced technology, allocating sufficient development budget, and implementing good governance principles in the production activities. This is believed among the strategic ways to accelerate the economic growth both at the regional and national levels of Indonesia.

To enhance empirical finding on the export-growth nexus, future studies might focus on the potential influences of other determinants from the political, social, economic, environmental, legal, and technological perspectives on the exports and, in turns, on the economic growth. Additionally, to provide a better picture on the nature of export-growth nexus, the future researches should consider assessing the role of exports both oil and gas sector and non-oil and gas sector on the national economy of Indonesia using all 34-province data.

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GREEN OPEN SPACE IN URBAN AREAS: A CASE IN THE GOVERNMENT OFFICE OF BOYOLALI, INDONESIA

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Abstract

Green open space has a necessary environmental role especially in urban areas where the demand for built-up land increases persistently. Its significance also applies to the integrated government office complex of Boyolali Regency. This research aimed to analyze the available and required green open space in the complex using a survey method, as well as aerial photo interpretation and field observation for data acquisition. The data was then analyzed to identify the available green open space by type, as classified in Act No. 26/2007 and the Regulation of the Ministry of Public Works No. 5/2008, and the required green open space using the Gerarkis method. This research also employed in-depth interviews with several key informants to sharpen the analysis. The results showed that the area of the office complex was 21.7 ha and the available green open space was 10.4 ha, which is larger than the recommended 30% of the total area. This research also found that the required green open space according to the oxygen need in the office complex was 0.006355 ha. Therefore, the available green open space has already met not only the legal requirement but also the oxygen need.

Keywords: availability, need, offices complex, urban green open space
JEL classification: O18, O20

1. Introduction

A city is an open system, which is physically and socio-economically non-static and dynamic, or commonly called as a system with temporary nature (Irwan 2005). A city is sometimes established as the government center of an area, but empirically it constitutes a place where various communities engage in social activities in different dimensions. A sustainable urban city is characterized by a balanced interaction and a reciprocal relationship between nature and human in the middle of their coexistence (Rahmy et al. 2012).

The development in several cities in Indonesia leads to widespread land use change in a relatively short time. It mostly changes green open space to urban infrastructures and buildings. Moreover, the industrial revolution has added to the deterioration of the environment in the urban areas (Patarkalashvili 2017). In the meantime, one of the conditions in urban area planning is the availability of green open space, which has become a necessity due to its abundant functions.

Open space accommodates specified activities of the people in its surroundings, either individual or communal. Its shape highly depends on the pattern and structure of the building mass (Hakim 1987). It is also essential in providing a window into social life in urban areas as well as into rural development (Leng and Li 2016).

Open space is equipped with roads, parking lots, pedestrian walkways, and trash cans to meet the needs of the community (Kristianova 2016). Furthermore, it has to meet the five elements, namely (a) good, (b) consisting of natural scenery, (c) encouraging the engagement and connection with the surrounding environment, (d) comfortable, and (e) harmonious (Lau, Gou, and Liu 2014).

Urban green open space is the interface between natural and artificial systems in an urban environment. Act No. 26/2007 on Spatial Planning explains that a region/city is obligated to allocate 30% of its total area for green open space, i.e., 20% for public use and 10% private green space. Green open space includes public parks and recreation areas, grass-covered

public parks, unroofed urban spaces and undeveloped natural landscapes, pieces of land between buildings, and any open urban spaces that are accessible to the public (Shabak et al. 2015). Open accessibility, as the key to effective social and ecological functions, optimizes the benefits of green open space (Gong, Zheng, and Ng 2017). Green open space comprises parks, cemeteries, yards and gardens, urban forests, wetlands, rivers, and lakes that provide services for the urban population (Breuste and Rahimi 2015).

On one hand, urban green open space is urgently needed by the population of a city due to its abundant roles. It functions as (a) a protection area, (b) a means to create cleanliness, health, harmony, and environmental aesthetics, (c) a media for microclimate improvement, and (d) a control to urban water management. On the other hand, urban green space is currently faced with many problems that often develop into land use conflict, i.e., the presence of green open space in densely populated areas.

Urban green open space also necessarily facilitates the interaction between human and nature (Hussain and Said 2015; Malek, Mariapan, and Rahman 2015; Mathers, Dempsey, and Molinc 2015). This interaction has been known to benefit human's health, such as reducing stress and encouraging sustainable pro-social behavior (Maller et al. 2006 in Roberts 2017) because green open space provides essential recreational services for urban population (Robert and Yengue 2017). Despite the acknowledgment to the many benefits, most urban green open space has gradually disappeared in various countries (Haas et al. 2015 in Southon et al. 2017).

Open space in offices or educational areas has a diverse use, for instance, as a playground, a gathering spot, and a place for sports, ceremonies, music performances, and other activities (Sintani, Ramli, and Zubair 2013). These open spaces should also be utilized for the development of urban forests. Office buildings can have a green space when their open lands are planted with trees and flowers and arranged optimally.

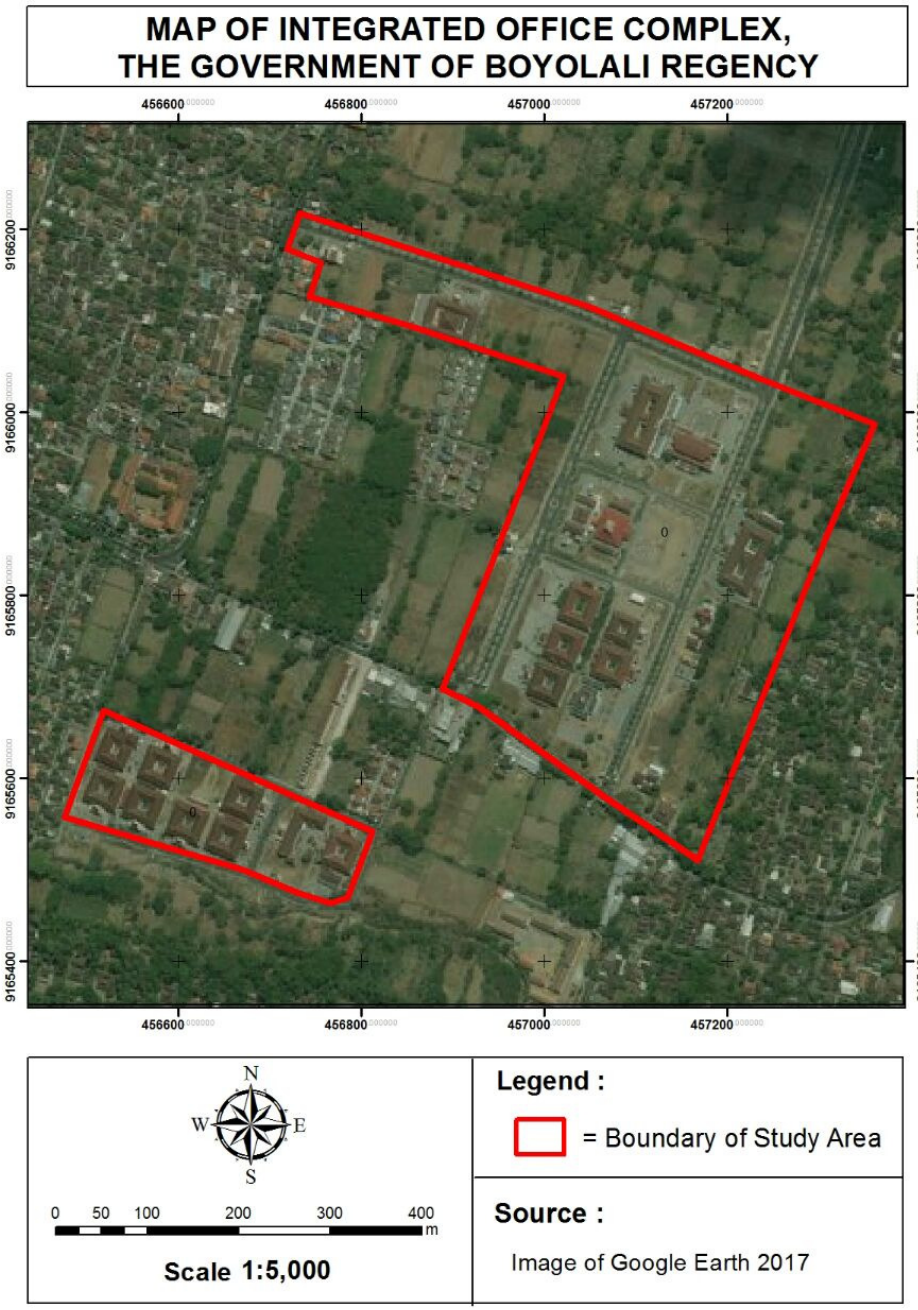
In addition to producing oxygen and absorbing carbon dioxide, the vegetation in green open space also breaks down harmful gases released during the combustion of fuels in vehicle engines. One of the factors affecting air quality is the increase in the number or volume of vehicles as a means of transportation, as it remains the primary source of air pollution in urban areas (Mutia, Ramli, and Zubair 2013).

Green open space in an office complex is related to oxygen availability for human beings, i.e., the employees, and their vehicles (Nastiti, 2018). The vegetation in green open space produces oxygen and contributes to the reduction of climate change impact by absorbing carbon dioxide (Abbasi, Alalouch, and Bramley 2016; Nero et al. 2017). One hectare of vegetation releases 600 kg O_2 to the atmosphere and absorbs 900 kg CO_2 (Frick and Setiawan 2002 in Baharuddin 2011). Green open space has to cover at least 30% of the total area of a region, which includes 20% public space and 10% private space (UU RI No. 26/2007).

Urban development also occurs in the integrated government office complex of Boyolali Regency. The change of the location of the central government prompted the necessary construction of new buildings to support the government activities, as seen in Figure 1. The government office of Boyolali Regency was originally located in Boyolali District. However, due to the space limitation for the expansion of the government building, the office complex was moved to Mojosongo District in 2013. The construction of the integrated office complex aimed to facilitate the implementation of an executive region and local government agency in one same zone. Nowadays, many constructions take place in Boyolali Regency due to the increasing demand for public facilities. The development occurs on the land that was originally a green space like gardens or green fields, as presented in Figure 2.

The change of the central government's location and the construction of the new office building have reduced the extent of green open space. Green infrastructure in urban areas is defined as a planned network of natural and semi-natural lands that is strongly recommended to be included in city planning due to its role in providing ecosystem services, preserving biodiversity, and producing a viable urban environment (European Commission 2003 in Mesimaki et al. 2017). This definition accentuates the necessity of available green open space in urban areas.

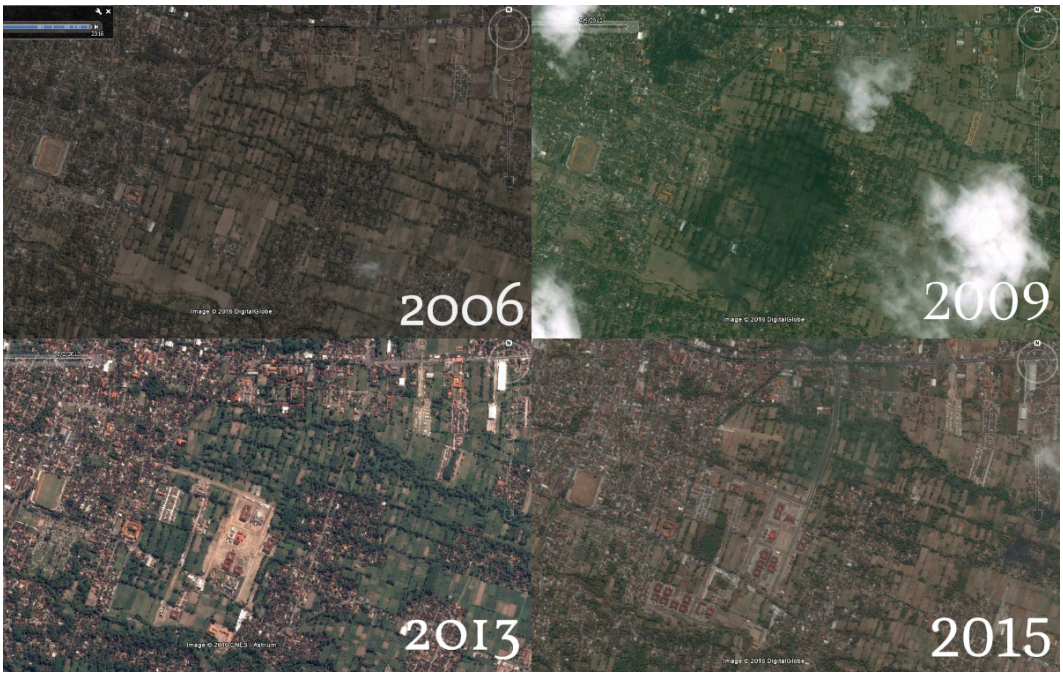
Figure 1: The Integrated Government Office Complex of Boyolali Regency



Source: Google Earth, 2017

Until recently, there has been no specific research documenting the available and required green open space in the integrated government office complex of Boyolali Regency. According to the scientific background elaborated above, this research becomes necessary and, thereby, it aims to (1) analyze the availability of green open space in the integrated government office complex of Boyolali Regency and (2) analyze the required green open space in the office complex. This research is expected to give two benefits, namely theoretical-academic benefit and empirical-practical benefit. From the theoretical-academic perspective, this research is believed to be able to develop sciences especially in the field of urban geography. Meanwhile, from the empirical-practical point of view, it is expected to contribute significantly to the formulation of development policies in urban areas that especially concern on the management of green open space.

Figure 2: Land Use Change in the Integrated Government Office Complex of Boyolali Regency in 2006-2015



Source: Google Earth, 2006, 2009, 2013, and 2015

2. Methodology

This research used survey method and acquired data from aerial photo interpretation and field observation. The data processing technique used to achieve the first objective was the interpretation of aerial photo obtained from Google Earth. The research utilized the feature 'calculate area' in Arc GIS software to identify the extent of the available green open space, as interpreted from the aerial photo. The available green open space in the office complex was presented along with the ability of this space to produce oxygen and absorb carbon dioxide. One hectare of green open space can release 600 kg O_2 to the atmosphere and absorb 900 kg CO_2 (Frick and Setiawan 2002 in Baharuddin 2011).

The second research objective was achieved using the Gerarkis method, which relied on the indicators of oxygen needs, namely the oxygen need of the employees of the office complex and the oxygen need of the vehicles. In one day, the employees work for averagely 9 hours. At the same time, adult humans require averagely 14,400 liters of air. Therefore, the oxygen need of the employees in one working day is 0.315 kg (Sintani, Ramli, and Zubair 2013). The equation used to calculate the oxygen need of the employees is as follows.

$$The\ oxygen\ need\ of\ employees = Total\ employees\ \times 0.315\ kg \quad (1)$$

A vehicle can function when it generates energy from fuel combustion. This process requires a specified amount of oxygen. A motorcycle needs 0.5817 kg/hour, while a car or a passenger vehicle requires 11.636 kg/hour (Wisesa 1988 in Ramadhan 2012). The oxygen required by vehicles can be estimated from the following equation.

$$The\ oxygen\ need\ of\ vehicles = Total\ vehicles\ \times O_2\ need\ per\ vehicle \quad (2)$$

The required area for green open space was calculated based on the volume of necessary oxygen consumption. The calculation used the Gerarkis method (1974) that had been slightly adjusted by Wijayanti (2003).

$$Lt = \frac{Pt + Kt + Tt}{(54)(0.9375)} m^2 \quad (3)$$

where Lt = Area of green open space (m^2), Pt = The oxygen need of employees (kg/hour), Kt = The oxygen need of vehicles (kg/hour), and Tt = The oxygen need of

livestock (kg/hour). Meanwhile, 54 and 0.9375 are constants that, respectively, represent 1 hectare of land producing 54 grams of plant dry weight per day and 1 gram of plant dry weight equal to the production of 0.9375 gram of oxygen.

The available green open space also plays a significant role in absorbing the carbon dioxide emitted from human activities. Humans oxidize 3,000 calories per day from their foods, consume 600 liters of oxygen or 840 grams of oxygen per day, and release 480 grams of carbon dioxide per day (White et al. 1959 in Sintani, Ramli, and Zubair 2013). The CO_2 emitted by the employees of the office complex was calculated based on the length of the office activities, i.e., averagely 9 hours/day. Accordingly, every employee in the office released 180 grams of carbon dioxide.

$$The\ amount\ of\ CO_2\ emission = Total\ employees\ \times 0.18\ kg \quad (4)$$

From the estimated amount of the carbon dioxide emitted by the employees, this research was able to determine whether the available green open space has met the demand for one. Furthermore, it also conducted in-depth interviews with several key informants to sharpen the analysis.

3. Results

Green open space becomes the primary contributor to the sustainability of the social life and ecological function in an urban environment (Hussain and Said 2015). It increases the ambient water quality by filtering urban water runoff, conserves energy, minimizes air pollution, and reduces the effects of greenhouse gases (Madurapperuma and Kuruppuarachchi 2016). The availability of green open space has a direct relationship with oxygen production and carbon dioxide absorption. A green open space is considered sufficient when it has met the oxygen need of the employees (as the main actors who conduct the activities in the office) and the oxygen need of the vehicles. Furthermore, a sufficient green open space is actualized when it can absorb the carbon dioxide emitted by the employees and their vehicles.

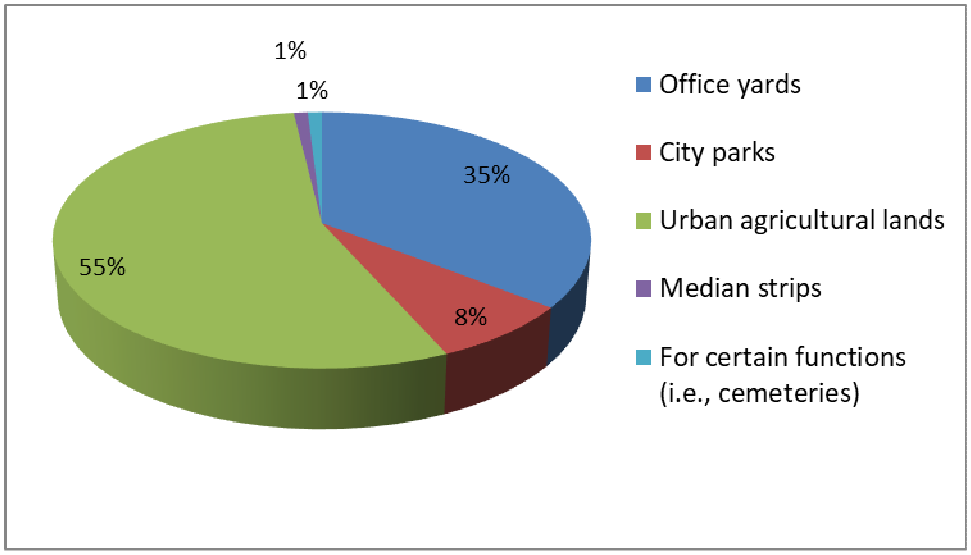
The available green open space in the integrated government office complex of Boyolali Regency was identified from the extent of the land that was not covered with buildings but planted with a variety of green plants. The office complex has 23 office buildings and 5 public facilities for worship. The extent of the available green space was interpreted from the aerial photo of the office complex. The results showed that the integrated government office complex of Boyolali Regency was built on 21.7 ha land. Meanwhile, the green open space in the complex was 10.4 ha. The distribution of available green open space in the study area is presented in Table 1, while the different types of green open space and their proportions are presented in Figure 3.

Table 1. The Available Green Open Space in the Integrated Government Office Complex of Boyolali Regency

Types of Green Open Space	Area (ha)
Office yards	3.7
City parks	0.8
Urban agricultural lands	5.7
Median strips	0.1
For certain functions (i.e., cemeteries)	0.1
Total	**10.4**

Source: Data analysis in 2017

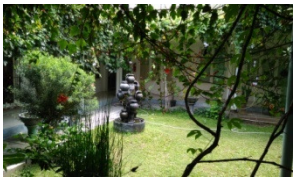
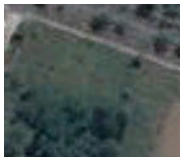
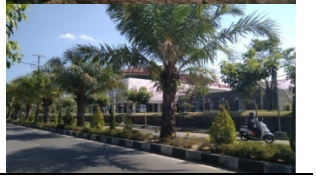
Figure 3: The Proportions of Available Green Open Space in the Integrated Government Office Complex of Boyolali Regency by Type



Source: Data analysis in 2017

Table 2 shows the available green open space in the study area, as seen on the satellite imagery and in the field. The extent of the available green open space, i.e., 10.4 ha from the total 21.7 ha of the office complex, has met the legal condition, namely 30% of the total area. The following quotes support this fact. "The green open space is sufficient because there are many annual plants around the office." (in-depth interview with DW on April 19, 2017) "The office complex is located in a village and surrounded by many trees, as well as the environmental parks in the office area. All of which provide sufficient green open space." (in-depth interview with WP on March 30, 2017)

Table 2. The Available Green Open Space Identified in the Integrated Government Office Complex of Boyolali Regency from Satellite Image and Field Observation

Types of Green Open Space	Locations of Green Open Space	Appearances in Google Earth Satellite Image	Appearances in the Filed
Office yards	The Office of BP3D		
City parks	The south town square		
Urban agricultural lands	Papaya cultivation land on Jl. Ahmad Yani		
Median strips	Jl. Merdeka Timur		

Types of Green Open Space	Locations of Green Open Space	Appearances in Google Earth Satellite Image	Appearances in the Filed
Certain functions	Public cemeteries		

Source: Data analysis in 2017

Based on the requirement issued by the law, i.e., 30% of the total area, the extent of green open space in the office complex was at least 6.51 ha. The study area had nearly twice the extent of the recommended green open space. Therefore, the green open space can provide various benefits for the office employees to be able to perform their activities comfortably. The extent of the green space, i.e., 47.92%, positively affects the amount of oxygen released to the atmosphere and the volume of absorbed carbon dioxide. The available green open space benefits the health condition of the people because it increases oxygen availability and pollutant absorption, all of which make the activities and the social contacts of the population become more comfortable (Tamosiunas et al. 2014). Moreover, the presence of green open space that produces oxygen and, at the same time, absorbs pollutants can reduce the risk of death due to chronic diseases (Wolch, Byrne, and Newell 2014).

Table 3 presents the amount of oxygen produced and the carbon dioxide absorbed by the vegetation area in the integrated government office complex of Boyolali Regency.

Table 3. The Weight of O_2 Produced and CO_2 Absorbed by Green Open Space

Types of Green Open Space	Area (ha)	Produced O_2 (kg/day)	Absorbed CO_2 (kg/day)
Office yards	3.7	2,220	3,330
City parks	0.8	480	720
Urban agricultural lands	5.7	3,420	5,130
Median strips	0.1	60	90
Certain functions	0.1	60	90
Total	**10.4**	**6,240**	**9,360**

Source: Data analysis in 2017

The results showed that 6,240 kg O_2 was produced in 12 hours per day from the green open space in the office complex. Also, the green plants in the office complex were able to absorb 9,360 kg CO_2. Accordingly, the amount of oxygen produced by the green open space also represents the available oxygen useful for human respiration (i.e., the office employee) and for dealing with the harmful gases generated by the fuel combustion process in vehicle engines. Because the widest green open space was in the form of urban agricultural lands, the highest oxygen production and carbon dioxide absorption by plants were contributed by urban agricultural lands found in the integrated government office complex of Boyolali Regency.

The need for green open space in urban areas is imperative to the actualization of environmental harmony. It also has a direct relationship with oxygen needs, which highly depend on several indicators, namely population size, number of vehicles, and number of livestock. Aside from producing oxygen, green plants also play a role in absorbing carbon dioxide and some other dangerous gases that, in this case, are generated by the use of vehicles in the office complex.

Humans oxidize 3,000 calories per day from their foods, consume 600 liters of oxygen or 840 grams of oxygen per day, and release 480 grams of carbon dioxide per day (White et al. 1959 in Sintani, Ramli, and Zubair 2013). All of the employees who performed the day-to-day activities in the office complex worked for averagely 9 hours per day—equal to the general working hours.

In addition to the oxygen need of the employees, the oxygen need of vehicles was also included in the calculation of the required green open space in the study area. Vehicles consume a particular amount of oxygen and, thereby, become necessary to consider. The

oxygen needs of the employees and their vehicles are the indicators in estimating the extent of the required green open space in the office complex. The oxygen needs were analyzed using the Gerarkis method with an adjustment proposed by Wijayanti (2003). The calculation of the required green open space excluded the oxygen consumption by livestock because no cattle or poultry was found in the office complex. Table 4 presents the analysis results of the required green open space based on oxygen need.

Table 4. The Required Green Open Space Based on the Gerarkis Method

Number of Employees	The O_2 Need of Employee (kg)	Number		The O_2 Need of Vehicles (kg)	The Required Green Open Space(ha)
		Motorcycles	Cars		
1,222	384.93	733	207	2,834.62	0.006355

Source: Data analysis in March 2017

The results showed that the required green open space to meet the oxygen needs of the employees and their vehicles was small, i.e., 0.006355 ha. Also, the green open space has sufficiently met the oxygen need of the vehicles, especially during the disposal of harmful gases produced by fuel combustion.

Aside from identifying the required green open space, the Gerarkis method also provides information on oxygen need and the ability of green open space to absorb carbon dioxide. Based on these two indicators, the required green open space is presented in Table 5.

Table 5. The Required Green Open Space Based on Oxygen Need and the Capacity to Absorb CO_2

Oxygen Need(kg)	Required Green Open Space (ha)	CO_2 Emission (kg)	Required Green Open Space (ha)
3,217.36	5.36	219.96	0.244

Source: Data analysis in March 2017

Based on the oxygen need, the required green open space was identified from the capacity of 1 hectare of green open space to produce 600 kg O_2 and absorb 900 kg CO_2. This research found that the integrated government office complex needed 5.36 ha of green open space to produce 3,217.36 kg of oxygen needed by employees who worked for 9 hours and their vehicles. Another 0.255 ha of green open space was also required to absorb 219.96 kg of carbon dioxide produced daily during the nine working hours in the office complex. The carbon dioxide emission came only from the employees in the office complex because not many vehicles pass by and emit carbon dioxide in the office complex during the working hour. Therefore, the carbon dioxide emission from vehicles was excluded.

The results of the Gerarkis method showed that the available green open space in the study area was considered sufficient in every criterion. The criteria were oxygen need, the capacity to absorb carbon dioxide emitted by the employees and their vehicles, and the condition issued by the law.

Green open space is the only public service free for many people every day, and it is available to everyone regardless of demographic characteristic and socio-economic status (Abbasi, Alalouch, and Bramley 2016).

4. Conclusion and Recommendation

4.1. Conclusion

The available green open space in the integrated government office complex of Boyolali Regency was 10.4 ha. It consisted of urban agricultural lands (55%), office yards (35%), city parks (8%), and median strips and cemeteries (2%). It has met the legal requirement issued in the Act No. 26/2007 on National Spatial Planning, i.e., 30% of the total area in question. Compared to the area of the office complex (21.67 ha), the available green open space covered 47.92% of the area.

The required green open space in the study area was only 0.006355 ha because the number of the office employees was small (i.e., 1,222 people) and not all of them used a vehicle to work. The currently available green open space has met various requirements, namely oxygen needs, the ability to absorb carbon dioxide, and legal criteria issued in Act No. 26/2007. Therefore, the preservation of urban green open space, as well as its ratio to built-up land, has to be intensified.

4.2. Recommendation

Based on the results, this research recommends the preservation of green open space and the increase of tree numbers especially in the parking lots of the office (i.e., the concentration of motor vehicles). Based on the findings of this research, the percentage of parking lots and environmental parks in every office needs a thorough attention primarily to maintain the high ratio of plants to vehicles.

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ON THE ISSUE OF EFFECTIVE ECONOMIC POLICY IN REGION UNDER LEASING

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Abstract
In the case of Mari El Republic the issues of creating an effective leasing policy in the region are revealed. The economic indicators are identified and can indirectly determine the effectiveness of leasing and its impact on regional economic development. Under certain indicators in financial statements of AO "Rosagroleasing" lessees it was conducted an analysis of companies, successfully acquiring property in leasing and the enterprises without effective dispose of leasing property. For the identification of shortcomings, it was proposed to conduct a series of the activities that could improve leasing business in region and the influence on growth of the economic potential in Mari El Republic.

Keywords: Leasing, investment, regional development, investment policy and leasing in the agriculture
JEL classification: R11, O1, O2, H83

1. Introduction

The relevance of the study is due to problems of theory and practice of the implementation in regional effective leasing policy. The purpose of the work is disclosure of the issues in creation of effective economic policy under leasing in the case of Mari El Republic. This aim is achieved by solving the following tasks:

- to identify the economic indicators, indirectly allowing determination of the effectiveness in leasing and its impact on regional economic development;
- to analyze companies, successfully acquiring property in leasing and the enterprises without effective dispose of leasing property, on certain indicators in financial statements of AO "Rosagroleasing" lessees;
- to propose to conduct a series of the activities that could improve leasing business in region and the influence on growth of the economic potential in Mari El Republic in order to identify shortcomings.

The problems of regional leasing were considered in the works of such authors as V.D. Gazman (2016), I.A. Rybina (2009), E.A.Fedulova (2018), A.V. Tepkina (2017) Yalyalieva, T.V., Napolskikh, D.L.(2017). However, leasing issues at the regional level were derived from insufficient development and required further analysis and theory generalization and practice in regions, raised questions of problems' identification, requiring decisions by development of scientific support for leasing and their interpretation in specific businesses of lessors and lessees.

Effective management of the economy in terms of regional development means to create the essential conditions for development in real sector of the economy, to find such means that contributed to the increase in profits as each individual enterprise and for the whole region. Such aimed means for developing investment activity includes leasing, including the Republic of Mari El.

The efficiency improving of leasing market in Mari El Republic will ensure growth of some economic indicators:

1. The gross regional product growth is result of renewal in fixed assets for huge number of enterprises. The quality of these funds leads to an increase in volume and range of manufactured products.

2. New equipment, obtained under a leasing agreement, provides the employment growth by creation of new jobs as well as wage growth. It reduces social tensions in the region.

3. The increase in investment and business activity for region is due to growth of leasing activity as well as the creation of favorable conditions for the investment in the Republic of Mari El.

4. The increase in production volume for Mari El Republic will also be result of leasing as financial mechanism.

5. The activation of processes in introducing innovations of leasing sector results to competitiveness increasing of small and medium-sized businesses.

6. Stabilization of the agro-industrial orientation of Mari El Republic by the use of leasing schemes for sale of the agricultural products.

7. Growth of small business is due to growth of the opportunities to update its material and technical base and the infrastructure in view of support for small business as one of prior directions in state and regional policy in the Republic of Mari El.

8. During the import substitution policy, leasing is a tool for state regulation of its implementation, as evidenced by rules on enterprises' investment in fixed assets, namely, the issues of leasing are reflected in "plan for the import substitution in Mari El Republic for 2016-2020.

The same document regulates the application of such macro-and micro-tools in regional policy as general economic regulators and regulators of targeted influence. Moreover, the accents are placed on micro-tools in region, in connection with the value of their application in context of the individual impact on regional subjects in the areas of policy effect on labor and capital. There are quite a lot of being done to create necessary conditions for growth in the investment activity (specific actions are discussed below) in Mari El Republic. It was greatly influenced by policy on the investment support of the Ministry of Economic Development in the Republic of Mari El.

2. Data and method

According to V.D. Gazman (2016), the investment strategy of region can be defined as "a system of multi-year purposes, priorities, benchmarks and limits (imperatives) of the investment activity that define trajectory of development of the economic system". As a part of practical approach, regional investment development strategy looks like a set of the interrelated elements according to a number of criteria: tasks, implementation timeframes, resources used.

The basic objectives of the investment policy in the republic are:

- creation of conditions for the attracting internal and external investments and resources;
- search and expansion of new investment sources and the efficiency growth;
- the involvement of public-private partnership for formation of regional infrastructure.

The mechanisms in the investment policy realization are state programs, private-public partnership tools, the investment programs of state monopoly companies; the system of interaction with investors; system of measures in state support for the investors; the investment projects of organizations in the Republic of Mari El.

Thus, it is necessary to match the leasing within control and regulatory sphere with the directions of general investment policy of the Russian Federation subject.

The leasing can become more than just an object for regulation by part of the state and in its potential acts as managing and controlling tool for regional economic processes (Rybina. 2009).

Figure 1 shows priority vectors of development and support for the implementation of leasing projects, taking into account specificity of regions.

Therefore, the leasing in regional economic structure is a tool of the improvement the investment climate efficiency and productive potential in region. It is also diversifying industry factor of regional economy and means of financial infrastructure enhancing. The leasing is a way of the economic differentiation reducing in regional economy. The development of leasing is due to the establishment of condition for its effective use in the Republic of Mari El.

There is an assumption on more intensive process of the leasing transactions implementation in region as a result of the active state-business cooperation in the leasing

sector. In addition, development of leasing will be contributed by well-considered investment regulation in the Republic of Mari El; consulting support for the entrepreneurs. Thus, only with such interaction between two levels of management subjects in leasing processes will provide effective management of regional leasing services market (Fig. 2).

Fig.1 - Directions in state regulation of the economic development under leasing

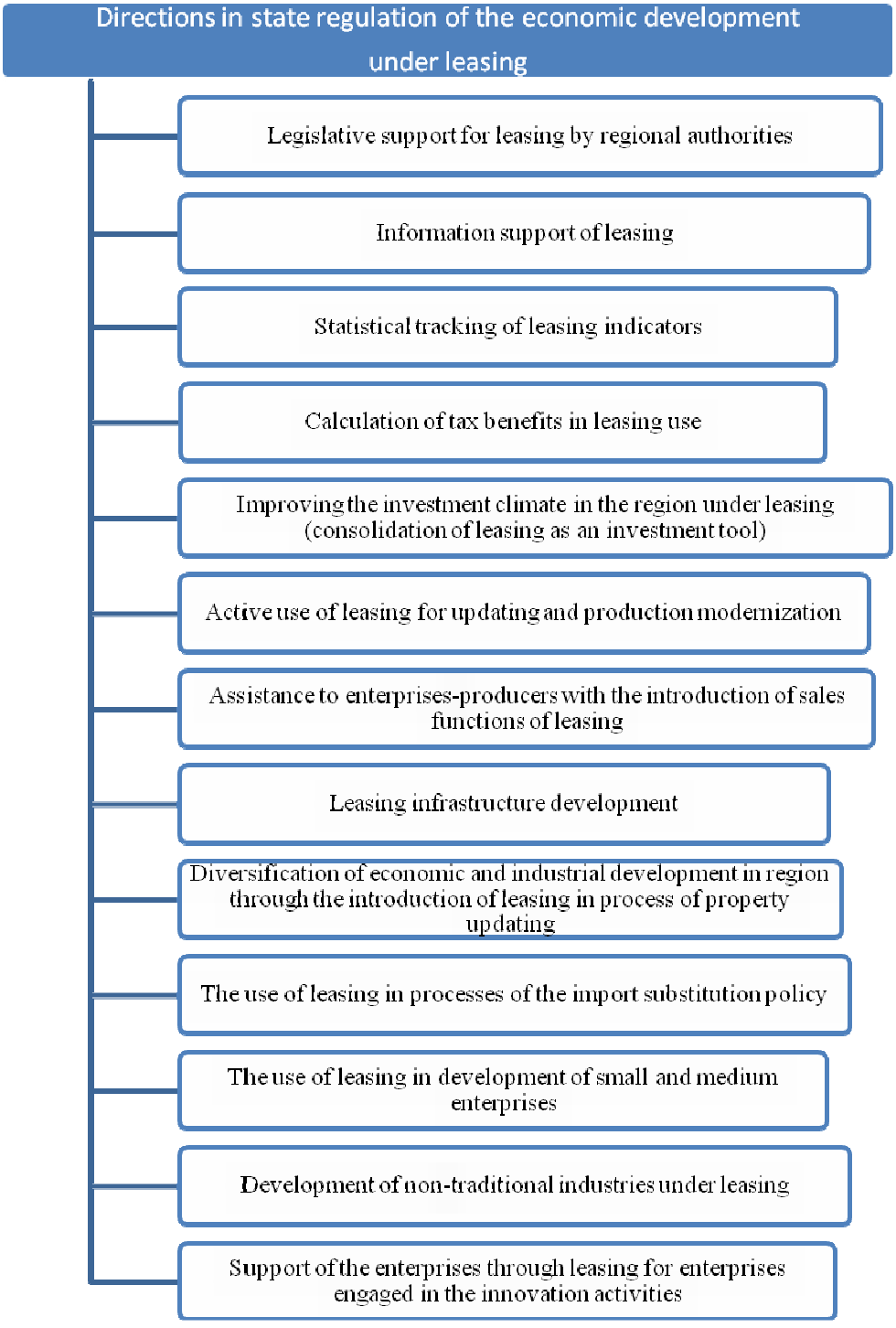


Fig.2 - Effective model for development of leasing market in the Republic of Mari El

In this regard, it is proposed to monitor the effectiveness in the investment component of leasing for development of the Republic of Mari El.

Special place among the agricultural enterprises in region is the agro-industrial leasing company AO “Rosagroleasing” (www.rosagroleasing.ru). According to the results of study, conducted by the Higher School of Economics, at the end of 2016, AO “Rosagroleasing”

ranks the first place in leasing segment of the agricultural machinery and the equipment and the second place in terms of the interaction with small business.

The leasing of the agricultural machinery demonstrates increased dynamics on regional financial domestic markets with the active participation of state. The leasing gives you the opportunity to maintain and update the agricultural machinery park on special terms that can be evidenced by the statistics - every year the harvest is done with the participation of 20% leased equipment.

The largest number of lessee's companies operates in cooperation with the agricultural company as AO "Rosagroleasing" in the Mari El Republic. The company provides the opportunity to purchase equipment for farms, pig-breeding complexes, bloodstock (cattle, small cattle). According to data, received from AO "Rosagroleasing" company up to July 1, 2017, 129 contracts were concluded in the Republic of Mari El for which fixed assets of a total value of 693,098,619 rubles are acquired.

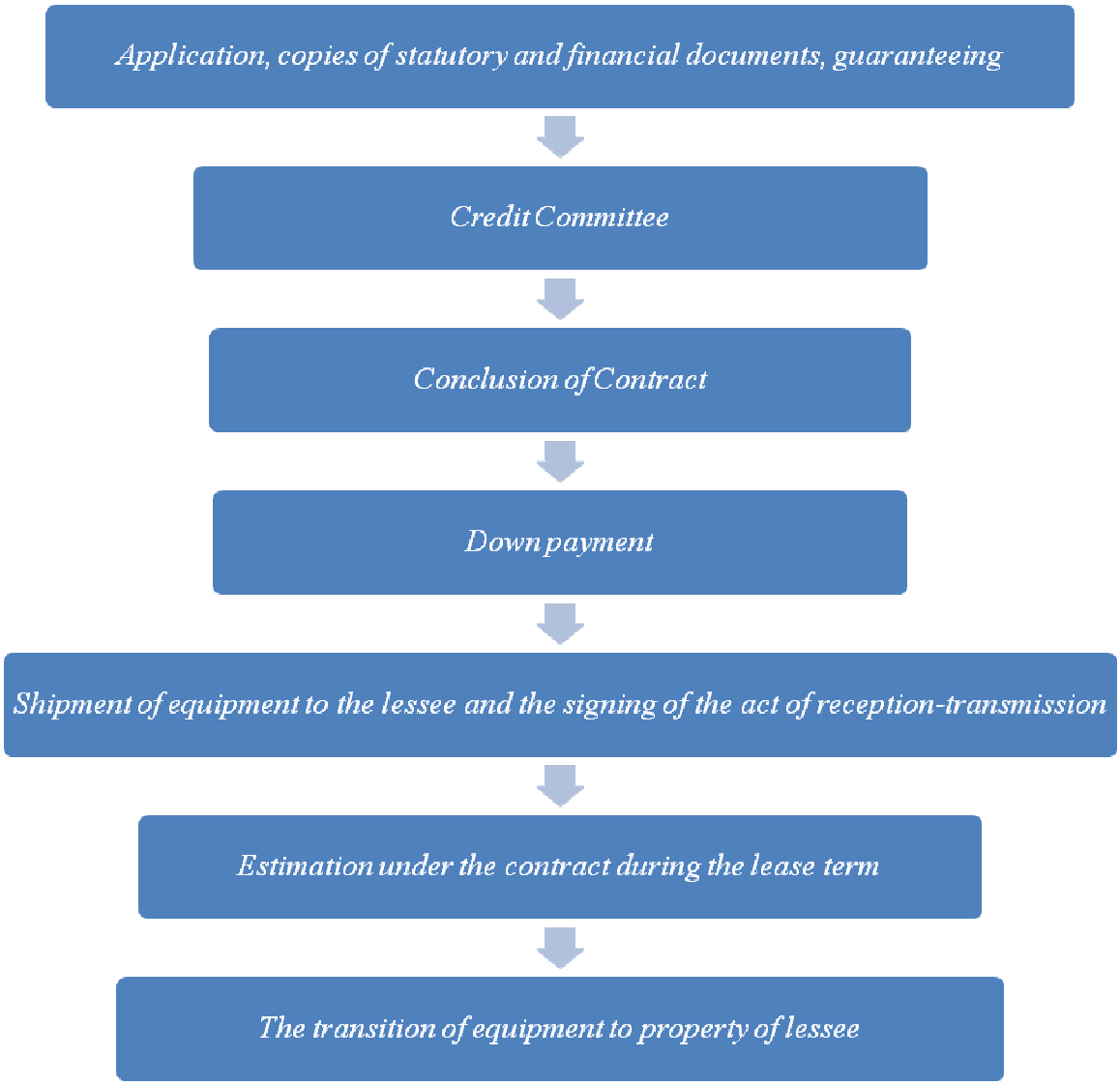
The activity of AO "Rosagroleasing" company is aimed for the achievement of target indicators in "State Program for Development of Agriculture and Market Regulation of Agricultural Products, Raw Materials and Food Markets for 2013-2020 and Food Security Doctrines of the Russian Federation ".

The framework of the enterprise looks so as it is presented in Figure 3. The company AO "Rosagroleasing" has certain budget, allocated by the state for the agriculture's financing. Further, producer of the agricultural products submits an application to AO "Rosagroleasing" company for the necessary agricultural machinery or equipment; request is analyzed by the Credit Committee and it passes the approval or rejection. In case of positive decision, the equipment is supplied by manufacturer.

Thus, the landowner gets the opportunity to purchase equipment at a cost significantly lower than market price with comfortable terms - 3.5% rise in price per year, the lease term is up to 10 years and it is offered preferential insurance.

For manufacturer of the agricultural machinery, leasing transaction provides an opportunity of growth in production volume under sales demand in the agricultural sector machinery and equipment. It leads to growth in turnover, social effect in the impact of new jobs, the establishment of condition for further production development of the industry.

Fig.3 - Scheme for the acquisition of property from AO "Rosagroleasing"



There are many methods for determining the effectiveness of leasing. Typically, this analysis is based on comparison of leasing with alternative financing options or using methods, founded on discounted estimates. However, it is almost impossible and difficult task for the assessing of the leasing effectiveness in the region since information on leasing operations is either not collected at all or if this information is collected with very limited access. The relevant estimations are made by the executors of programs at the federal level. Nevertheless, such information is often confidential.

For instance, it is necessary to assess the impact of leasing on the basis in production expansion specifically for leasing government programs. In this case, the only thing that can be done is to make an approximate estimation of the state support. For example, preferential car leasing program is designed for 60,000 cars per year, when number of domestic produced cars is about 1.1 million in 2016. Thus, the share of leasing in total production of passenger cars will be 60,000 / 1,100,000 = 5.4%. That is, every twentieth domestic car is sold under the program of preferential car leasing.

3. Analysis and results

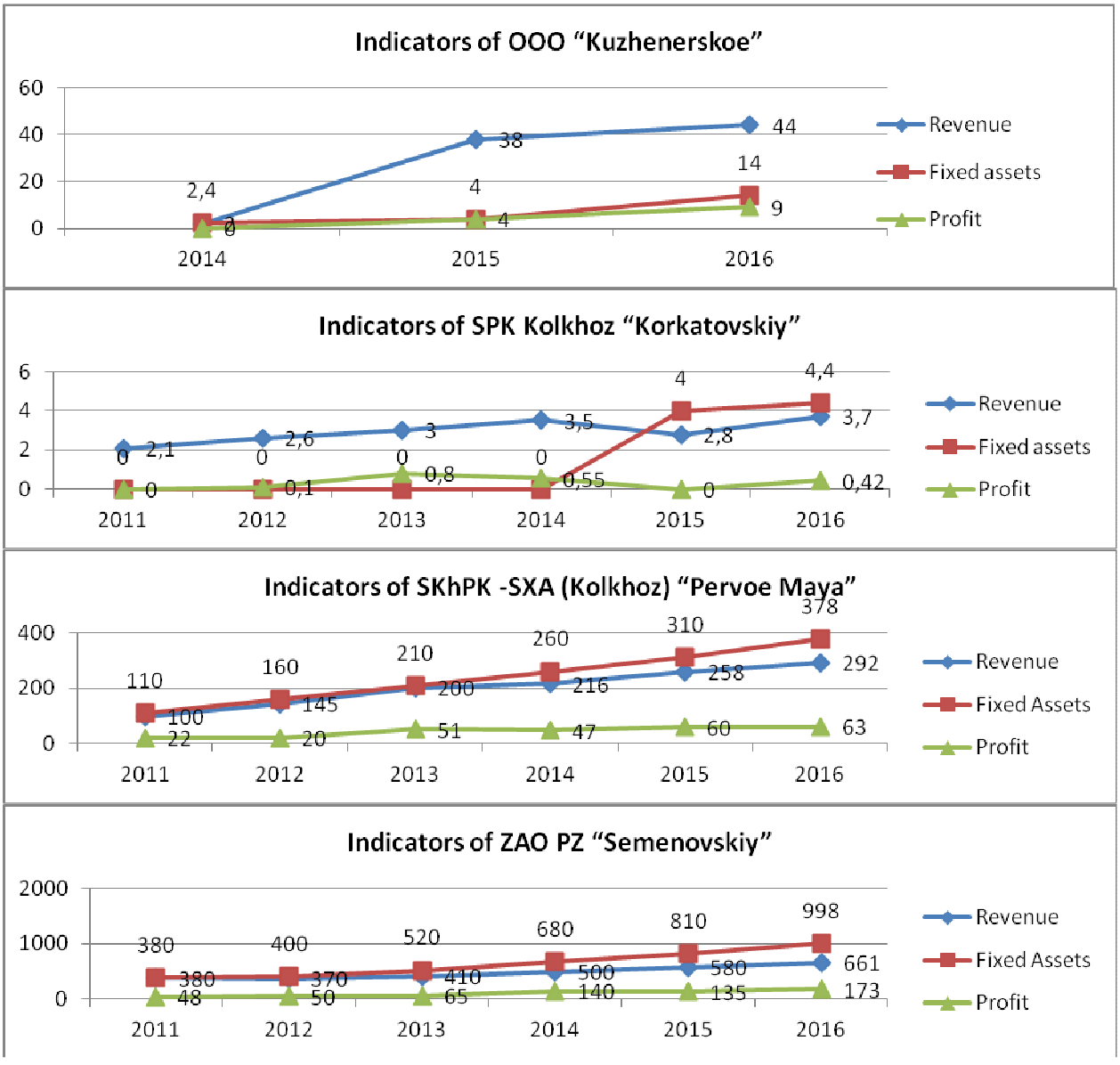
From 2002 to 2012, in the Republic of Mari El the leasing was more important according to the program of providing agricultural producers with the engineering products based on financial rent (leasing) at the expense of republican budget. Today, purchase of the agricultural machinery in leasing is possible only in the context of federal state programs in

the Republic of Mari El. For the analysis of the effectiveness for lessee companies we select a number of regional enterprises, cooperating with AO “Rosagroleasing” company (Table 1)

Table 1 – Sample of the enterprises in the Republic of Mari El, providing the acquisition of assets from AO "Rosagroleasing" company

№	Name of counterparty	Number of Contract	Total of commitments, rubles
1	OOO Agrofirm “Victoria”	1	2 500 368
2	OOO Company “Belaya Ptitsa”	1	21 386 644
3	OOO Agrofirm “Zalesie”	29	349 352 059
4	SPK Kolkhoz “Korkatovskiy”	1	742 263
5	OOO “Kuzhenerskoe”	2	9 684 071
6	SPK SKhA “Marisola”	2	1 520 939
7	SKhPK -SXA (Kolkhoz) “Pervoe Maya”	6	27 464 311
8	ZAO PZ “Semenovskiy”	6	45 658 809
9	SKhPK Kolkhoz “Voskhod”	2	4 751 113
10	SKhPK Kolkhoz im.Tukay	1	2 256 004
11	OOO “Emekovo”	3	3 203 885
	…		…
	Total	129	693 098 619

Fig.4 - Dynamics of the enterprises, effectively implementing leasing projects, million RUB.



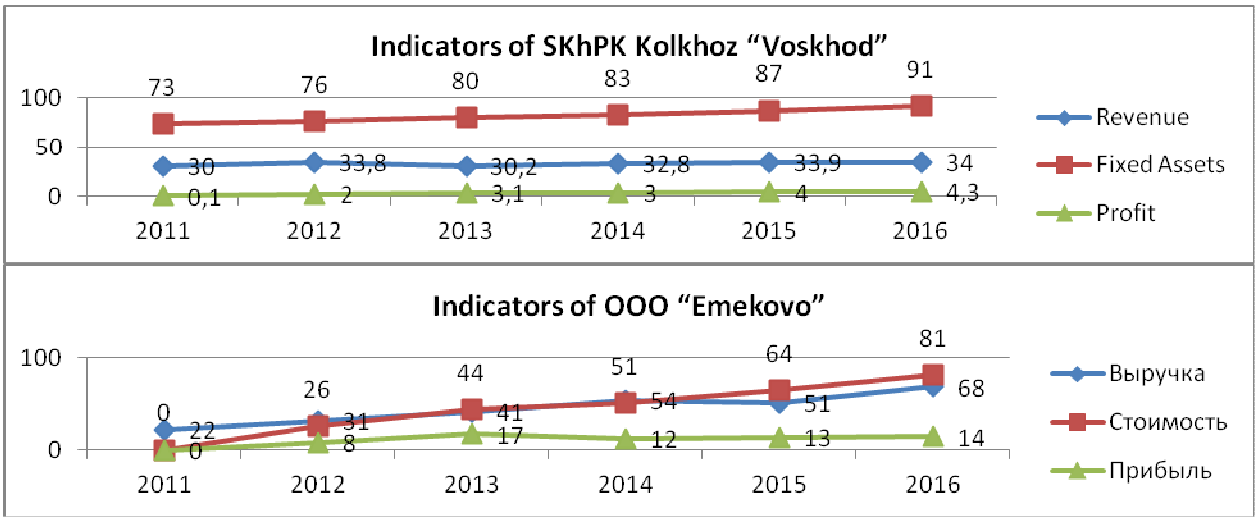
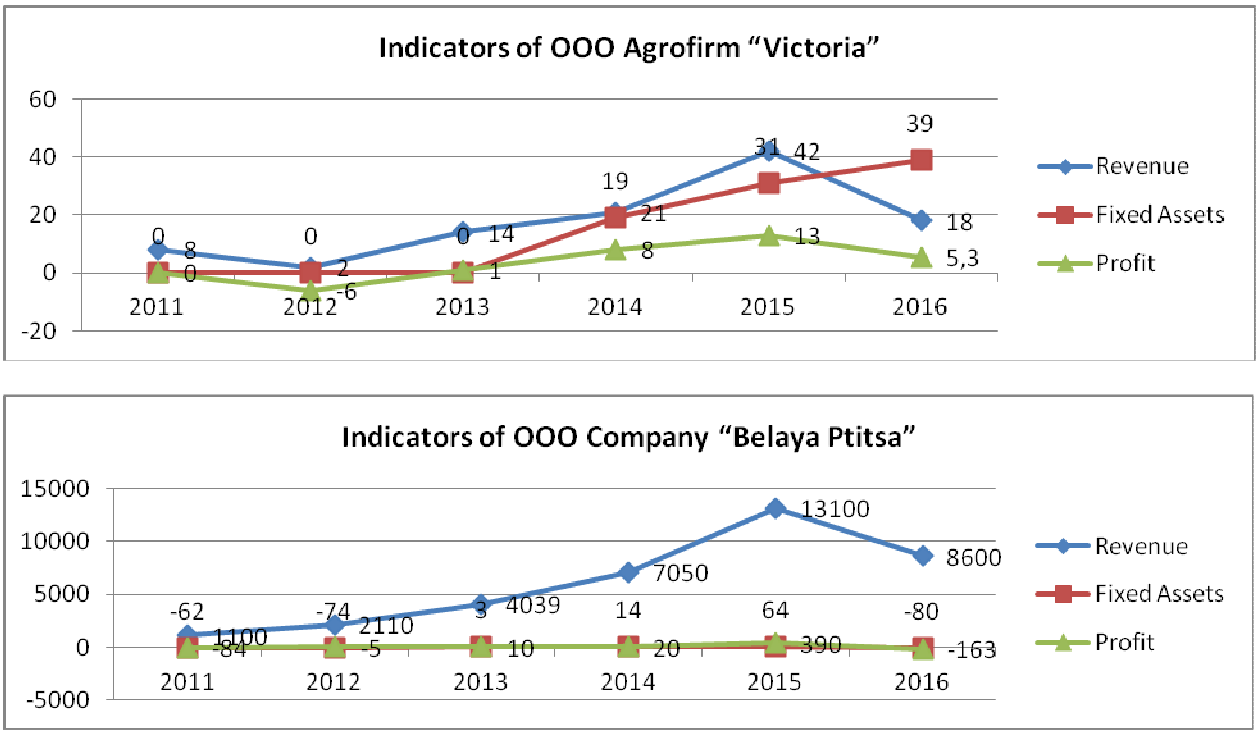
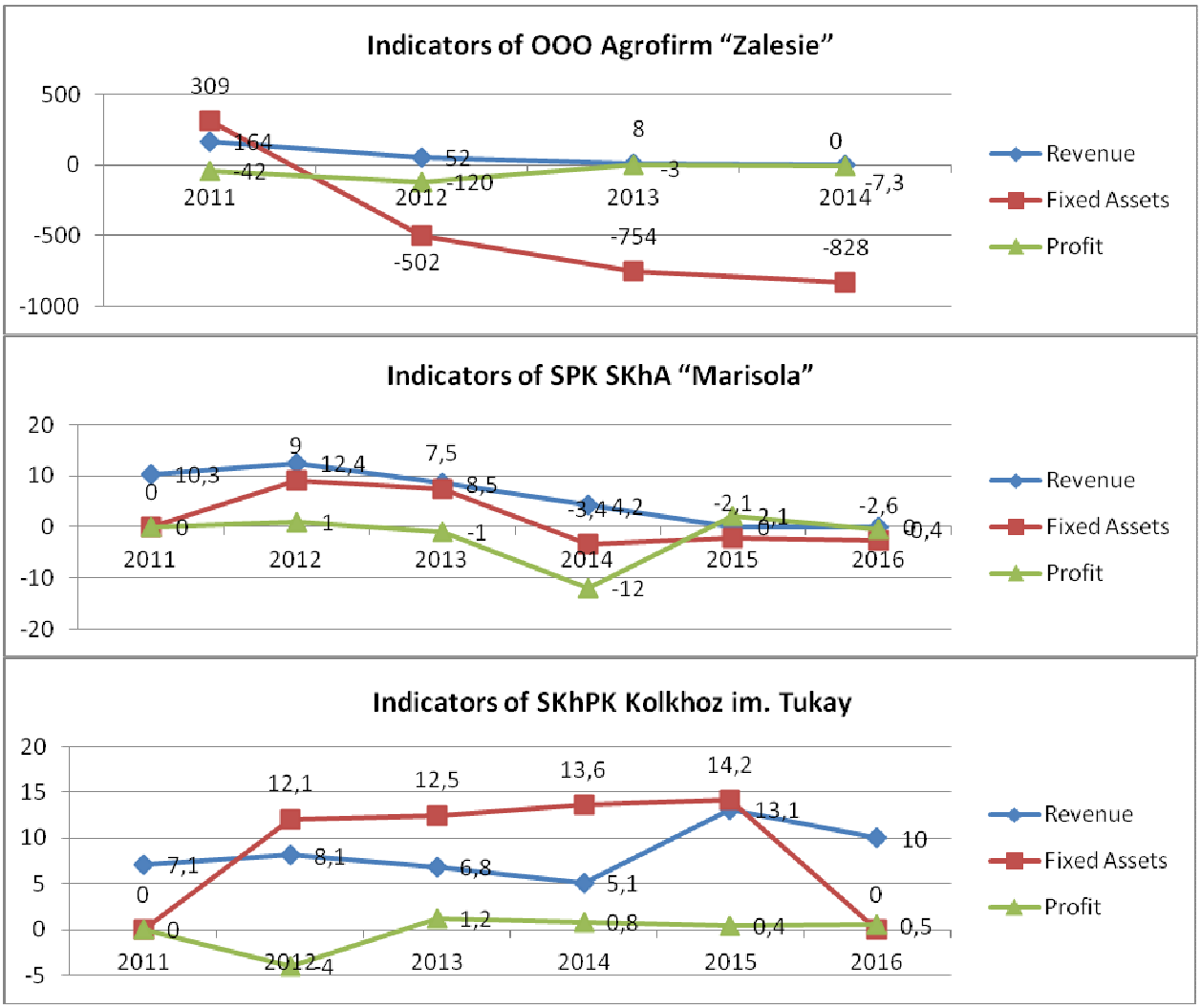


Fig.5 - Dynamics of the enterprises, purchasing property in leasing, under conditions of financial uncertainty, million RUB.





The company may have a direct and indirect influence on development of region. The direct influence is beyond counting, but the indirect impact is not subject to direct measurement. Defining the essence of lease operations, it can be tried to follow how AO "Rosagroleasing" and lessee companies realize the investment activities and how leasing projects can affect development of these enterprises.

The valuation of the enterprises held by three indicators: revenue from sales of products and goods, receipts from the execution of works, provision of services (reporting line - 2110), profit before taxation (line 2300) and value of fixed assets (line 3600). A significant disadvantage is the lack of information for 2017, because data of AO "Rosagroleasing" company is presented for 2017. However, from the analyzed sample the enterprises purchased property on lease few years earlier, and by the time of 2017 companies continue to pay leasing payments. The financial accounting reports are published by the Federal State Statistics Service with delay, the report for previous (2017) year usually becomes available in September-October of the current year (2018). Thus, it is not possible to analyze 2017 by the thesis completion.

The revenue includes funds resulting from the sale of goods or services, and with main purpose of compensation on cash expenses of company in process of its economic activity. In the case of the earnings income in planned period is ensured by continuous operation of the enterprise at the expense funds' circulation.

The profit until tax represents full amount of financial result that obtained by in the reporting period the enterprise. The analysis of this indicator is carried out on the basis of the "Report on financial results". A positive value indicates profitable activity of company, but negative value indicates its unprofitable nature. The value of this indicator is defined as difference between the income and the expenses as determination by the accounting rules. The domestic tax legislation applies leasing payments in production costs, leading to decrease

in tax base, and the lessee receives higher profit, provided tax savings in the outflow of leasing payment (Alpatov, 2016).

The increase in net assets is criterion for growth of the investment attractiveness and the indicator of company's own capital growth under capitalization of retained earnings, additional and reserve capital. As a result, financial stability of company and its rating in financial market also grows (Tepkina, 2017).

As shown in Figure 4, the enterprises of this group actively use and introduce the leasing into their activities. There is positive trend of three analyzed indicators for these enterprises. Figure 5 shows companies that are unable to benefit of it, despite the acquisition of property in leasing, or the effect of property acquisition on lease was substantially less than the effect of other economic processes in the enterprise.

For instance, "Agrofirm "Zalesie" company was included in the list of strategic enterprises and the organizations in real sector of the economy in the Republic of Mari El since 2009. It was allocated 137 million rubles from the Mari El budget. Moreover, under guarantees of Mari El government it was obtained a series of loans and grants with total amount of 1,100 million from the Agricultural Bank, AO "Rosagroleasing" company and other organizations. In this case, the company had undeveloped sales system, incomplete capacity utilization, limited expansion possibilities of markets, staff turnover and low qualifications, debt growth and insolvency of the enterprise by the end of 2015 led to bankruptcy and further liquidation.

It is similar situation with "SKhA "Marisola" company that was also one of systematically important enterprises of real sector in the economy and received government funding, but in 2016, by decision of the Arbitration Court of the Mari El Republic from 13.04.2016, case № A38-6281 / 2015 it was declared bankrupt.

According to data of AO "Rosagroleasing" such companies as "Victoria", "Belaya Ptitsa" and "Kolkhoz im. Tukay" consistently pay leasing payments on property, but financial accounting statements of these enterprises indicate non-effective management. Despite the influence of the external macroeconomic factors in form of the economic and political crisis in 2014 and the overall decline in revenues and profits, the asset value indicator grows only in the first enterprise. It means that at "Belaya Ptitsa" and "Kolkhoz im. Tukay" companies the financial conditions can be assessed as unstable. So for the avoiding negative consequences it is necessary to pose a question about the effectiveness of using property, purchased in leasing.

The situation on leasing market in the Republic of Mari El, as well as common economic situation in the region, indicates the necessity for measures to improve leasing activities in region:

1. The development of leasing credit schemes and cooperation between banks for region in the context of procedure for joint lending for the investment projects. This promotion activates participation of banks and federal companies in the leasing process and gives the ability risk spreading among several investors.

2. The Ministry of Industry, Economic Development and Trade of the Republic of Moldova has to develop the effective mechanism for provision of state grants with financing of lease projects. It is especially important for federal leasing projects in priority sectors of Mari El Republic (agriculture, innovative industry, construction, small business).

For instance, the situation is unacceptable when 137.0 million rubles were invested from national republican budget for "Agrofirm "Zalesie" company. The planned tax revenues for republican budget (as long the enterprise will be profitable) are 1.9 million rubles. Thus, it will take 72 years to recoup the money, invested from the budget. The situation with the purchase of the equipment from AO "Rosagroleasing" company for 349 million rubles amount similarly indicates an insufficiently developed system of monitoring and risk assessment for the investment projects.

3. Create division (department) of leasing under the Ministry of Industry, Economic Development and Trade of Mari El Republic, similar to the Ministry of Economic Development of the Russian Federation and its main functions are shown in Figure 1.

4. It is necessary to create an information and consulting center on leasing issues in the Republic of Mari El. The classic success factors are the following prerequisites:

- the extensive database of leasing is caused by the need for the organization information support for development of leasing in Mari El Republic and outside. Transparency and

information about main leasing programs will help improve the collection of statistical data on leasing projects, for monitoring the situation and adjust strategic decisions on leasing;

- consulting services in the field of development and decision-making on financing under leasing scheme, management of leasing projects, efficiency analysis, risks calculation, organization of the accounting.

- the introduction of a leasing reform in 2016 may have very negative impact on local leasing companies owing to high demands and even lead to their closure. In this regard, the information and consulting center on leasing should be aware of all changes affecting the leasing activity, provide training on the basics of leasing activity in new conditions, its legal, organization, accounting and economic features,

- the importance of maintaining and improving high professional level of specialists in such leasing center, as well as cooperation with local authorities and liaise with universities, research centers or institutes.

- the foundation of advertising campaign in favor of a leasing and consulting center. The main types of incentives for leasing sales are the following possibilities: personal (individual or group) conversations with potential consumers, representatives of leasing companies in exhibitions and presentations of equipment and vehicles, test drives and other events; conduction of training with potential buyers about the advantages of leasing in comparison with other types of financing; organization of consulting sales.

4. Conclusion

Therefore, represented analysis of the theory and practice in lease using in regions on the example of Mari El Republic leads to the following conclusions:

1. The increase of the efficiency in lease market in the Republic of Mari El will ensure growth of such economic indicators as gross regional product; the employment and wages of population; the investment and business activity in region; the increase in production of certain goods; the activation of the innovation process, stabilization of industry and agriculture; small business development.

2. For creation of favorable conditions for leasing development, it is necessary to create a number of conditions that could ensure successful use of leasing in the Republic of Mari El.

3. For the analysis of the efficiency of lessee companies a number of enterprises, engaged in the active work with AO “Rosagroleasing” company in the Republic of Mari El, were selected. The rating of these companies was based on three indicators: revenue from sale of products and goods, revenues connected with performance of work, provision of services, profit before tax and value of fixed assets. There is positive dynamics of three analyzed indicators at the enterprises with active using and introducing leasing in the operations as shown by the analysis. Nevertheless, there are enterprises that could not take advantage of its benefits, despite the acquisition of property in leasing, or the effect to the acquisition of property in leasing was substantially less than the effect of other economic processes in the enterprise.

4. The formation of comprehensive system on leasing relations provides the opportunity for the most advantageous cooperation between participants of leasing activities that ultimately gives powerful impetus for development of entrepreneurship in general.

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STRATEGIES OF SMALL ENTERPRISES DEVELOPMENT IN AFRICAN COUNTRIES

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Abstract
The article describes the basic concepts and classification icons/symbols of small enterprises. Small enterprises are defined by the author as irreplaceable drivers of economic development, which are a source of economic growth and a tool for resources redistribution. This study analyzes the current strategies of small enterprises development in African countries such as Morocco, SAR and Tunisia, which made it possible to formulate conclusions and recommendations.

Keywords: African country, SMEs, entrepreneurship, small enterprises development strategies, competitiveness.

1. Introduction

The relevance of the study is determined by the need of increasing the productivity of small businesses in Africa, as a catalyst for progress on this continent. On the African continent small enterprises make up 90% of private companies and provide 66% of workplaces, while micro-enterprises make up 70%. The low level of socio-economic status and political instability in Africa are obstacles in the acceleration of economic development.

The aim of the article is to analyze the existing strategies of small enterprises development in African countries (Morocco, SAR, Tunisia).

Increasing of small business productivity and creating programs for its development can be a catalyst for the progress in Africa, which determines the relevance and promptness of this study.

2. Concept and classification of small enterprises

In the scientific literature "small enterprises" are defined as "entrepreneurial activities carried out by subjects of a market economy in certain cases established by laws, government agencies or other representative private or public organizations" [1]. The economic, social and cultural aspects of a country are reflected in the characteristics of small enterprises. That is why the definitions of small businesses change over time and in accordance with the certain geographic region. For example, some countries do not distinguish between legal and statistical definitions. This applies to Canada, Greece, Portugal, Mexico and Slovakia. In this case, the definition may be based on an income threshold, such as in Canada, or on labor rates such as in the UK, the Slovak Republic or Mexico. Also, the evaluation of small business can be based on two criterias: the number and qualifications of employees (e.g. in Portugal). The countries of the European Union have accepted the differences between legal and statistical definitions. The main criteria for determining statistical target is the number of employees; in a legal definition – consideing the number of employees, annual turnover, total balance and degree of autonomy (Table 1).

Table 1. Criteria of small enterprises in European Union

Companies	Number of employees	Annual turnover (euros)	Total balance (euros)	Autonomy
Micro-enterprises	From 1 to 9	Less than 2 million	Less than 2 million	25% and more from the capital or the vote from another company
Small enterprises	From 10 to 49	Less than 10 million	Less than 10 million	

In Morocco, there are the following small business criterias: a workforce of at least 90 full time employees and annual turnover, excluding tax, at least 50 million dirhams and/or a total balance limited to 60 million dirhams. For new small enterprises the law provides that they must have an initial investment program of less than 10 million dirhams and take into account the ratio of investment and employment to less than 100,000 dirhams [5].

Regarding the definition of small business in the Democratic Republic of Congo, several definitions are formulated either according to financial capital, or according to labor, or according to the nationality of the owner or the specialized management method. There are four definitions.

Law No. 073-011 of January 5, 1973, establishing the Office for the Development of Small Congolese Enterprises, defines small enterprises as agricultural, commercial, industrial and service enterprises owned by individuals Congolese citizens or companies whose capital belongs to the majority, individuals or legal entities of the Congolese citizenship in which all management functions, i.e. management, finance, production, marketing and supply are carried out by the head of the company. It is worth noting that this definition has a generalizing character and does not demonstrate the necessity of small business. Table 2 presents the classification of small enterprises.

Table 2. Characteristics of a small enterprise [2, p.268].

Business activity	Businexx-sections	Legal forms	Company orogin
Commersial enterprise	Primary (agricultural enterprises and possibly mining)	State company	African
Banks or similar financial institutions	Secondary (industrial enterprises)	Private company	
Administration	Tertiary (service companies: transport, commerce, banking etc.)	Company anonymously (SA)	
Industrial enterprise	Informal	Individual business (EI)	Foreign
Service companies		Limited Liability Company «Interpersonal Limited Liability Company» (EURL)	
		Limited Liability Company (SARL)	

3. Characteristics of small enterprises development strategies

Let us analyze the strategies of small enterprises development in certain African countries.

3.1. Small enterprises development strategies in Morocco

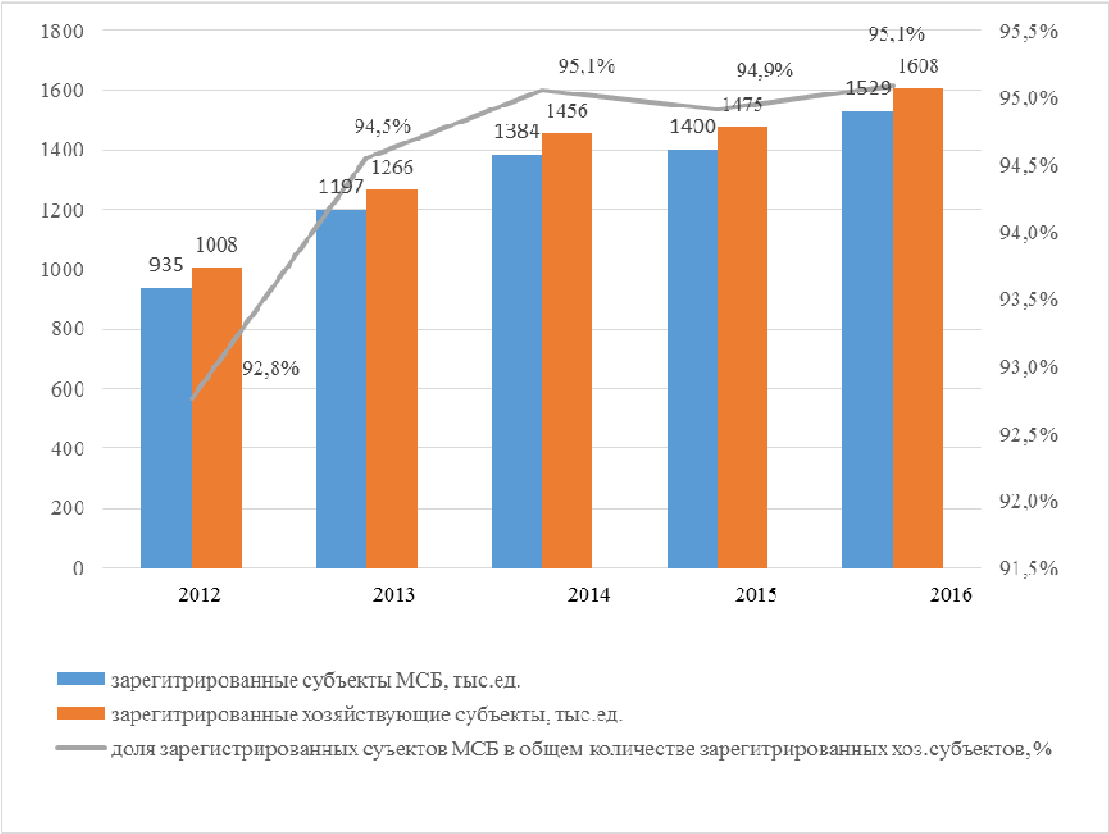
To ensure the efficiency and sustainable development of small business, the government of Morocco introduces a policy for supporting small businesses. The state has established institutions and funds designed to assist and modernize small businesses. The Central Guarantee Fund provides access to financing and the National Agency for the Promotion of Small Enterprises for the pilot implementation of the national program of small businesses modernization.

The government of Morocco is implementing a number of programs (MICNT, INTILAK, TATWIR, Innov'Act) aimed at improving the competitiveness of small business through three initiatives: small business growth, strengthening its competitiveness and creating the competitiveness of new small businesses.

The Imtiaz program is one of the measures taken by the National Industrial Development Pact (PNEI), which aims to support small businesses by strengthening its financial and non-material assets. Analysis of the distribution of small business by regions in Morocco showed that the largest number of it are in the city of Casablanca – 220.4 thousand or 14.4%, Tangier-Tetouan – 213.9 thousand or 14.0%, and Rabat-Sale – 186.0 thousand or 12.2%. The smallest quantity of small business subjects are in North-Moroccan region – 40.8 thousand (2.7%), West-Moroccan region – 45.3 thousand (3.0%) and Menes-Fez – 49.4 thousand (3.2%) [9]. This is due to the agrarian orientation of the regions and small volumes of production.

Among the registered subjects of small and medium businesses the largest number of legal entities are in the city of Casablanca – 77.8 thousand (31.4%), Tangier-Tetouan – 34.8 thousand (14.0%), South Moroccan region – 22.2 thousand (9.0%) and Rabat-Sale – 16.8 thousand (6.8%). Figure 1 shows the dynamics of the number of registered SMEs and their unit weight in the structure of the total number of economic entities of Morocco [8].

Fig. 1 Dynamics of the number of registered SMEs and their unit weight in the structure of the total number of economic entities of Morocco[9]



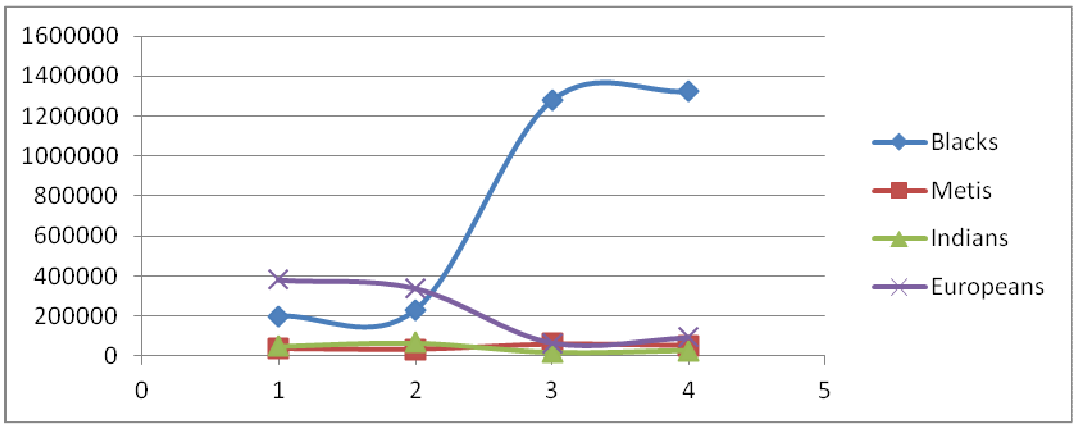
In 2016, the number of active SMEs were increased by 6.9%. At the same time, in the structure of SMEs the share of active individual entrepreneurs were 73.3%, peasant (farmer) entities – 18.2%, legal entities of small and medium-sized business – 8.4%.

3.2. Strategies of small enterprises development in SAR

The characteristics of South African small enterprises are very different from those of other developing countries because of the apartheid heritage. A new economic sequence is a sufficient condition for the revival of small business economy. The elimination of apartheid (if necessary) is not enough to master the full potential of small business economy. Structures inherited from apartheid make a major contribution to economy that has two sides, characterized not only by a high level of productivity (modern), but also by another (informal) sector with low productivity and little interaction between the two sectors. There is also a division by race [16]. The transitional stage is marked by political uncertainty and significant crimes and violence that have a negative impact on direct investment in the business sector.

Most small business owners (71%) in South Africa are African and followed by Europeans (20%). The number of white homeowners declined in the period 2008-2015. Indians and blacks were the only groups of people who emphasized an increase in the share of small business ownership. The number of small enterprises owned and operated by Indians increased by 47% in the period 2008-2015, while the number of small enterprises owned by blacks increased by 5% (Figure 2).

Fig2. Dynamics of structure of small enterprises owners in SAR in 2011-2015 [13]



The national structure of local economic development in South Africa aims to support the development of a sustainable economy through integrated government action. This government action is aimed at planned development, it stimulates the "heart" of the economy, which includes small enterprises operating in local municipalities [4]. It is based on an assessment of economic development practice and on the current context and problems of South Africa. The entry into force of the Small Enterprises Act since 1996 officially recognized the existence of small business in South Africa, which served as the basis for creation and promotion of small business at all levels of public administartion. Many informal small enterprises provided means of subsistence for people in South Africa. That is why the creation of local economic development units requires an understanding of various forms that can be implemented in this area, including the development of small business.

Let us regard the distribution of small enterprises between 9 regions of South Africa (Table 3).

Table 3. Placing of small enterprises in South Africa [15]

Small enterprises	The number of small enterprises in 2008				The number of small enterprises in 2015			
Sector	general	Formal	Informal	Other	general	formal	informal	other
General	2182823	666501	1420933	95389	2251821	667433	1497860	86528
Western Cape	223933	114976	95212	13745	230324	110107	110188	10030
Eastern Cape	218865	56579	154631	7655	197366	50670	141739	4957
Northern Cape	29894	11450	11768	6676	20611	8534	9058	3019
Independent states	114949	31040	76127	7783	96846	26224	60816	9806
Kwazulu-Natal	418406	102591	289347	26468	373434	74976	283165	15293

North-West	109860	25817	76855	7188	112856	27430	79153	6273
Gauteng	687556	270093	405180	12283	785321	306231	465100	13989
Mpumalanga	193259	29760	156814	6685	185399	35208	141129	9063
Lompopo	186101	24193	155001	6907	249663	28054	207512	14098

From 2008 to 2015 the number of small enterprises in South Africa increased by only 3%. As recorded the highest rate of growth in the number of small business (34%) was among the Limpopo regions, and second place goes to Gauteng (14%). Northern Cape lost the most (31%), after it the rest of the independent states (16%) [19].

The ratio of GDP and small business is an indicator of the economic environment in which small enterprises operate. Of the 2.2 million small enterprises in South Africa, the overwhelming majority (944.5 thousand) are in the domestic trade (wholesale and retail trade) and residential sectors, followed by the public and social services sector [11]. However, the turnover of small enterprises in different sectors varies greatly.

Taxes paid by small enterprises increased significantly between 2010 and 2015. In 2010 the economy had just “recovered” after the Great Recession, after which companies recovered a little in subsequent years. Currently, most corporate taxes are paid by enterprises in the trade and manufacturing sectors.

Financial services are a general process of providing basic financial opportunities such as loans, grants and donations. Small enterprises need to build relationships with relevant financial service providers. Issues of managerial literacy in small enterprises of SAR have a number of problematic aspects in terms of the availability of business knowledge, lack of management skills, inadequate planning and staff inexperience [6]. Dependence on the sole ownership of the majority of small enterprises leads to inefficient use of human resources, where there are no new qualified personnel.

Today South Africa focuses on how to ensure effective economic development so that most citizens enjoy the benefits of the country's economic activities. Leaders in the economic sphere of the country adhere to the fact that sustainable economic activity is necessary for the well-being of the society.

South Africa has provided many initiatives to find answers to development problems. Interventions to promote local economic development include different initiatives such as public-private partnerships and small business promotion [12].

3.3. Strategies of small enterprises development in Tunisia

The small business development strategy in Tunisia for the coming period is based on the implementation of a new generation of economic and social reforms by consolidating the foundations of management and improving the climate of the economy. Priorities are business, the development of economic structure, the deepening of integration into world markets and the development of partnerships in addition to developing the financing system, upgrading infrastructure, ensuring a balance between regions, maintaining human and social resources, and strengthening sustainable development. The new management policy is aimed at consolidating the principles of democracy and increasing the efficiency of the administration in addition to improving the management of public funds and facilitating access to information [3].

The development of the small business sector is a top priority considering the potential of this sector, which calls for the need to accelerate the recovery of the sphere, liberalization of service sector and supporting of promising small enterprises in this section.

The economy of Tunisia is considered one of the most diversed and stable economies in Africa.

The new industrial strategy for 2025 (what does it have specifically for the development of the SB?) demonstrates the country as a pole of innovation for the future in the Euro-Mediterranean region. The new industrial policy is based on the creation and development of small business, as well as on investments in research and development of technological innovations in the conditions necessary for increasing attractiveness and competitiveness at the international level (Agency for the Promotion of Industry and Innovation, 2016) [17]. The main objectives of the strategy of the Tunisian industry by 2025 are:

- increase in exports of the industrial sector of Tunisia to 50 billion dinars by 2025 compared with 23.7 billion dinars in 2014;
- increase in added cost of export sectors from 15% at present to 20% by 2020;
- growth in the share of sectors with high technological content from 20% of GDP in 2015 to 30% in 2020;
- growth rate of investment to 25% of GDP in 2020.

Despite of the development of small business in Tunisia, many of these small enterprises face significant challenges. First, there is the difficulty of accessing funding sources during the company's long-term operation or after obtaining working capital.

The small business of Tunisian industry is the first major program implemented in Africa. The results of this program are very encouraging, and in Tunisia remains the relatively dynamic economy of Africa [10, pp. 116-125].

In Tunisia, small businesses provide more workplaces than large enterprises. According to the government of Tunisia, small enterprises in the informal sector employ more labor. The development of the informal sector is associated with several problems, such as for example laws on bank financing for small business with the exception of cases of renewed banking credit conditions.

With the discovery of Tunisian economy in the European market small enterprises have proven their role in the development of economic activity, workplaces creation and the reduction of poverty and inequality. Since 1995 Tunisian officials have been trying to promote this role and are now forced to intervene in order to facilitate the receipt of credit by small enterprises, which despite the various mechanisms and institutions created to adapt to their needs remain a very important part of economic life. This means that the fundamental economic role of the bank is not clearly defined in Tunisia. Domestic credit provided to the private sector and non-financial public enterprises accounts for about 70% of Tunisia's GDP, while in the EU it averages 120% [7].

4. Conclusion

The study presented leads to a number of conclusions.

1. In the context of globalization and increasing competition the study of new markets is becoming a necessity especially for small business. In Africa, there are opportunities for the development of small enterprises that they want to export to a number of European countries.
2. In Morocco in order to ensure the efficiency and sustainable development of small business the government is implementing a policy aimed at its support. The state has established institutions and funds designed to assist and modernize small businesses. The Central Guarantee Fund provides access to financing and the National Agency for the Promotion of Small Enterprises – for the pilot implementation of the national program for modernizing small businesses.
3. The national structure of local economic development in South Africa aims to support the development of a sustainable economy by encouraging and supporting small enterprises.
4. The economy of Tunisia is the most diversed in Africa, and therefore small business has great potential for development. The government of Tunisia wants to liberalize the service industry.

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INVESTMENT IMPROVEMENT EFFORTS IN THE AGRICULTURAL SECTOR

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Abstract

The agricultural sector in Central Java has great potential and contributes to the third largest GRDP. It can absorb the largest labor force. This sector also has a large impact on other economic sectors. However, investment in the agricultural sector is very small each year. This study aimed to determine the factors that caused low investment in the agricultural sector in Central Java Province, and formulated priority programs in increasing investment in the agricultural sector in Central Java Province. It used quantitative approach with primary and secondary data. The analyses used were regression using the Ordinary Least Square (OLS) and Analytic Hierarchy Process (AHP) estimation methods. The findings of this study indicated that the factors that influenced the low investment in the agricultural sector in Central Java was Gross Regional Domestic Product (GRDP). Labor was the main criterion in increasing investment in the agricultural sector in Central Java Province. The next criteria were the criteria for the availability of land for agriculture, GRDP criteria, and the criteria for credit interest rates. Factors that hinder the strategy of increasing investment in the agricultural sector were infrastructure, low quality of human resources in the agricultural sector, and lack of access to capital. The solutions that can be done are by reducing the conversion of agricultural land, improving the quality of labor in the agricultural sector, and providing easy access to banking capital for farmers.

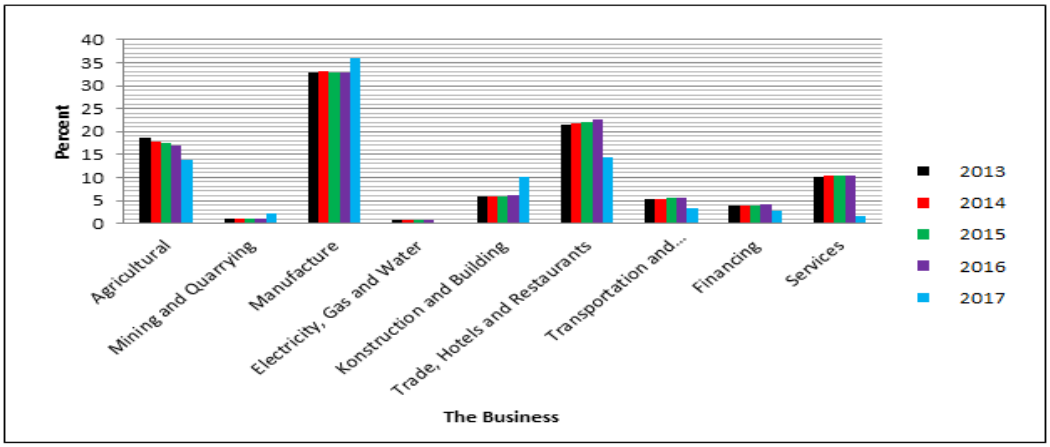
Keywords: Investment, Agriculture, Strategy, Central Java, Analytic Hierarchy Process.

1. Introduction

Development and investment activities are two things that are very closely related because the formation of capital or investment is seen as one of the main factors in economic development. According to Harrod Domar (in Badrudin 2012: 127) investment is the key to economic growth because investment can create income and can increase the economic production capacity of a region through increasing capital stock. It not only affects the formation of national output but can also have an effect on increasing the establishment of various industries so that it will have an impact on reducing unemployment. Thus, investment can increase national output and employment opportunities which will ultimately have an impact on economic welfare.

Central Java is one of the national food buffer provinces. The importance of the agricultural sector in Central Java Province can illustrate that the agricultural sector can be a mainstay sector if its potential can be explored and continues to be driven to become the engine driving the economy of Central Java Province. When viewed from the structure of Central Java's GRDP, the agricultural sector is included in the top three contributors to Central Java GRDP in 2013-2017 after the processing and trade industries, hotels and restaurants. This can be seen in Figure 1 below.

Figure 1. The Distribution of Percentage of GRDP with the Basis of Constant Prices According to the Business Field of Central Java Province 2013-2017



Source: Jawa Tengah Dalam Angka, 2017

Based on the diagram in Figure 1, it is known that in 2013-2017 the manufacturing industry sector had the largest contribution of the total value of Central Java GRDP. It was then followed by the trade, hotel and restaurant sector. The agricultural sector contributed the third largest after the manufacturing industry and trade, hotels and restaurants. Nevertheless, the economy of Central Java still has an agrarian pattern because there are still many residents in the countryside who still rely on the agricultural sector as their livelihood. This is also supported by the study of Friday Francis (2012) who says that development in the agricultural sector in rural areas is very important to be improved because most economies in African countries, especially in rural areas still rely on the agricultural sector to meet food needs in African countries. Also, agriculture sector is one of the most important raw materials for increasing economic growth in the industrial sector in African countries. Based on data from the Central Statistics Agency (BPS, 2017: 69) in 2013-2017 the number of people working in the agricultural sector was higher than other economic sectors in Central Java Province. This can be seen in Table 1 below.

Table 1: Population Aged 15 Years and Over Who Work According to Major Occupation Fields in Central Java Province 2013-2017

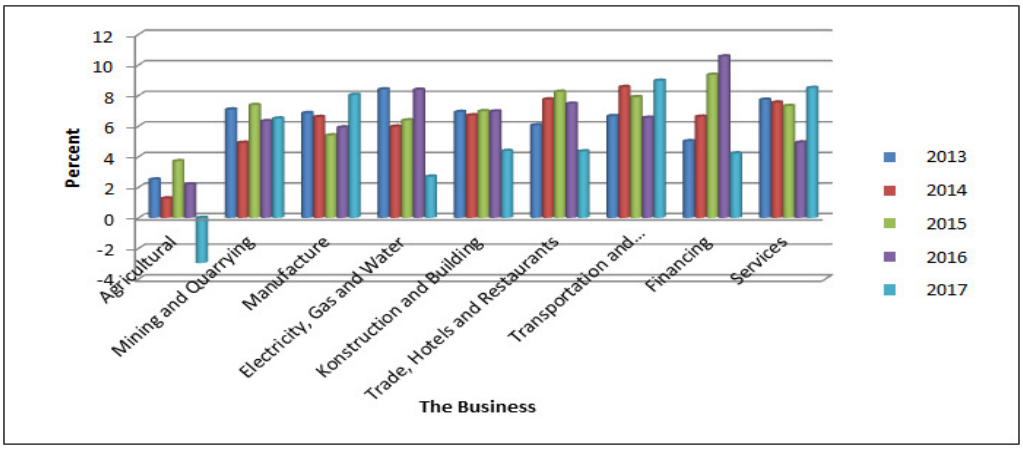
Sector	2013	2014	2015	2016	2017
Agriculture	5,616,529	5,376,452	5,064,377	4,926,629	5,173,986
Mining, Electricity, Gas & Water	136,625	108,592	117,772	87,143	115,201
Manufacture	2,815,292	3,046,724	3,297,707	3,044,428	3,173,217
Kontruction and Building	1,046,741	1,097,380	1,207,067	950,578	1,269,113
Trade, Hotels and Restaurant	3,388,450	3,402,091	3,447,147	3,585,596	3,715,488
Transportation	664,080	563,144	547,944	603,862	587,391
Financing	179,804	264,681	282,810	314,246	322,402
Services	1,961,926	2,057,071	2,168,066	2,451,566	2,193,884

Source: Jawa Tengah dalam Angka, 2017

The Central Java agricultural sector was the sector that absorbed the largest labor force compared to other economic sectors from 2013-2017. Even though the absorption of labor in the agricultural sector was quite large, the number of workers in the agricultural sector from 2013-2017 continued to decline. This was due to the transition of traditional economic structures to the structure of a modern economy which has been dominated by the manufacturing sector. Therefore, many workers in Central Java were more interested in working in other sectors such as the manufacturing industry which is always increasing every year with the hope that they will get higher wages or salaries than working in the agricultural sector, although the agricultural sector was able to provide the third largest contribution to the value of Central Java's GRDP and the workforce working in the agricultural sector was the

most compared to other economic sectors. However, the growth rate in the agricultural sector was the smallest compared to other economic sectors. This can be seen in Figure 2 below.

Figure 2. GRDP Growth Rate on the basis of Constant Prices according to the Business Field of Central Java Province 2013-2017



Source: Central Java in Figures, 2017

Based on the diagram in Figure 2, the GRDP growth rate in the agricultural sector was the smallest compared to other economic sectors which were equal to 2.51% in 2013 even this figure always decreased until its growth was negative in 2017 which were -2.95%. The low rate of growth in the agricultural sector was due to a lack of government support in the agricultural sector such as low infrastructure, a lack of government capital assistance in the agricultural sector, traditional technology. Therefore the growth rate in the agricultural sector was very slow from 2013-2017.

Even though the Agriculture sector was one of the third largest contributors to GDP and was a potential sector as well as absorbed the most labor. However, investment in the agricultural sector in Central Java Province was less developed and almost no investors invested in the agricultural sector, including the primary sector compared to the secondary sector such as the manufacturing industry.

Table 2: The Realization of the Value of Domestic Investment and Foreign Direct Investment in Central Java2013-2017 According to the Sector (billion)

Sector	2013	2014	2015	2016	2017	Total
Agriculture			27,107	3,068	1,400	31,575
Mining	18,000					18,000
Manufacture	3,440,448	1,710,962	2,337,312	999,548	3,284,531	11,772,801
Electricity, Gas, & Water						NA
Konstruction	14,350	16,132	34,000	15,500		88,469
Trade	103,078	209,879	174,957	118,265		606,179
Transportation	33,075	175,620			3,646,347	3,855,043
Financing						NA
Services	1,800	10,975	9,437	720		22,932

Source: The Central Bureau of Statistics of Jawa Tengah Dalam Angka

Based on Domestic Investment (PMDN) and Foreign Investment (PMA), the investment invested in the agricultural sector was very small compared to the manufacturing sector. In 2013-2017 Central Java's largest investment was invested in the manufacturing sector, which amounted to 11,772,801 billion. Then, it was followed by the transportation and communication sector, which amounted to 3,855,043 billion and the trade, hotel and restaurant sector which amounted to 606,179 billion. The agricultural, mining and services sectors got small domestic investment (PMDN) and foreign investment (PMA) from 2013-2017, which was 31.575 billion for the agricultural sector, 18,000 billion for the mining sector and 22.932 billion for the services sector.

Based on the description above, it can be seen that the agricultural sector had great potential and contributed the third largest GRDP as well as could absorb the largest number of workers, of course, this sector also has a large impact on other economic sectors. However, investment in the agricultural sector is very little from year to year with almost no investment. Therefore, investment in the agricultural sector in Central Java Province is still relatively few and underdeveloped.

This is also supported by a research conducted by Daniel (2015) entitled "Chinese Trade and Investment in the Nigeria's Agricultural Sector: a Critical Analysis" which shows that investment in the agricultural sector in Nigeria is still low compared to other economic sectors because the agreement trade with China has still not been improved. It was caused by the development of the agricultural sector in China is more advanced and developing in increasing investment in the agricultural sector in the country of Nigeria. As a result, further studies are needed on factors which can cause foreign investment and domestic investment do not invest in the agricultural sector, the Government's strategy to increase both domestic and foreign investment in the agricultural sector to the economy of Central Java, and obstacles and solutions to improve investment in the agricultural sector in Central Java.

2. Methods

The data used in this study were time series secondary data and primary data. The analytical method used was regression analysis and the analysis of Analytic Hierarchy Process (AHP). The estimation method was realized by the use of Ordinary Least Square (OLS). The data were collected through questionnaire technique, interviews, observation, and documentation. The sample taken in this study were 11 key persons consisting of academics, the private sectors, the government, and the communities.

The variables used in this study were dependent and independent variables. The dependent variable used was investment in the agricultural sector. On the other hand, the independent variables used were agricultural sector labor, agricultural sector GDP, Credit Interest Rate (SBK), and availability of land for agriculture.

The analytical method employed in this study was multiple linear regression analysis with estimation of Ordinary Least Square (OLS). The regression equation built in this study is as follows:

$$Y = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + \beta_4 X4 + e$$

Notes:
Y = Agricultural sector investment
β_0 = Constants
β_1 X1 = Credit Interest Rate (SBK) Variable
β_2 X2 = GRDP in the agricultural sector Variable
β_3 X3 = Labor in the agricultural sector Variable
β_4X4 = Availability of land for agriculture Variable
e = error level

In addition, this study also used the Analytic Hierarchy Process (AHP) method with the aim of developing priority programs that must be included in an effort to increase investment in the agricultural sector in Central Java Province. Therefore, this study required several competent (key-persons) parties to determine program alternatives in an effort to increase investment in the agricultural sector in Central Java Province. Moreover, the arrangement of hierarchies needed to develop several programs in an effort to increase investment in the agricultural sector in Central Java Province which was offered by relevant stakeholders, namely:

Program 1: Availability of labor in the agricultural sector must be increased.

Program 2: Provide knowledge and skills for farmers to improve the quality of labor in the agricultural sector.

Program 3: Increase wages or salaries for agricultural sector workers.

Program 4: Improve the quality of agricultural products in Central Java Province.

Program 5: Increase the price of agricultural commodities in Central Java Province.

Program 6: Shorten the agricultural product chain in Central Java Province.

Program 7: Increase the availability of paddy fields to produce agricultural products

Program 8: Improve the quality of paddy fields that have been well irrigated to produce agricultural products

Program 9: Provide assistance in maintaining and maintaining paddy fields that have been well irrigated to farmers.

Program 10: Decrease in credit interest rates.

Program 11: Extension of credit period.

Program 12: Add credit facilities.

According to Saaty in Prajanti (2013: 85), in order to set priorities for elements in a decision problem, there is a need to make pairwise comparisons, namely each element is paired and compared with a specified criteria. The form of pairing comparisons was in matrix. The paired compared matrix filling was done by using numbers that describe the relative importance of an element above the others.

3. Analysis Results

In analyzing the factors that can cause low investment in the agricultural sector in Central Java Province, the researchers used the Ordinary Least Squares (OLS) method. Based on the regression results, the resulting model was as follows:

$$LogY = \beta_0 + \beta_1 X_1 + \beta_2 LogX_2 + \beta_2 LogX_3 + \beta_2 LogX_4 + \mu$$

$$LogInvestment = 16.31836 - 0.035582\ SBK + 0.445159\ LogPDRB - 0.630604\ LogTK - 0.076347\ LogKL + \mu$$

If Y is an investment in the agricultural sector, by seeing the coefficient value of 16,31836 in the regression results, it can be interpreted that if all the independent variables had a value of zero (0) then the amount of investment in the agricultural sector in Central Java Province was 16,31836 Rupiah.

The coefficient value (X_1) which was the Credit Interest Rate (SBK) was equal to -0.0355. This showed that if every reduction in credit interest rated by 1%, it will be able to increase investment in the agricultural sector by 0.0355 percent. For more, the variable coefficient (X_2), which was the Gross Regional Domestic Product (GRDP) of the agricultural sector gained 0.4451. This showed that if every increase in agricultural sector GDP was 1%, it will be able to increase investment in the agricultural sector by 0.4451 percent.

The coefficient value for (X_3), namely the agricultural sector labor was -0.6306. This showed that if every decline in the agricultural sector workforce was 1%, it can increase investment in the agricultural sector by 0.6306 percent. Furthermore, the coefficient value (X_4), namely the availability of land for agriculture was equal to -0.0763. This showed that if every decrease in land availability for agriculture was 1%, it will be able to increase investment in the agricultural sector by 0.0763 with the assumption of *ceteris paribus*.

In accordance with regression results, namely the value of F-count = 6.396448> F-table = 2.76, then the decision was the null hypothesis (H0) was rejected and the alternative hypothesis (Ha) was accepted. Therefore, the results of the F test stated that the independent variables namely credit interest rates, agricultural sector GDP, agricultural sector labor, the availability of land for agriculture in the form of irrigated land jointly had a significant effect on the dependent variable, namely agricultural sector investment in Central Java Province (Fuadi, 2013: 48).

The regression results indicated that the credit interest rate obtained t-count value of -1.772896, the agricultural sector labor obtained t-count value of -0.946233, and the availability of land for agriculture at -0.161984, while the t-table value of 2.060, so the loan interest, agricultural sector labor, availability of land for agriculture obtained a t-count value

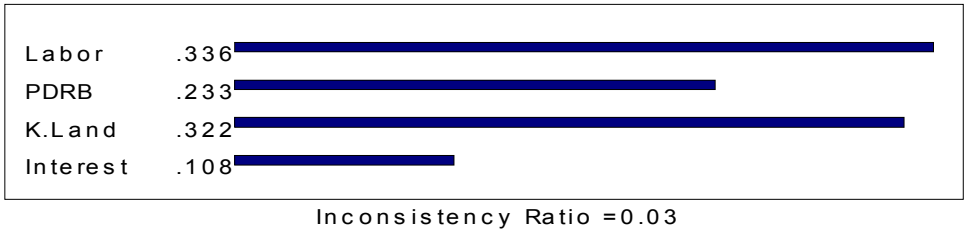
(-1.772896, -0.946233, -0.161984 <2,060) respectively. Then, the decision was the null hypothesis (H_0) was accepted and the alternative hypothesis (H_a) was rejected. The results of the test stated that loan interest rates, agricultural sector labor, and the availability of land for agriculture did not have a significant influence on investment in the agricultural sector in Central Java Province. Meanwhile, GRDP had a positive and significant influence on investment in the agricultural sector in Central Java Province.

Based on the results of the regression analysis, the agricultural sector labor, credit interest rates, and the availability of land for agriculture did not have a significant influence on increasing investment in the agricultural sector in Central Java Province. This is supported by the research of G. Lachov (2005) with the title "Uncertainties Surrounding Investment in Agricultural Land in Bulgaria and Solution Using a Real Options Approach" which shows that an increase in investment in agricultural land in Bulgaria depends on the following factors: such as land prices in European countries, and increased efficiency due to new technologies, and the possibility of land in Bulgaria owned by foreign citizen.

3.1. Program Criteria and Investment Improvement Strategies in the Agriculture Sector in Central Java Province

Based on the tabulation obtained from the opinions of several key persons, the criteria for obtaining the agricultural sector labor (weight value 0.336) were the criteria that had the highest weight. Hence, the criteria for labor needed to be considered in increasing investment in the agricultural sector in Central Java so that investors would be willing to invest in the agricultural sector. The next criterion was the criteria for the availability of land for agriculture obtained (weight value 0.322), the GDP of the agricultural sector obtained (weight value 0.233), and the criteria for credit interest obtained (weight value 0.108). This can be seen based on the following figure:

Figure 3. Criteria for Increasing Agricultural Sector Investment



Source: Primary Data processed, 2018

The results of AHP data processing were used to determine the priority aspects in providing information about aspects to improve or develop to increase investment in the agricultural sector in Central Java Province. AHP results were obtained from several key persons who were respondents in this study. The results based on AHP analysis showed that the government must pay more attention to the aspects of the agricultural sector labor because labor in the agricultural sector was still not optimal. Furthermore, the aspects that became the most and the least priority criteria will be elaborated into alternatives that can be prioritized in order to increase investment in the agricultural sector in Central Java Province.

3.2. Labor Aspect Criteria

Based on the results of the AHP analysis, it can be seen that providing knowledge and skills for labor in the agricultural sector were the most priority alternative in increasing the investment in the agricultural sector in the aspect of labor with a percentage of 60.9%. Furthermore, the second priority from the aspect of labor was an increase in wages or salaries for the agricultural sector workers with a percentage of 20.7%. And, the last priority to increase investment in the agricultural sector from the aspect of labor was the availability of agricultural sector labor with a percentage of 18.4%.

3.3. Aspects of Land Availability Criteria for Agriculture

According to the results of the study obtained from the AHP analysis, it can be seen that the alternative which gained the most important priority in increasing investment in the agricultural sector from the aspect of land availability for agriculture was increasing the availability of land to produce agricultural products with a percentage of 41.3%. Furthermore, the second alternative priority from the aspect of land availability for agriculture was to provide assistance in maintaining and maintaining well irrigated land with a percentage of 32.7%, and the last priority was to improve the quality of irrigated land for agriculture by 26%.

3.4. Aspect Criteria for Gross Regional Domestic Product (GRDP)

From the results of AHP analysis on aspects of GRDP, it was known that improving the quality of agricultural products was the most important alternative priority with a priority percentage of 40.7%. Furthermore, the second priority of the GRDP aspect was the aspect of shortening the marketing chain with a priority percentage of 37%, and the third priority of the GRDP aspect was to increase the prices of agricultural commodities by a percentage of 22.4%.

3.5. Aspect of Credit Interest Rates Criterion

By referring to AHP analysis, it showed that the first priority of the aspect of credit interest rates in an effort to increase investment in the agricultural sector was the reduction in lending rates by a percentage of 66.3%. Furthermore, the second priority of the loan interest rate aspect was the extension of the credit interest with a percentage of 17.8%. The last priority was the addition of a credit facility with a percentage of 15.9%, so the addition of this facility became a non-priority alternative compared to the other two alternatives in the aspect of credit interest rates.

3.6. Agricultural Sector Investment Priority Programs

The results of the overall analysis (overall) based on AHP revealed the highest priority and the lowest priority of several aspects of the criteria that can increase investment in the agricultural sector. Of the several alternatives there were three alternatives which turned into the main priorities and there were three other alternatives that were least prioritized in increasing investment in the agricultural sector. The most important alternative priority was to provide knowledge and skills for the agricultural sector workforce with a value of (0.163).

Furthermore, the second most important alternative priority was increasing the availability of land to produce agricultural products with a value of (0.156). Next, the most important last priority was to provide assistance in maintaining and caring for irrigated land area with a weight value of (0.124). The least prioritized alternative priority was the addition of a credit facility with a weighting value of (0.013). Furthermore, the second priority that belonged to the least priority was the extension of the credit period with a value of (0.014). For more, the last was an alternative increase in the availability of labor in the agricultural sector with a value of (0.49). Knowing the highest criteria and alternative priorities in increasing investment in the agricultural sector will help in developing strategies to increase investment in the agricultural sector in Central Java Province.

Hence, the criteria and alternatives produced using the AHP method can be used as the right policy that must be applied by the government in increasing investment in the agricultural sector in Central Java. The most important aspect must be considered by the government in increasing investment in the agricultural sector were, namely the aspect of labor by providing knowledge and skills for the workforce in the agricultural sector. Those needed to be done because the availability of skilled and educated labor in the Province of Central Java was still relatively small

The second aspect that must be considered by the government in increasing investment in the agricultural sector in Central Java Province was the aspect of the availability of land for agriculture by providing land to produce quality agricultural products. The third aspect that must be considered by the government in increasing investment in the agricultural sector was

the Gross Regional Domestic Product (GRDP) by increasing the added value produced by agricultural products through improving the quality of agricultural products and shortening the marketing chain for agricultural products. Furthermore, the last aspect that must be considered by the government was the aspect of lending rates by making low and relatively stable loan interest rates.

3.7. Obstacles and Solutions to Increase Investment in the Agricultural Sector in Central Java Province.

The agricultural sector in Central Java Province had many obstacles that until now have been an obstacle in the development of agricultural products in Central Java Province, among others: The first obstacle, in increasing investment in the agricultural sector, there was an obstacle in the availability of infrastructure in the agricultural sector. It was realized in the provision of physical infrastructure the agricultural sector which was still lacking. This was because the area of rice fields in Central Java from year to year has declined. In addition, the rice fields in Central Java Province could not be fully irrigated properly. This can be explained based on data from BPS showing that in 2017 rice fields in Central Java Province amounted to 991,524 Ha, however, the well-irrigated land area were 659,063 Ha.

The second obstacle was related to labor in the agricultural sector. Currently, from year to year the availability of labor in the agricultural sector was decreasing. This was due to the transition of traditional economic structures to modern ones which were originally engaged in agriculture now becoming a processing industry sector. In addition, the quality of human resources working in the agricultural sector was still relatively low. It was because workers who work in the agricultural sector are mostly old people who have low education. Whereas, the young generation who are highly educated do not want to work in the agricultural sector with hope that they will get a higher salary or wage if they work in the industrial sector compared to working in the agricultural sector.

The third obstacle was the lack of access to capital in the agricultural sector. This was because most farmers are still not prosperous. Thus, it was very difficult to get capital through the banks because banks and other financial institutions do not want to bear the risk that is too high. Hence, the role of financial institutions and banks in channeling credit to the agricultural sector can be said to be limited and still very small from the total share for loans that have been disbursed for all economic sectors (Prajanti, 2013: 23).

The last obstacle was the existence of central regulations with needs in the regions that have not been balanced. Therefore, it resulted in an imbalanced policy between the central government and the regional government.

The solutions that must be done by the government to overcome problems in increasing investment in the agricultural sector in Central Java Province, among others: Improving physical infrastructure in the agricultural sector by not making rice fields as entertainment places, housing, and industrial sites that will have an impact declining agricultural productivity in Central Java. In addition, it is needed to improve irrigation channels that have not yet run well and add irrigation canals to land areas that do not have irrigation channels.

Alternatively, the quality of labor in the agricultural sector needs to be improved. By providing knowledge and skills for workers who work in the agricultural sector, it is expected that that the workers can have skills in managing agricultural products. Furthermore, providing convenience to farmers in lending capital to banks and financial institutions. This solution can be conducted by giving very light interest to the farmers, and providing conditions that do not impose on farmers. Finally, there is a harmonization of central policies with regions such as the Province, District/City. It is done by way of deliberation and consensus in determining all policies that will be determined in increasing investment in the agricultural sector.

4. Conclusion

Based on the findings, the study found that the factors that can affect the low investment in the agricultural sector in Central Java Province is the Gross Regional Domestic Product (GRDP) variable. On the other hand, the analysis of Analytic Hierarchy Process (AHP) shows that labor is the main criterion in increasing investment in the agricultural sector in Central

Java Province. The next criteria are the criteria for the availability of land for agriculture, GRDP criteria, and the criteria for credit interest rates. Factors that hinder the strategy of increasing investment in the agricultural sector in Central Java are physical infrastructure, low human resources working in the agricultural sector, lack of access to capital. The solutions that can be done are by not making agricultural land as a housing and industrial place, improving the quality of labor in the agricultural sector, and providing convenience to farmers in borrowing capital from the banks.

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MANAGEMENT OF THE TERRITORY TAX POTENTIAL TO ENSURE ITS TAX SECURITY

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Abstract
The authors investigated theoretical approaches to the tax potential category, substantiated the position that tax potential should be managed to ensure tax security of public law education and the basis of its assessment. Forecast models of tax potential developed in relation to the Republic of Mari El. The purpose of the study is to examine The purpose of the study is to examine structure of the consolidated budget tax revenue. One of the objectives of the study is to validate the uniformity of the tax revenue structure. The authors determined that the share of the three main taxes (personal income tax, corporate income tax and corporate property tax) in the total tax revenues of the consolidated budget does not practically change. Models are built using correlation-regression analysis, describing the dependence of macroeconomic indicators and the main sources of tax revenues. The results of the study is constructed model, which is used to determine the region tax potential.

Keywords: tax potential, tax security, tax revenues, assessment of tax potential
JEL classification: F43, H2, H21

1. Introduction

Tax revenues are the basis for the formation of a budgets profitable part. In this regard, the issues of estimating these revenues, their limits and possibility of increasing cause particular interest. The amount of tax revenues inextricably connected with tax potential. Entity determination problem and tax capacity management is an important government task. The issues of formation, assessment, and forecasting of tax potential have received modern reasoning and substantiation in numerous scientific works domestic and foreign scientists. However, many problematic issues still require reflection and the search for new scientific approaches.

Consider the approaches to the definition of the concept under study. It should be noted that in the scientific literature the categories of tax potential and tax burden (the ratio of taxes to GDP) are sometimes used as synonyms (for example, Stefan Brem, 2013), which, in our opinion, is not quite true in some publications by the same authors delimited concepts as: "taxable capacity" and "tax capacity".

Thus, in the studies of Tuan Minh Le, Blanca Moreno-Dodson and Jeep Rojchaichaninthorn (2012), the term “taxable capacity” refers to the predicted value of the tax burden indicator (ratio of taxes to GDP), assessed using regression analysis taking into account country characteristics, and the category of tax Capacity refers to an integral part of the financial (income) potential.

Professor Hemlata Rao (1993), arguing about the quantitative assessment of tax potential and measures for its mobilization, defines these categories as a measure of income (1) and the amount of tax revenues received (2). In the first case, income is taken as a measure of tax

potential, formed from state and local taxes received by the budget and other non-tax revenues. In the second, tax potential means resources, that is, the projected amount of tax revenues of any state obtained at different levels of taxation and comparing results with other states, which gives a "measure of relative tax potential". The continuity of these categories is due to the fact that when comparing tax revenues with tax potential, it is necessary to take into account the efforts of tax authorities to mobilize them.

The study of Luky Alfirman (2003) on the stochastic boundaries of tax potential seems to be the most interesting. According to the author, the tax potential is defined as the tax capacity that can be obtained if the economy uses all its resources and capabilities to mobilize all possible tax revenues, taking into account the main characteristics. In other words, tax-intensiveness is the actual value of tax revenues, and the tax potential is the predicted value of tax revenues obtained as a result of a regression analysis of stochastic boundaries. Moreover, the tax limit is understood as a system of various tax potentials. The spectrum of implemented instruments of research, technology and innovation policy is widely differentiated nowadays including the institutions and mechanisms of technology transfer (Kokkinou A., Ladias C., Papanis E., Dionysopoulou P. 2018).

Enlinson Mattos, Fabiana Rocha and Paulo Arvate (2011) adhere to the point of view of Alfirman (2003) and note that the unused tax potential is a measure of inefficiency, however, they believe that it cannot be determined.

The calculation of the tax potential index is typical for countries that use a representative tax system (RNS) to the tax potential estimated. Horacio Sobarzo (2004) defines this index as the Tax Potential Index Use (TPIU) and offers to count as the ratio of actual tax revenues to the possible.

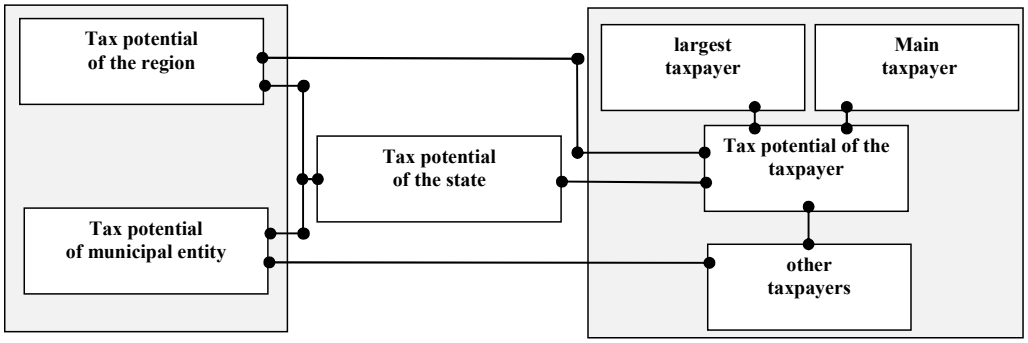
Russian scientists use different terms (taxable capacity, tax capacity, tax potential) for disclosing the contents term of tax potential. Most of the approaches are very similar, the difference in concepts, as a rule, is explained by the objectives of the research, or the tasks of managing a specific national taxation system.

2. Materials and methods

The author's approach to the term “tax potential of the state” is presented in Figure 1. On the one hand, the tax potential consists of a set of tax potentials of all the subjects of the federation (regions), which in turn is a consolidation of the tax potentials of the territories (municipalities) included in them, on the other hand, it is made up of the tax potentials of tax and tax payers: depending on the status, of individuals and legal entities; in relation to the provision of tax revenues, the administrative and territorial division is the largest and main.

The dualistic property of tax potential influences the choice of its assessment method, which should take into account not only macroeconomic indicators, but also the behavioral model of the taxpayer, which serves as an indicator of the effectiveness of the applicable tax policy and the quality of tax administration.

Figure 1 - Dualism of the "tax potential" category



Source: compiled by the authors

The above allows us to reveal the category of tax potential from two positions:

1– as a predicted value and control object;

2– as the volume of actual receipts of tax revenues in the budget system.

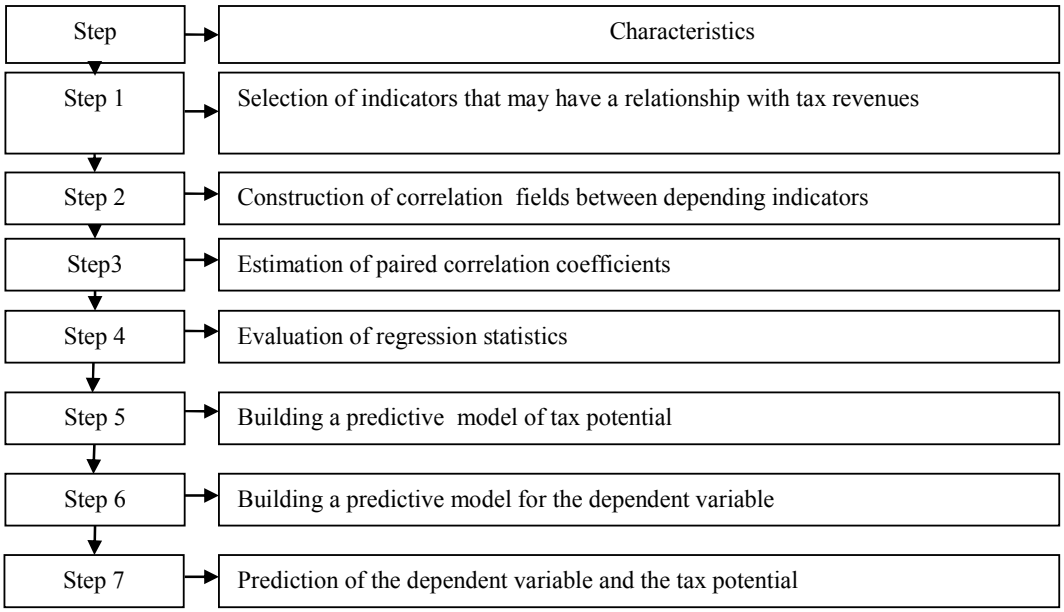
In turn, the receipt of tax revenues in time periods allows us to consider the tax potential in the aggregate of its two components:

- actual tax potential;
- strategic tax potential.

Strategic tax potential can be considered in different time periods, including for 1 year (short-term) and for longer periods (medium-term, long-term), which is due to the planning and forecasting methodology, which proves its viability.

The actual tax potential is the receipt of taxes and fees on a specific reporting date. The actual tax potential is the object of planned management, information for monitoring and regulating the development of the regional economy. Considering this component of the studied category, we can say that each territory (region, urban district, municipality, etc.) at a certain point in time receives revenues in the form of taxes and fees, which are the maximum achievable under these conditions. Those the short-term tax potential was not fulfilled or exceeded the forecast value due to the influence of various factors, the resulting amount of tax revenues is the actual tax potential, which is subject to monitoring, analysis and adjustment of further forecast values. Strategic tax potential is the ability of the tax base in the future to generate income in the form of tax revenues. This indicator is a flexible tool for assessing tax revenues for the long term. In this case, it becomes necessary to create an information-analytical system for forecasting the tax potential, revealing the influence of all internal and external factors, taking into account possible development scenarios, as well as a reflective basis of the mechanism for their implementation. The management of the tax potential of a territory should be based on its assessment. The assessment is carried out on the basis of the forecast of tax revenues, which have the largest share in the total amount of tax revenues and at the same time this share remains almost unchanged during the period preceding the assessment. The algorithm is shown in the figure 2.

Figure 2 - Algorithm for estimating the tax potential based on regression analysis.

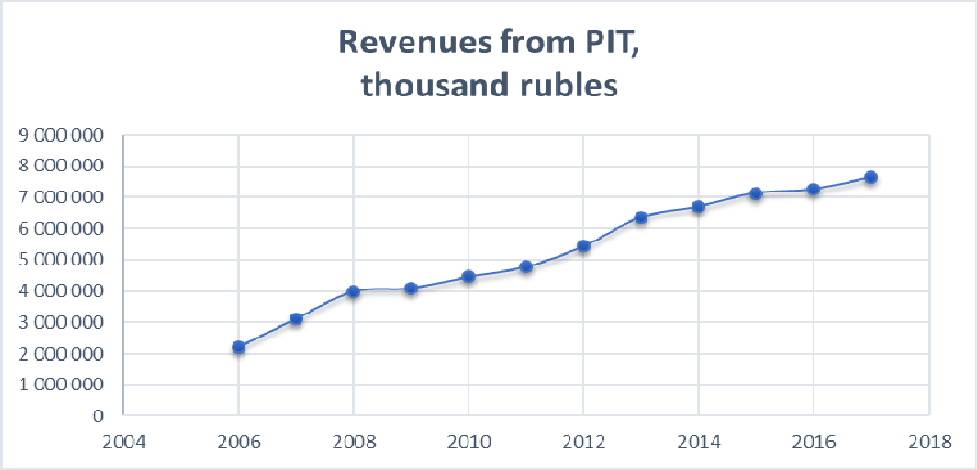


Source: compiled by the authors

3. Results

Graphic analysis of tax revenues from personal income tax to the consolidated budget of the Mari El Republic presented in Figure 3.

Figure 3 Revenues from PIT to the consolidated budget of the Mari El Republic, thousand rubles



Source: compiled by the authors based on data from the Federal State Statistics Service

Tax revenues from personal income tax is increasing annually. At the same time, the growth rate of revenues corresponds to the recorded dynamics of growth in nominal wages according to the data of the Federal State Statistics Service Mari El Republic. In this regard, the average nominal wage per month was chosen for building the model.

The initial data for the calculation are presented in the table 1.

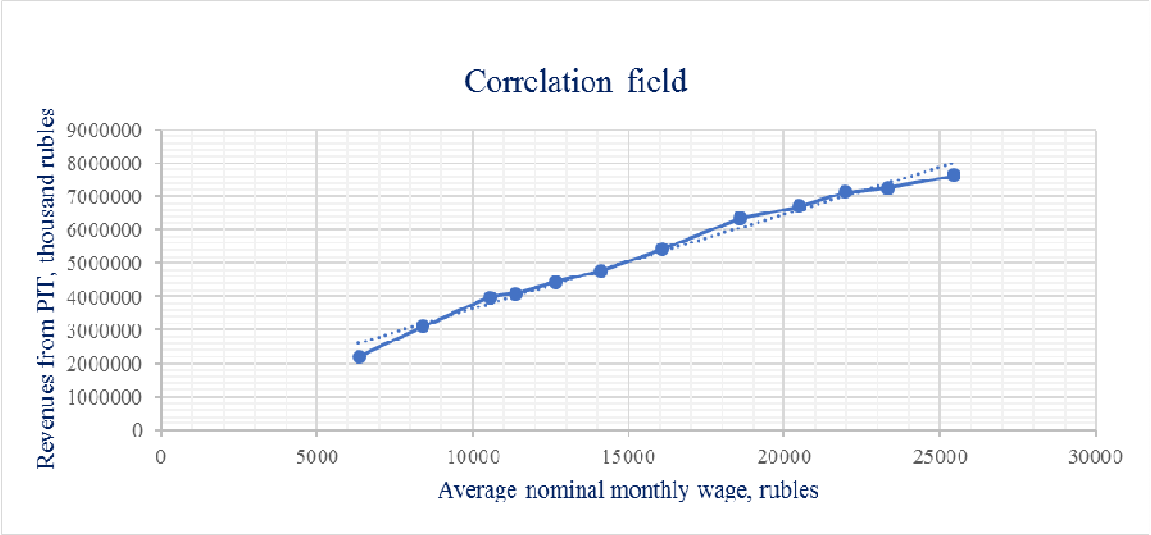
Table 1– Input data for model building

Year	Revenues from PIT, thousand rubles	Average nominal monthly wage, rubles
2006	2 215 090	6344,00
2007	3 123 792	8404
2008	3 987 615	10535
2009	4 098 128	11357,10
2010	4 454 793	12669,40
2011	4 774 698	14128,40
2012	5 432 880	16075,40
2013	6 357 278	18558,33
2014	6 704 799	20473
2015	7 134 082	21947
2016	7 256 173	23305,3
2017	7 626 691	25439,5

Source: compiled by the authors based on data from the Federal State Statistics Service

In the second step of the analysis, we, according to the proposed method, we will build a correlation field between PIT revenue and the dependent indicator that have selected - average nominal accrued wage. The results are presented in the figure 4.

Figure 4 Correlation field dependence of PIT revenues from average nominal monthly wage



At the third stage, we need to build a matrix of paired correlation coefficients. The results are presented in the table 2.

Table 2 - Matrix of paired correlation coefficients

-	Y	X
Y	1	-
X	0,9944	1

Source: compiled by the authors

The correlation coefficient (multiple R) tends to 1, which means a strong relationship between the dependent and independent variable.

At the 4th stage, we will conduct a regression analysis of the initial data. The results are presented in table 3.

Table 3– Regression Statistics

Regression Statistics	
multiple R	0,995422605
R-squared	0,990866163
Normalized R-squared	0,98956133
Standard error	147,8455189
Observations	9

Source: compiled by the authors

The coefficient of determination (R-square) shows that in 99% of cases, the variability y (income tax on individuals) can be explained using the predicted value of the average nominal accrued wages.

Normalized R-squared is almost no different from the coefficient of determination, which indicates the quality of the proposed model. The values of the coefficients are presented in table 4.

Table 2– Coefficients

-	Coefficients
Y-intersection	457,4246056
Variable x 1	0,312718053

Source: compiled by the authors

An analysis of Student's t-statistics (t estimated = 27.5> t tabular = 2.36), evaluating the ratio of the magnitude of the linear correlation coefficient to the standard deviation, concluded that there is a relationship between the variables and the correlation coefficient found is significant.

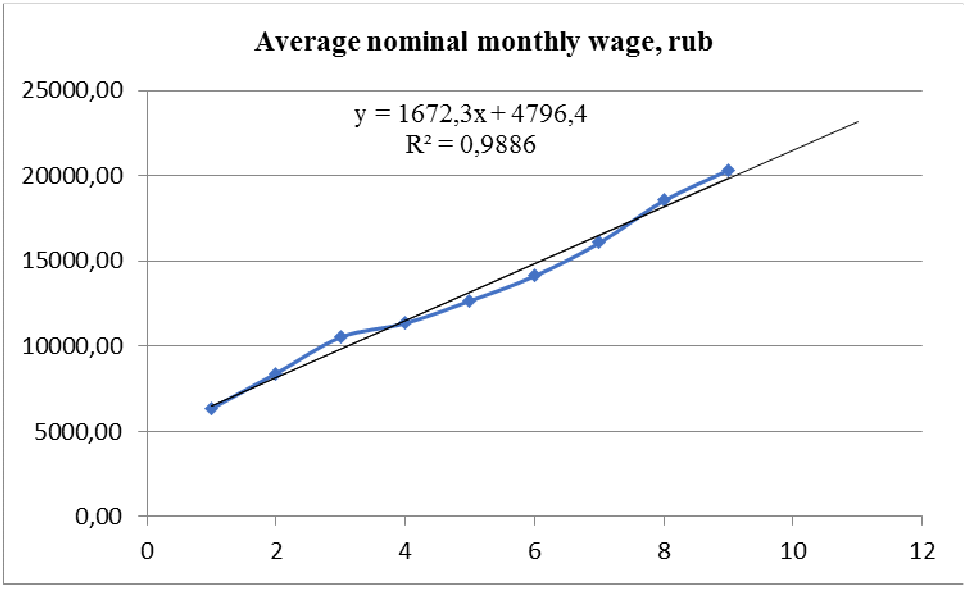
The p-value was less than 0.05, which also indicates the significance of the resulting equation. The statistical significance of the equation was estimated using the Fisher F-test. The tabular value of the F-test (for the significance level α = 0.05) is 5.32, which is less than F = 759.3. The conclusion of the statistical significance of the regression equation. Therefore, the connection of the tax on personal income with the factor included in the model is significant.

At 5 stage is building a predictive model. An equation (1) describing the forecast of revenues from PIT:

$$y=457,42+0,31x \quad (1)$$

At the 6th stage, a predictive model is building for the dependent variable, i.e. an equation is made describing the relationship between the values of x. To do this, the time factor t is introduced into the model, we construct a graph, determine the dependence, select the trend and estimate the R-squared value. The results are shown in Figure 5.

Figure 5- Forecast average nominal monthly wage



Source: compiled by the authors based on data from the Federal State Statistics Service

Thus, the following equation (2) is obtained, describing the forecast of the average nominal accrued wages:

$$x = 1672,3t + 4796,4 \quad (2)$$

At the 7th stage, we will make a forecast of the income tax receipts on the basis of the given dependencies. The results are presented in table 5.

Table 5– Calculation results

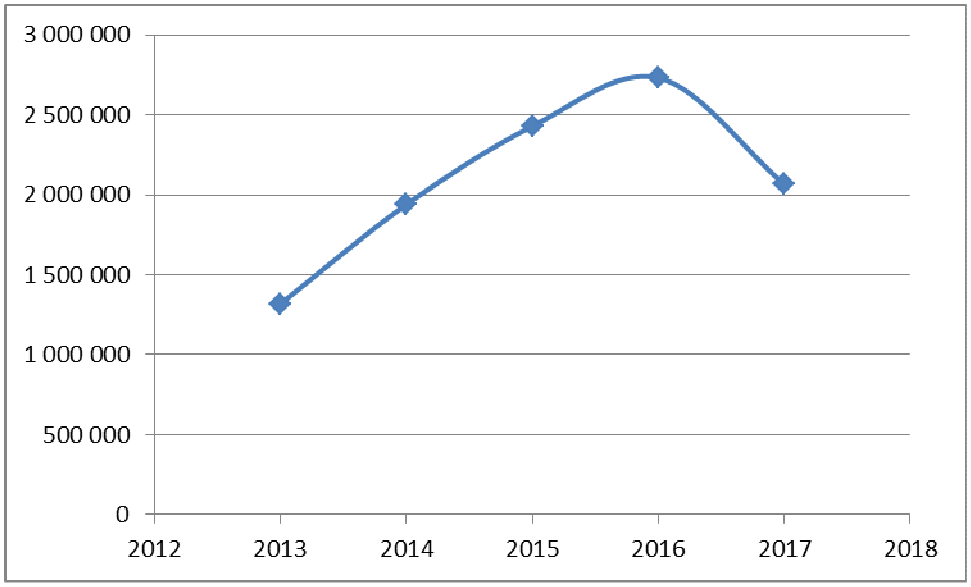
Case	Indicator	2016	2017	2018
inertial	Revenues from PIT, thousand rubles	21519,4	23191,7	24864
	Average nominal monthly wage, rubles	7128,434	7646,847	8165,26
optimistic	Revenues from PIT, thousand rubles	22595,37	24351,285	26107,2
	Average nominal monthly wage, rubles	*7461,985*	*8006,31835*	*8550,652*
pessimistic	Revenues from PIT, thousand rubles	20443,43	22032,115	23620,8
	Average nominal monthly wage, rubles	6794,883	7287,37565	7779,868

Source: compiled by the authors

A similar study was conducted for income tax. The results are presented in Figure 6.

Stage 1

Figure 6– Corporate Income Tax Revenues in the consolidated budget of the Republic of Mari El in 2013-2017.



Source: compiled by the authors based on data from the Federal State Statistics Service

The working hypothesis of the study was the following: building a predictive model for income tax should be made taking into account such indicators as: investment in fixed capital, current asset turnover, balanced financial result. Testing the hypothesis was carried out on the basis of identifying the correlation dependence between factors. Original data for the construction of the model are shown in Table 6.

Table 6 – Input data for model building. in millions rubles

Year	Corporate Income Tax Revenues	Fixed investment	current asset turnover	Balanced financial result by manufacturing activity
	Y	x_1	x_2	x_3
2013	1 318	16576,2	133260,6	1582
2014	1 940	22304,2	166770	2655
2015	2 429	26860,8	199084,3	3892
2016	2 731	31656,5	226110,8	5299
2017	2 065	45126	228974,5	4268,7

Source: compiled by the authors based on data from the Federal State Statistics Service

The values obtained are presented in table 7 - paired matrix of correlation coefficients:

Table 7– Paired matrix of correlation coefficients

-	Y	x_1	x_2	x_3
y	1	-	-	-
x_1	0,482928258	1	-	-
x_2	0,830720584	0,886272427	1	-
x_3	0,984509811	0,406244112	0,780318	1

Source: compiled by the authors

The value of the pair correlation coefficient of less than 0.5 indicates a weak connection with the performance indicator, and therefore the factor x1 should be excluded from the model. The application of the Farrar-Glober algorithm has led to the conclusion that there is a multicollinearity between the factors. In this connection, we concluded that it is more expedient to build a model with the factor x3. At the same time, it should be borne in mind that the main income tax revenues are in the Republic of Mari El for processing industries, it is more expedient to use the indicator of the net financial result for this type of activity. Input data for the model construction are shown in Table 8.

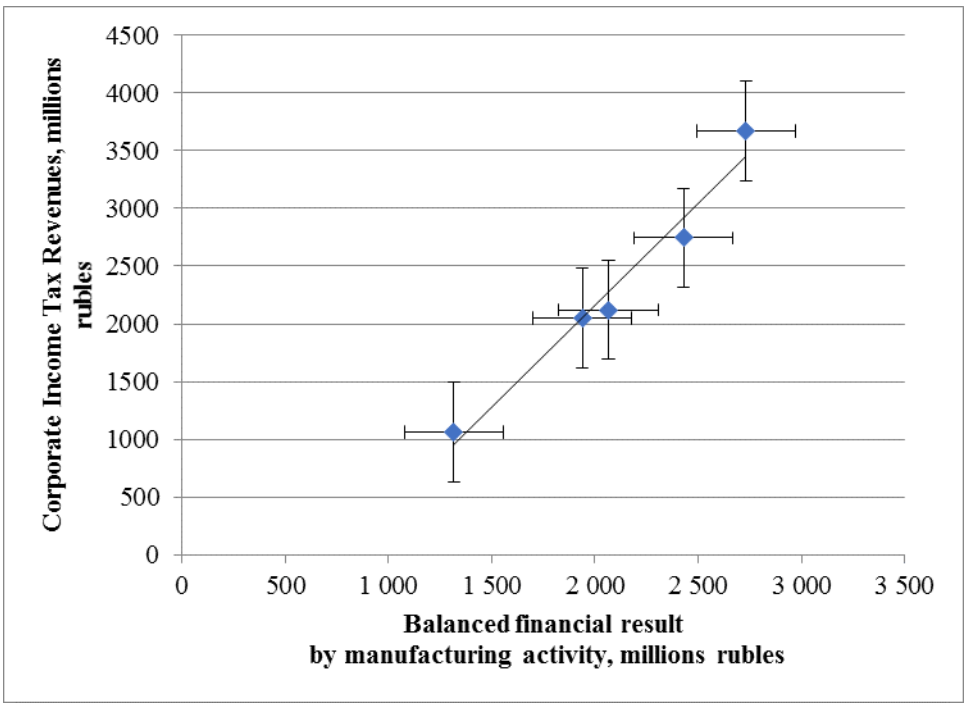
Table 8– Input data for the model construction , in millions rubles

Year	Corporate Income Tax Revenues	Balanced financial result by manufacturing activity
	y	x_1
2013	1 318	1062,5
2014	1 940	2049,8
2015	2 429	2745,9
2016	2 731	3673,4
2017	2 065	2121,9

Source: compiled by the authors based on data from the Federal State Statistics Service

The correlation field of the relationship between Corporate Income Tax Revenues and Balanced financial result by manufacturing activity is presented in Figure 7.

Figure 7- correlation field of the relationship between Corporate Income Tax Revenues and Balanced financial result by manufacturing activity



We conducted a regression analysis of the source data. The regression statistics are shown in table 9.

Table 9– Regression Statistics

Regression Statistics	
multiple R	0,984509811
R-squared	0,969259568
Normalized R-squared	0,959012757
Standard error	108,3153492
Observations	5

Source: compiled by the authors

The correlation coefficient (multiple R) tends to 1, which means a strong relationship between the dependent and independent variable.

The coefficient of determination (R-square) shows that in 97% of cases, the variability of y (income tax revenues) can be explained using the predicted value of the balanced financial result of organizations related to the type of activity in manufacturing.

The normalized R-square practically does not differ from the coefficient of determination, which indicates the quality of the proposed model.

On average, the calculated values deviate from the actual by 6.02%. Since the error is less than 7%, this equation can be used as a regression. The results are presented in table 10.

Table 10-The data obtained

-	Coefficients	standard error	t-statistic
Y-intersection	821,1277977	139,796	5,873758
Variable x 1	0,547216288	0,056264	9,725808

Source: compiled by the authors

An analysis of Student's t-statistics (t calculated = 9.72> t tabular = 3.182) allowed us to conclude that there is a relationship between the variables, and the calculated correlation coefficient is significant.

The p-value was less than 0.05, which also indicates the significance of the resulting equation.

The statistical significance of the equation was estimated using the Fisher F-test. The tabular value of the F-test (for the significance level $\alpha = 0.05$) is 10.1, which is less than F = 94.5. Therefore, the regression equation is statistically significant. Therefore, the relationship of income tax with the factor included in the model is significant.

Thus, we obtain the following equation (3) describing the revenue forecast of corporate income tax:

$$y= 821,12+0,54x \quad (3)$$

Stage 6

The forecast indicator of Balanced financial result by manufacturing activity was carried out on the basis of the Holt-Winters method.

Stage 7

The forecast of Corporate Income Tax Revenues is presented in table 11.

Table 11 - Corporate Income Tax Revenues, in millions rubles

Year	Corporate Income Tax Revenues
2018	3737,66
2019 (Plan)	2630,12

Source: compiled by the authors

A similar study was conducted for corporate property tax.

Stage 1

Input data for the model construction are shown in Table 12.

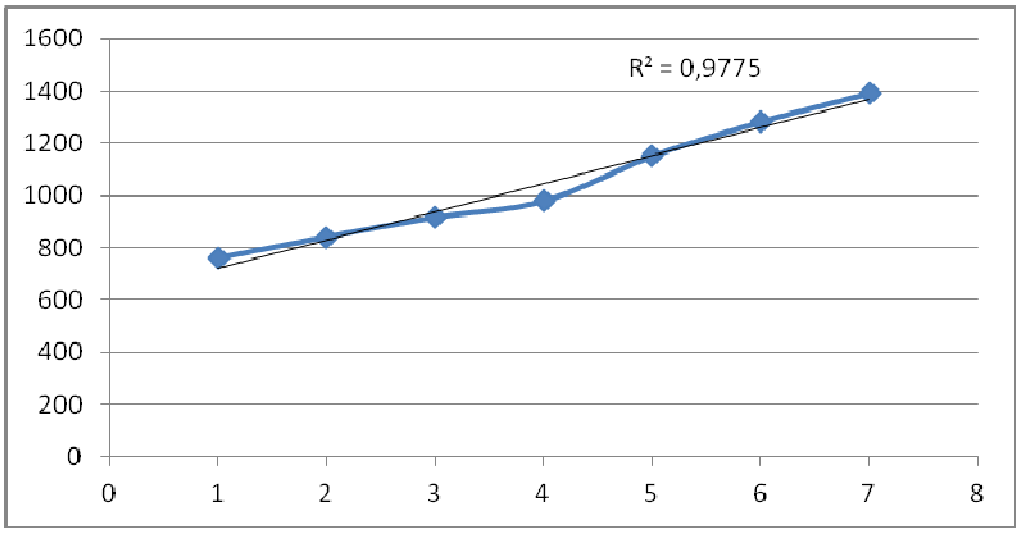
Table 12– Input data for the model construction, in millions rubles

revenues	Year						
	2011	2012	2013	2014	2015	2016	2017
Corporate property tax	757,9	840,3	915	977,2	1150,2	1 281	1 391

Source: compiled by the authors

Imagine the data graphically, select the trend using the method of analytical alignment. The results are presented in the figure 8.

Figure 8– Schedule of corporate property tax

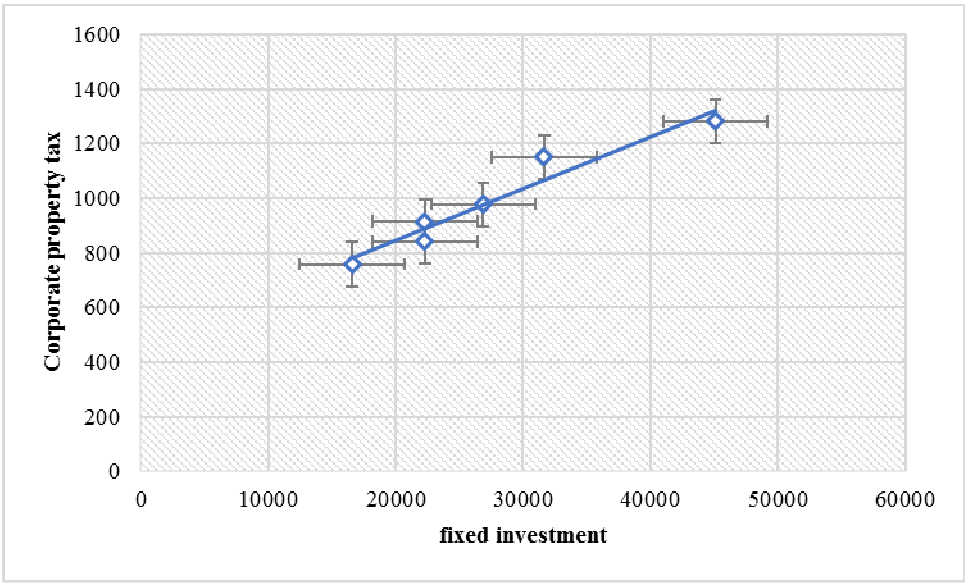


Source: compiled by the authors based on data from the Federal State Statistics Service

Stage 2

We construct a correlation field of the relationship between the corporate property tax and fixed investments. The results are presented in figure 9.

Figure 9- The correlation field depending between the corporate property tax and fixed investments.



Source: compiled by the authors

Stage 3-4

We conducted a regression analysis of the source data. The regression statistics are shown in table 13.

Table 13– regression statistics

multiple R	0,976670782
R-squared	0,953885816
Normalized R-squared	0,938514421
Standard error	44,62419326
Observations	5

Source: compiled by the authors

The correlation coefficient (multiple R) tends to 1, which means a strong relationship between the dependent and independent variable.

The coefficient of determination (R-square) shows that in 95% of cases, the variability of y (revenues from the property tax of organizations) can be explained using the predicted value of investments in fixed assets.

The normalized R-square practically does not differ from the coefficient of determination, which indicates the quality of the proposed model. The results obtained are shown in table 14.

Table 14– Results Obtained

-	Coefficients	standard error	t-statistic	P-Value
Y-intersection	570,4173216	61,99542983	9,200957605	0,002715221
Variable x 1	0,01622108	0,002059151	7,877557053	0,004262442

Source: compiled by the authors

The analysis Student's t-statistic is concluded that there is a dependence between the variables and the correlation coefficient found significant.

The p-value was less than 0.05, which also indicates the significance of the resulting equation.

The statistical significance of the equation was estimated using the Fisher F-test. The tabular value of the F-criterion is less than F = 94.5. Therefore, the regression equation is statistically significant. Thus, the connection of the property tax of organizations with the factor included in the model is essential.

Stage 5

Thus, the following equation (4) is obtained, which describes the forecast corporate property tax:

$$y=570,4+0,016x \quad (4)$$

Stage 6

Input data for the forecast of **fixed investment** are given in table 15.

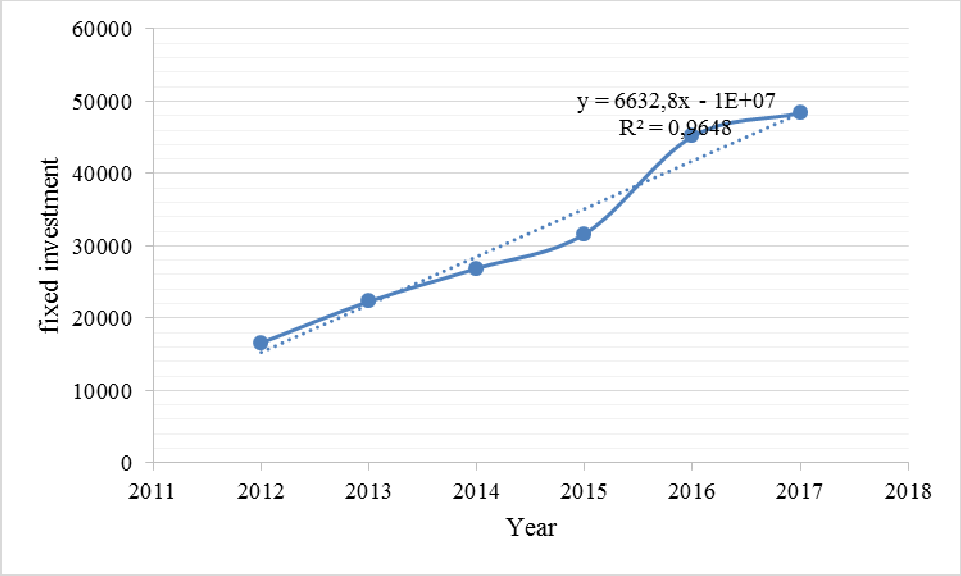
Table 15 - Input data for the forecast fixed investment , in millions rubles

Year	fixed investment
2012	16576,2
2013	22304,2
2014	26860,8
2015	31656,5
2016	45126
2017	48353,6

Source: compiled by the authors based on data from the Federal State Statistics Service

Prediction dependent factor is performed by an analytical alignment. As a result of the graphical representation, a linear trend is revealed, as reflected in Figure 10.

Figure 10- fixed investment



Source: compiled by the authors based on data from the Federal State Statistics Service

Based on the resulting prediction equation implemented dependent factor. The results are presented in table 16.

Table 16 – Forecast , in millions rubles

Year	fixed investment
2018	55027,7
2019	61660,5

Source: compiled by the authors

Stage 7

Using the obtained values, the property tax of organizations is predicted. The results are presented in table 17.

Table 17 – Forecast , in millions rubles

Year	Corporate property tax
2018	1450,8432
2019	1556,968

Source: compiled by the authors

On the basis of the proposed models, formula (5) is designed for prediction of region tax potential:

$$НП_p = \frac{y_1+y_2+y_3}{n} \times 100 = \frac{1848,94+0,31x_1+0.54x_2+0.016x_3}{n} \times 100 \quad (5)$$

where

n– average value of the share of three major taxes over the past three years;;

$НП_p$– region tax potential.

A summary of the calculation results is given in table 18.

Table 18 - Summary table of calculation results, in millions rubles

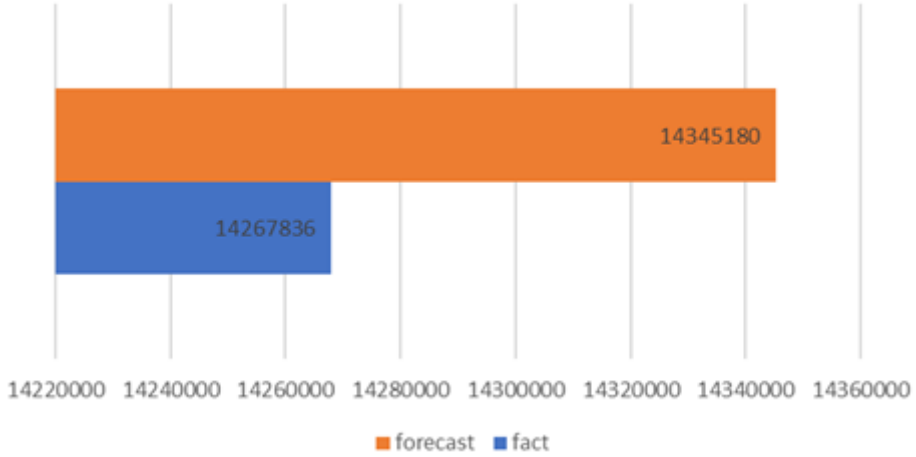
Indicator	conventional name	Model	Forecast	
			2018	2019
Modeling region tax potential considering uniformity coefficient by using the method of correlation-regression analysis				
Revenues from PIT, thousand rubles	y_1	$y_1=457,42+0,31x$	7461,98	8006,31
Average nominal monthly wage, rubles	x_1	$x_1= 1672,3t + 4796,4$	22595,37	24351,28
Corporate Income Tax Revenues	y_2	$y_2= 821,12+0,54\ x_2$	3737,66	2630,12

Balanced financial result by manufacturing activity	x_2	$x_2 = Lt + p * Tt$	5401	3350
Corporate property tax, mln. Rub.	y_3	$y_3 = 570,4 + 0,016\, x_3$	1450,84	1556,96
fixed investment, mln.rub	x_3	$x_3 = 6632,8t + 8598,1$	55027,7	61660,5
Tax potential of the region, mln. Rub.	$НП_p$	$НП_p = \frac{y_1 + y_2 + y_3}{n} * 100$	**14882,93**	**14345,18**

Source: compiled by the authors

Comparison of the forecast model and the actual tax revenues is shown in the figure 11.

Figure 11- Region tax potential in 2018



Source: compiled by the authors based on data from the Federal State Statistics Service

4. Conclusion

The results of the study led to the following conclusions:

1. Tax potential should be managed to ensure tax security of public law education and the basis of its assessment. The forecast of region tax potential should be made on the basis of those taxes whose share in the structure of the region's tax revenues does not change or changes only slightly.

2. The assessment of tax revenue uniformity is carried out by analyzing the structure of tax revenues of the region consolidated budget.

3. The relationship between macroeconomic indicators and tax revenues is revealed with the help of the correlation-regression analysis, models are constructed that describe these dependencies. As the analysis shows, such an approach allows one to estimate the tax potential fairly accurately.

4. The results of the study consolidated budget of the Mari El Republic showed that determined that the share of the three main taxes (personal income tax, corporate income tax and corporate property tax) in the total tax revenues of the consolidated budget does not practically change. This allowed us to build models using correlation-regression analysis, describing the dependence of macroeconomic indicators and the main sources of tax revenues.

5. Acknowledgments

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MODELING OF REGIONAL ECONOMIC DEVELOPMENT BASED ON INNOVATIVE CLUSTERS

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Abstract
The subject of the research is improvement of methodological tools for modeling economic development based on the formation of innovative clusters of environmental management within the region economic space. The aim of the work is to develop an economic-mathematical model for the formation of innovative clusters, expanding the methodological potential of forecasting and planning territorial development. Special attention is paid to the peculiarities of innovative cluster development process, which determine the initial conditions of the problem of finding the optimal spatial location and long-term development of industrial production in the cluster. The problems of optimization of spatial distribution of new and development of existing industries in the process of implementation of the cluster initiative are considered, approaches to mathematical modeling of formation and development of innovative clusters are generalized. The features of the economic-mathematical model of the formation of innovative cluster of environmental management are identified. The problem of optimizing economic development for territory on the basis of innovation cluster are formulated.

Keywords: economic clustering, innovation clusters, environmental management, optimization of economic development, economic-mathematical model, territorial development, industrial policy, regional economy, old-industrial regions, resource-producing industries, inter-sectoral interaction.
JEL classification: O1, R58

1. Introduction

The solution of the tasks of economic development and modernization for regional old-industrial economic systems actualizes the task of the practical implementation of the model for perspective development of cluster initiatives in the framework of the innovation economy. In the framework of the study, the old industrial region is understood as a territory with a predominantly obsolete industrial base characterized by a low level of technological development. The main problem of this type of regions is overcapacity, represented by large and medium-sized enterprises with outdated equipment and technologies. Modernization of the economy of old industrial regions, as a rule, is also complicated by the presence of a complex of social, demographic and environmental problems.

The author's approach to analyzing the relationship of innovative clusters and sectoral specialization of the territory where they are located is based on identifying two main types of territorial economic systems with industrial, scientific and technical potential to create and develop innovative clusters. The first type includes the potential innovative clusters identified on the basis of the calculation of the localization factor for the production of “agglomeration” based on the existing high-tech industrial production within the territory. The second type of territorial systems selected by the author is formed by “conglomerates” of sectoral complexes uniting enterprises in related economic activities. For this type of territorial systems, the implementation of production technologies of previous technological structures is typical. Consideration of old industrial regions as one of the promising areas of cluster policy is due to the following factors: old industrial regions have a developed production infrastructure and

fairly stable links between economic entities, and these territories have a strong industry specialization, characterized by a high proportion of the main branches of production.

2. Data and method

Cluster development model. The innovation cluster allows integrating both traditional (old-industrial) and resource-oriented sectors, as well as related innovative activities within the sixth technological order, within a single organizational environment. The formation of an innovation cluster, which is the "core" of multi-cluster, creates a scientific and technological base for the transformation of economic systems of old industrial regions (Napolskikh, 2017). Within the framework of the author's approach, it is possible to talk about the following areas of economic modernization: a change in the economic specialization and employment structure of the population of single-industry towns due to their inclusion in the formed industrial clusters; general transformation of the economic space of the regions within the framework of cluster policy, implying qualitative and quantitative changes in the structure of industrial production, renewal of fixed assets, growth of labor productivity.

It is proposed to highlight innovative environmental management clusters as an adequate model of economic modernization for most old-industrial regions. The formation of innovative clusters of environmental management is especially important for areas that do not have hydrocarbon resources and a developed industrial base. The formation of this type of cluster is based on the integration of related economic activities, based on the following technologies:

technologies of resource-saving ("lean") industrial production;

technologies of resource-saving processing of forest resources and minerals.

technologies for sustainable forest management and reforestation;

technologies for the production of organic food and efficient processing of agricultural products;

veterinary and phytosanitary technologies to ensure the safety of crops and animals;

technologies of "green energy" and intellectual energy saving;

technologies for environmentally safe transportation and disposal of industrial wastes;

technologies for the production of fuel and new energy sources based on organic raw materials.

Consequently, an innovative environmental management cluster is a territorial-production system integrated on the basis of innovative environmental management technologies, within which renewable resources of the territory are optimally used and a sustainable restoration of the natural environment is ensured (Napolskikh, 2014).

Features of the economic and mathematical model of clustering of the regional economy based on the formation of an innovative cluster of environmental management. Building an economic-mathematical model for optimizing the structure and size of production within a cluster increases the level of objectivity of the cluster development strategy (Gimadeeva, 2015). The practical application of the developed economic and mathematical model is considered on the basis of the application of modern mathematical methods for solving complex optimization problems (Lychkina, 2012; Starikov and Kuscheva, 2008) and the use of specialized software packages (Apatova, 2009; Afraimovich and Prilutsky, 2010), regional policy, which endogenous growth strategy utilizes (Papadaskalopoulos, A Nikolopoulos P., 2018), including the institutions and mechanisms of technology transfer (Kokkinou A., Ladias C., Papanis E., Dionysopoulou P. 2018).

The economic essence of the task of optimizing the structure and size of production within the cluster is in the following provisions:

known limited amount of non-renewable natural resources of the territory and the maximum allowable use of renewable resources of the cluster;

the need to optimize the use of natural resources in the cluster within the framework of the concept of environmental management;

known current volumes of industrial production and promising indicators of its development;

known needs for raw materials and finished products of consumers belonging to other industry segments of cluster;

possibility of integrating production with other regions, the supply of cluster products to consumers located in region, other regions, as well as deliveries to the external market.

Also, as the determining factors of the formation of the economic-mathematical model, it is necessary to highlight:

integration within the framework of the model of main types of raw materials, materials and finished industrial products;

consideration of the production capabilities of the industrial enterprises of the cluster based on their availability of material, energy, labor and other types of resources;

inclusion in the model of sources for the development of cluster production capacities.

3. Analysis and Results

3.1. Statement of the task for optimizing the economic development of a territory based on the formation of innovative cluster of rational nature management.

Consider a innovative cluster of rational environmental management in the form of an ordered multi-structured regional economic system, which includes enterprises and final consumers of finished products (Korobov, 2010). The industry segments of the cluster are proposed to be considered separately, taking into account its relationship with other segments. Accordingly, we adopt the following conventions:

i – is the index of the type of natural resources extracted on the territory of the cluster, ;

i^t – is the index of the type of technological waste used as secondary raw materials and secondary fuel and energy resources both within the framework of the considered and other industry segments of the cluster, $i^t = \overline{1, n^t}$ $i^t = \overline{1, n}$;

j – is the index of the type of primary processed natural resources of a commercial type produced on the territory of a cluster, , also we introduce sub-indices for the primary processed natural resources of a commercial type in accordance with the territory of their supply:

j_c – deliveries to consumers within a cluster;

j_g – deliveries to consumers within the region;

j_e – deliveries to consumers in other regions and for export.

k^1 – is the index of the type of primary raw material natural resources produced on the territory of the cluster, and we also introduce sub-indices for raw natural resources in accordance with the territory of their supply:

k^1_c – deliveries to consumers within a cluster;

k^1_g – deliveries to consumers within the region;

k^1_e – deliveries to consumers in other regions and for export.

k^2 – index of the type of secondary raw natural resources produced on the territory of the cluster, $k = \overline{1, r^2}$, also we introduce sub-indices for raw natural resources in accordance with the territory of their supply:

k^2_c – deliveries to consumers within a cluster;

k^2_g – deliveries to consumers within the region;

k_s^2 – deliveries to consumers in other regions and for export.

s^1 – the index of the type of finished industrial products produced by enterprises of the cluster from primary raw materials, $s = \overline{1, d^1}$,

s^2 – the index of the type of finished industrial products produced by enterprises of the cluster from primary and secondary type raw materials, ;

w – the index of low-grade natural resources used both within the framework of the surveyed and within the rest of the industry segments of the cluster within the framework of technological processes $[(w]_1^1$), and also as side fuel and energy resources (w_2).

We also introduce the following designations of the initial information for the construction of an economic-mathematical model:

A^{max} - maximum allowable use of natural resources on the territory of the cluster;

a_i – the volume of natural resources used by their types;

B_k – the total production capacity of the industrial enterprises of the cluster: k^1 - production using primary raw materials, k^2 – production using primary and secondary raw materials;

$Q_{k_c}; Q_{j_c}$ – the total needs of consumers within the cluster by types of raw natural resources and primary processed commodity resources;

$\underline{Q_{k_g}}; \underline{Q_{j_g}}$ – commitments on the supply of raw natural resources and raw materials processed raw materials within the region;

$\underline{Q_{k_e}}; \underline{Q_{j_e}}$ – for the supply of raw natural resources and primary processed commodity resources to other regions and to the external market;

$Q_{k_c^1 s^1}; Q_{k_c^2 s^2}$ – internal needs of cluster consumers for finished industrial products.

We also introduce the following notation for the main sought-for variables in the framework of the economic-mathematical model:

$x_{j_c i}$ – the production of the *j*-th type of primary processed natural resources of the commodity type for the *i*-th type of natural resources mined in the cluster for the internal needs of its industry segments;

$x_{j_g i}$ – the production of the *j*-th type of primary natural resources of the commodity type for the *i*-th type of natural resources extracted in the territory of the cluster to meet the needs of the region of its location;

$x_{j_e i}$ – the production of the *j*-th type of primary processed natural resources of the commodity type for the *i*-th type of natural resources mined on the territory of the cluster for supply to other regions of the country and to foreign markets;

$x_{k_c^1 i s^1}$ – the volume of production of the *k*-th type of raw natural resources from the *i*-th type of natural resources extracted on the territory of the cluster for processing at enterprises with the aim of producing s^1--th industrial products produced by the cluster enterprises from primary raw materials;

$x_{k_g^1 i}$ – the volume of production of the *k*-th type of raw natural resources from the *i*-th type of natural resources extracted on the territory of the cluster to meet the needs of the region where the cluster is located;

$x_{k_e^1 i}$ - the volume of production of the *k*-th type of raw natural resources from the *i*-th type of natural resources extracted on the territory of the cluster for deliveries to other regions of the country and to foreign markets;

$x_{k_c^2 i s^2}$ – the volume of production of the *k*-th type of raw natural resources from the *i*-th type of natural resources extracted on the territory of the cluster for processing at enterprises for the production of s^2-th type of industrial products produced by the enterprises of the cluster as from primary, and secondary raw materials;

$x_{k_{\hat{e}}^2 i t_s z}$ – the volume of formation of the k^t-th type of technological waste used as secondary raw materials, and accordingly its industrial processing at the k^2 -th production of the cluster with the aim of producing the s^2-th type of finished product;

$x_{w_1 i s^2}$ – the volume of production of the w-th type of low-grade natural resources from the i-th type of natural resources extracted on the territory of the cluster with the purpose of their industrial processing in the production of the s^2-th type of finished products;

$x_{w_2 i}$ – the volume of production of the w-th type of low-grade natural resources from the i-th type mined in the cluster to be used as secondary fuel and energy resources;

x_{i^t} – the volume of formation of the i-th type of technological waste used as side fuel and energy resources.

Thus, the formulated equation of the objective function F (x), describing the total economic income for the whole will have the following form:

$$F(\mathrm{x}) = \sum_{j_c,i}^{m,n} x_{j_c i}\, y_{j_c i} + \sum_{j_g,i}^{m,n} x_{j_g i} y_{j_g i} + \sum_{j_e,i}^{m,n} x_{j_e i} y_{j_e i} + \sum_{k_{\hat{c}}^1,i,s^1}^{r^1,n,d^1} x_{k_{\hat{c}}^1\, i s^1} y_{k_{\hat{c}}^1\, i s^1} + \sum_{k_{\hat{g}}^1,i}^{r^1,n} x_{k_{\hat{g}}^1 i} y_{k_{\hat{g}}^1 i} +$$
$$+ \sum_{k_{\hat{e}}^1,i}^{r^1,n} x_{k_{\hat{e}}^1 i} y_{k_{\hat{e}}^1 i} + \sum_{k_{\hat{c}}^2,i,s^2}^{r^2,n,d^2} x_{k_{\hat{c}}^2 i s^2} y_{k_{\hat{c}}^2 i s^2} + \sum_{k_{\hat{c}}^2,i^t,s^2}^{r^2,n^t,d^2} x_{k_{\hat{c}}^2 i^t s^2} y_{k_{\hat{c}}^2 i^t s^2} + \sum_{i,s^2}^{n,d^2} x_{w_1 i s^2} y_{w_1 i s^2}$$
$$+ \sum_{i=1}^{n} x_{w_2 i} y_{w_2 i} + \sum_{i^t=1}^{n^t} \mathrm{x}_{i^t} \mathrm{y}_{i^t} \rightarrow \max \quad (1)$$

where y – is the total economic income from the use, production and sale of one conventional unit of enlarged types of raw materials, materials and products of the cluster.

3.2. Restrictions of the values of the desired variables.

First of all, the condition of no negativity of values, respectively, x≥0, extends to all the required variables x. We will also consider the limitations caused by the economic characteristics of the location and development of production within the cluster of rational environmental management.

We introduce into the model the restrictive conditions for the cluster resuscitation industries, due to their characteristics and requirements for environmental management. The restriction based on the total maximum allowable total use of natural resources is as follows:

$$\sum_{j_c,i}^{m,n} x_{j_c i} + \sum_{j_g,i}^{m,n} x_{j_g i} + \sum_{j_e,i}^{m,n} x_{j_e i} + \sum_{k_{\hat{c}}^1,i,s^1}^{r^1,n,d^1} x_{k_{\hat{c}}^1\, i s^1} + \sum_{k_{\hat{g}}^1,i}^{r^1,n} x_{k_{\hat{g}}^1 i} + \sum_{k_{\hat{e}}^1,i}^{r^1,n} x_{k_{\hat{e}}^1 i} + \sum_{k_{\hat{c}}^2,i,s^2}^{r^2,n,d^2} x_{k_{\hat{c}}^2 i s^2} + \sum_{i,s^2}^{n,d^2} x_{\mathrm{w}_1 i s^2}$$
$$+ \sum_{i=1}^{n} x_{w_2 i} \le A^{max} \quad (2)$$

Therefore, when included in the economic-mathematical model of the planned use of natural resources within the framework of the cluster development policy (V1) compared with the already achieved volumes (A0), the formulated restriction will take the following form:

$$\sum_{j_c,i}^{m,n} x_{j_c i} + \sum_{j_g,i}^{m,n} x_{j_g i} + \sum_{j_e,i}^{m,n} x_{j_e i} + \sum_{k_{\hat{c}}^1,i,s^1}^{r^1,n,d^1} x_{k_{\hat{c}}^1\, i s^1} + \sum_{k_{\hat{g}}^1,i}^{r^1,n} x_{k_{\hat{g}}^1 i} + \sum_{k_{\hat{e}}^1,i}^{r^1,n} x_{k_{\hat{e}}^1 i} + \sum_{k_{\hat{c}}^2,i,s^2}^{r^2,n,d^2} x_{k_{\hat{c}}^2 i s^2} + \sum_{i,s^2}^{n,d^2} x_{w_1 i s^2}$$
$$+ \sum_{i=1}^{n} x_{w_2 i} - V_1 = A_0 \quad (3)$$

Considering the cluster of rational nature management, it is necessary to introduce restrictions on the use in the production of secondary raw materials. Accordingly, the restrictive condition for the formation of secondary raw materials and its use in the industry segments of the cluster along with the primary raw materials for the production of finished products (s2) has the following form:

$$\sum_{j_c,i}^{m,n} u_{k^2 i} x_{j_c i} + \sum_{j_g,i}^{m,n} u_{k^2 i} x_{j_g i} + \sum_{j_e,i}^{m,n} u_{k^2 i} x_{j_e i} + \sum_{k_c^1,i,s^1}^{r^1,n,d^1} u_{k^2 i} x_{k_c^1 i s^1} + \sum_{k_g^1,i}^{r^1,n} u_{k^2 i} x_{k_g^1 i} + \sum_{k_e^1,i}^{r^1,n} u_{k^2 i} x_{k_e^1 i} + \sum_{k_c^2,i,s^2}^{r^2,n,d^2} u_{k^2 i} x_{k_c^2 i s^2} + \sum_{i,s^2}^{n,d^2} u_{k^2 i} x_{w_1 i s^2} + \sum_{i=1}^{n} u_{k^2 i} x_{w_2 i} - \sum_{k_c^2,i^t,s^2}^{r^2,n^t,d^2} x_{k_c^2 i^t s^2} - \sum_{i^t=1}^{n^t} x_{i^t} = 0 \quad (4)$$

where $u_{k^2 i}$ – the formation factor when using the i-th type of natural resources of the k^2-th type of waste, which can be used as secondary raw materials for the manufacture of finished products at cluster enterprises.

We will also introduce into the model limitations that characterize the conditions for the provision of raw materials to cluster enterprises using primary raw materials, taking into account the expansion of existing and creation of new industries within the cluster policy:

where: $B_{k^1}^{min}$ B_k^{min} – the minimum capacities of typical production (workshops, lines, units, etc.), characterized by the volumes of processing of primary raw materials;

z_{k^1} – the variables sought in the framework of the economic-mathematical model, which are multiplicity coefficients; z_{k^1}=0,1,2,3 …

When the planned volumes of industrial processing of natural resources are included in the economic-mathematical model within the framework of the cluster development policy (V_{k^1}) compared to the already achieved processing volumes ($M_{k^1}^0$), the stated restriction will take the following form:

$$\sum_{k_c^1,i,s^1}^{r^1,n,d^1} x_{k_c^1 i s^1} - V_{k^1} = M_{k^1}^0 ; k^1 = \overline{1, r^1} \quad (7)$$

We will also introduce restrictions into the model that characterize the conditions for the provision of raw materials to enterprises that use secondary raw materials obtained in the course of industrial processing, taking into account the expansion of existing and creation of new industries:

$$\sum_{k_c^1,i,s^1}^{r^1,n,d^1} u_{k^2 k^1} x_{k_c^1 i s^1} - \sum_{k_c^2,i,s^2}^{r^2,n,d^2} x_{k_c^2 i s^2} - \sum_{i^t=1}^{n^t} x_{i^t} = 0 ; \; k^2 = \overline{1, r^2} \quad (8)$$

where: $u_{k^2 k^1}$ – the coefficient of formation in the course of industrial processing of primary raw materials of k^2-type of waste, which can be used as secondary raw materials for the manufacture of finished products at cluster enterprises.

Let us introduce restrictions into the model, which characterize the conditions for the provision of cluster enterprises with raw materials using primary and secondary raw materials, taking into account the expansion of existing and creation of new productions within the cluster policy:

$$\sum_{k_c^2,i,s^2}^{r^2,n,d^2} x_{k_c^2 i s^2} + \sum_{k_c^2,i,s^2}^{r^2,n,d^2} \mu_{k^2 k^1} x_{k_c^2 i s^2} \leq B_{k^2} ; k^2 = \overline{1, r^2} \quad (9)$$

$$\sum_{k_c^2,i,s^2}^{r^2,n,d^2} x_{k_c^2 i s^2} + \sum_{k_c^2,i,s^2}^{r^2,n,d^2} \mu_{k^2 k^1} x_{k_c^2 i s^2} - B_{k^2}^{min} z_{k^2} \leq 0; k^2 = \overline{1, r^2} \quad (10)$$

where: $\mu_{k^2 k^1}$ – the coefficient of interchangeability of primary raw materials secondary.

$B_{k^2}^{min}$ – the minimum capacities of typical production (workshops, lines, units, etc.), characterized by the volume of processing of secondary raw materials;

z_{k^2} – the variables sought in the framework of the economic-mathematical model, which are multiplicity coefficients; z_{k^1}=0,1,2,3 …

When the planned volumes of industrial processing of natural resources are included in the economic-mathematical model within the framework of the cluster development policy (V_{k^2})

compared to the already achieved processing volumes ($M^0_{k^2}$), the stated restriction will take the following form:

$$\sum_{k_c^2,i,s^2}^{r^2,n,d^2} x_{k_c^2 i s^2} + \sum_{k_c^2,i,s^2}^{r^2,n,d^2} \mu_{k^2 k^1} x_{k_c^2 i s^2} - V_{k^2} = M^0_{k^2}; k^2 = \overline{1, r^2} (11)$$

Next, we consider the restrictive conditions of the economic-mathematical model, due to the internal needs of the cluster and the delivery obligations:

the total needs of consumers in a multicultural cluster for the primary processed commodity resources:

$$\sum_{j_c,i}^{m,n} x_{j_c i} = Q_{j_c}; j = \overline{1, m} (12)$$

total consumer needs in a cluster for natural resources:

$$\sum_{k_c,i}^{r,n} x_{k_c i} = Q_{k_c}; k = \overline{1, r} (13)$$

obligations for the supply of primary processed commodity resources within the region:

$$\sum_{j_g,i}^{m,n} x_{j_g i} - Q_{j_c} \geq \underline{Q_{j_g}}; j = \overline{1, m} (14)$$

obligations for the supply of raw natural resources within the region:

$$\sum_{k_g,i}^{r,n} x_{k_g i} - Q_{k_c} \geq \underline{Q_{k_g}}; k = \overline{1, r} (15)$$

commitments on the supply of primary processed commodity resources to other regions and to the external market:

$$\sum_{j_e,i}^{m,n} x_{j_e i} - Q_{j_c} - \underline{Q_{j_g}} \geq \underline{Q_{j_e}}; j = \overline{1, m} (16)$$

commitments on the supply of raw natural resources to other regions and to the external market:

$$\sum_{k_e,i}^{r,n} x_{k_e i} - Q_{k_c} - \underline{Q_{k_g}} \geq \underline{Q_{k_e}}; k = \overline{1, r} (17)$$

total domestic needs of cluster consumers in finished industrial products made from primary raw materials:

$$\sum_{k_c^1,i,s^1}^{r^1,n,d^1} x_{k_c^1 i s^1} \geq Q_{k_c^1 s^1}; k = \overline{1, r} (18)$$

total domestic needs of cluster consumers in finished industrial products made from primary raw materials:

$$\sum_{k_c^2,i,s^2}^{r^2,n,d^2} x_{k_c^2 i s^2} + \sum_{k_c^2,i,s^2}^{r^2,n,d^2} \mu_{k^2 k^1} x_{k_c^2 i s^2} \geq Q_{k_c^2 s^2}; k = \overline{1, r} (19)$$

Also, in the framework of the economic-mathematical model, restrictions were introduced that characterize the objective economic possibilities for the development of a cluster. Restrictive conditions on the availability of internal (μ) and external (φ) investment resources for the development of production within a cluster will be as follows:

$$\delta_1 V_1 + \sum_{k^1=1}^{r^1} \delta_{k^1} V_{k^1} + \sum_{k^2=1}^{r^2} \delta_{k^2} V_{k^2} - \varphi = \mu (20)$$

where: δ – the specific investment rate for the development of the functioning and creation of new productions of the cluster, in rubles per unit of power of the productive forces.

Based on this restrictive condition, restrictions on other factors of cluster development (labor resources, etc.) can be included in the economic-mathematical model.

4. Conclusion.

Thus, the practical application of the developed economic-mathematical model is possible with the help of specialized application packages. Economic-mathematical modeling of cluster development processes complements the existing methodological tools of cluster policy, reducing the influence of subjective factors in solving the problems of spatial development of the productive forces. The results obtained in the course of the study are aimed at expanding the methodological tools of representatives of the scientific and educational community, state and local government bodies, and institutions of territorial and industrial development.

The results obtained in the framework of the study allowed us to expand the methodological basis of cluster policy, while in the modern practice of implementing cluster policy, the traditional approach remains with spatial localization of the formed clusters (Markov, 2015; Naydenov, Spiryagin and Novokshonova, 2015)

Within the framework of this approach, the territory of cluster development processes, the implementation of multiplicative effects and innovative transformation of the economy often coincides by default with the existing administrative boundaries of the constituent entities and municipalities (Gimadeeva, 2015; Chernyakina, 2015). It should be noted that the possibilities for implementing the proposed model for old industrial regions are limited by market conditions and the presence of a complex of political and social factors. In particular, low susceptibility to managerial innovation can be identified; the inertia of the historically established industrial specialization of the territory in the division of labor; as well as the narrow localization of markets for products, in turn, has a low level of technology.

Consequently, today, for the economic thought, the development of methods for modeling and visualizing the development processes of clusters within the economic space of the regions remains relevant. The solution of this scientific task involves the further study of the transformation processes of the internal structure of the economic space of a region under the influence of clustering processes.

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TOURISM AND ECONOMIC GROWTH NEXUS IN INDONESIA: THE DYNAMIC PANEL DATA APPROACH

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Abstract

The positive impact of tourism on economic growth is generally influenced by various indicators at both global and national levels. However, the question remains whether tourism encourages economic growth or vice versa. This paper examines the importance of tourism as a conditioning factor for economic growth in Indonesia. The validity of the relationship between tourism and economic growth can be examined by using the dynamic panel data estimation approach and convergence analysis to provide evidence of the impact of tourism on economic growth in Indonesia. In accordance with the initial hypothesis on tourism and economic growth, the result shows that the former can encourage the latter, although there is no indication of convergence among provinces in Indonesia. Therefore, if the supply characteristics of the tourism sector are improved, then it can be considered as an alternative source for stimulating economic growth in Indonesia.

Keywords: Economic Growth, Tourism, Dynamic Panel Data, Convergence
JEL classification: C23, L83, O40, O53

1. Introduction

Conceptually, economic growth and welfare are often linked to the growth of key sectors, such as agriculture, construction, and manufacturing. It is also attributed to the growth of foreign capital inflows for investment purposes (Sinclair, 1998). This condition has not emphasized the important role of tourism in economic growth. In its development, empirical data show that tourism is one of the largest and most rapidly growing services sectors in the world. Tourism is recognized as an alternative to boost economic growth (Belloumi, 2010; Chou, 2013; Clancy, 1999). For this reason, economists have shown an increased interest in conducting in-depth research on the role of tourism in economic growth.

According to the estimates of experts involved in forecasting global economic trends, the future of the economy will be marked by the continued development of the tourism industry as one of the main pillars of economic growth (especially in the case of developing countries). This fact is also supported by the United Nations World Tourism Organization estimate that between 2011 and 2021, the direct contribution of tourism to global GDP will be about 4%. Moreover, within the same period, tourism will generate an additional 69 million jobs (through direct or indirect impacts to other sectors).

In Indonesia, tourism development can be seen in the increased number of foreign tourist arrivals from 2000 to 2014. Despite the fluctuations, the number of foreign tourist arrivals in 2000 (5.1 million) continued to increase, reaching 9.4 million in 2014. The same thing can be observed in the development of tourism receipts from 2000 to 2014, which also indicated an increase. In 2000, tourism receipts reached US$5748.8 million, and then further increased to US$11166.13 million in 2014.

Geographically, Indonesia is located in the Southeast Asia region, which has abundant natural resources as capital to tourism development. Tourism in Indonesia is an important economic sector. By 2015, tourism ranked fourth in terms of foreign exchange earnings after oil and gas commodities, coal and palm oil, with earnings of US$12,225.89 million. Based on the data for 2016, the number of foreign tourists who came to Indonesia further increased to 11.9 million, thus indicating an increase of 15.03% compared with the previous year (Ministry of Culture and Tourism, RI).

In general, the positive impact of tourism on economic growth is influenced by various indicators at the global and national levels. However, the question remains as to whether tourism encourages economic growth or vice versa. In an attempt to provide an answer, the current work examines the validity of one of three relevant hypotheses (i.e., the tourism-led growth hypothesis, the hypothesis of economic growth as a driver of tourism growth, and the hypothesis of causality between tourism and economic growth) on the type of relationship between tourism and economic growth (Oh, 2005).

Aside from being a driver of economic growth, tourism contributes to job creation, production activities and per capita income, private sector growth, and infrastructure development. Tourism also has the potential to encourage increased state revenues from taxes, especially indirect taxes. With such activities, this sector serves as a major source of income, employment, private sector growth, and infrastructure development in many countries. Due to these advantages, tourism development not only stimulates industry growth, but also induces overall economic growth (Lee and Chang, 2008).

Tourism can also reduce regional or economic growth disparities (Li et al., 2016). The fundamental problem of economic asymmetry is due to inequalities in economic potential. For example, some regions or provinces may have abundant natural resources so they will not experience problems in building economic activities as a center of growth. By contrast, many other areas lack ample natural resources and sufficient dry land conditions. Nevertheless, there are areas with less than ideal natural conditions that are adequate for agricultural activities; often, these areas have strategic positions and receive maximum assistance from the central government to help them establish industrial estates as centers of economic growth in their respective regions.

The increasing importance of tourism has been studied, especially in terms of distributing inter-regional development, encouraging regional economic growth, and reducing regional disparities. Shaw and Williams (1991) argue that tourism distributes development from economic centers to less developed areas. Thus, tourism development has often been used as a tool to narrow the regional gap. Proenca and Soukiazis (2008) find that international tourism has a prominent influence on reducing regional disparities between different locations in Spain, Italy, Greece, and Portugal. Similarly, Soukiazis and Proença (2008) show that tourism (tourism capacity as a proxy) increases the level of convergence within the NUTS-2 and NUTS-3 regions in Portugal.

As tourism can encourage the reduction of regional disparities through economic growth, tourism is considered an important factor in examining the issue of regional growth convergence. In relation to convergence analysis, convergence is increasingly becoming the center of attention due to several factors: (1) the existence of poor countries that are getting worse while there are countries experiencing high economic growth, (2) the development literature model of economic growth after the Solow growth model, and (3) the continued misunderstanding of the meaning of the word “conditional” in terms of conditional convergence (conditionals contain the meaning of the essence or sterilization of actual differences in growth rates affecting other variables, especially physical investment and human resources), and (4) the differences in concepts and methodologies employed in various studies on convergence.

Determining the speed of convergence in Indonesia is an interesting research topic, especially if it is incorporated with other factors, such as tourism, in terms of regional economic growth acceleration in the region. Given that various regions in Indonesia have excellent natural resources and also diverse cultures, natural and cultural riches are an important component of tourism in Indonesia. The country has a combination of tropical climates, 17,508 islands of which 6,000 are uninhabited, and the world's third longest shoreline after Canada and the EU. Indonesia is also the largest and most populous island

nation in the world. The beaches of Bali, the diving sites in Bunaken, Mount Rinjani in Lombok, and various national parks in Sumatra are examples of natural tourism destinations in Indonesia. The attractions are supported by a rich cultural heritage that reflects the dynamic history and diversity of Indonesian ethnic groups with 719 regional languages spoken throughout the islands. Meanwhile, Prambanan and Borobudur, Toraja, Yogyakarta, Minangkabau, and Bali are examples of cultural tourism destinations in Indonesia. Based on the above-described background, the research problems in this study are formulated in the form of the following research questions:

(1) What is the role of tourism to regional economic growth in Indonesia?

(2) Can tourism be considered as a conditional factor to improve the living standards of residents in Indonesia?

2. Literature Review

The importance of tourism to national economic development has been widely recognized, especially for its contribution to the balance of payments and production and labor (Shaw and Williams, 1991). In addition, there exists an important link between economic development and tourism in the sense that tourism can stimulate domestic demand levels. The ability of the national economy to benefit from tourism depends on the availability of investments to develop the necessary infrastructure. Benefits can be obtained as long as the country is able to provide the services needed by travelers, such as accommodation, food, transport facilities, entertainment, and others. Thus, there exists a strong relationship between tourism and other economic sectors, including transportation, retail, wholesale, manufacturing, agriculture, arts and crafts, and other services.

Balaguer and Cantavella-Jordá (2002) studied the role of tourism in Spain's economic growth by using export-driven growth approaches for the period 1975–1997. The tourism-led growth hypothesis is confirmed through co-integration and causality testing. The results of their work show that economic growth in Spain has been influenced by the continuous expansion of international tourism. They also found the multiplier effects on growth through the expansion of the tourism sector.

Eugenio-Martin (2004) studied the relationship between tourism and economic growth in Latin American countries from 1985–1998. Their analysis was based on a panel data approach with dynamic GMM estimation techniques. The author found a significant relationship between economic growth and growth in the tourism sector, which is conditioned by other macroeconomic variables. The presented evidence suggests that tourism is favorable for economic growth in middle- or low-income countries, but not necessarily in developed countries.

Several studies have examined the relationship between tourism and economic growth by applying convergence approaches. One such study is that of Proenca and Soukiazis (2008), who used the ordinary least square (OLS), LSDV, and GLS methods of studying the relationship of tourism and the convergence of economic growth in four European countries (Greece, Italy, Portugal, and Spain) from 1990–2004. Using international tourism revenue as a tourism proxy, they found that tourism contributes significantly to economic growth and acts as a convergence factor. Furthermore, Soukiazis and Proença (2008) examined the relationship of tourism to regional economic growth in Portugal from 1993–2001. They used the LSDV, GLS, and GMM-System estimator methods as well as used accommodation capacity in the tourism sector as a proxy for tourism variables. Their results indicate that tourism (through accommodation capacity) has a positive impact on regional economic growth in Portugal, which also increases convergence. In addition, tourism can be considered as an alternative source to stimulate higher regional economic growth in Portugal.

Cortés-Jiménez (2008) used time series data from 1990–2000 and examined tourism relations and regional economic growth in 20 regions in Italy and 17 regions in Spain. They divided the region into three parts: internal regions, coastal regions, and regions with the Mediterranean coast. That study used the GMM method developed by Arellano and Bond (1991) and the LSDV method developed by Bruno (2005). It used nights spent by residents and non-residents and the arrival of domestic and international tourists as tourism variable proxies. The results show that for coastal areas, both domestic and international tourism is an

important factor for the convergence of regional economic growth. The same results also apply to areas with the Mediterranean coast. However, for internal areas, only domestic tourism is relevant in increasing the convergence of regional economic growth.

Sequeira and Nunes (2008) used a dynamic panel data approach to examine whether tourism influenced economic growth in small countries and poor countries from 1980–2002. They used the GMM (Blundell and Bond, 1998) estimators and the corrected least square dummy variables (LSDVC). Sequeira and Nunes also used international tourist arrivals, tourism receipts derived from percentages of exports as well as tourism receipts obtained from a percentage of GDP as proxies for tourism variables. The results show that tourism is a positive determinant factor for economic growth for poor countries, although this impact is not significant in small countries.

Andraz et. al. (2015) examined the influence of tourism on regional economic growth in the five administrative regions of Portugal, North, Center, Lisbon, Alentejo and Algarve during the period 1987–2011. They used the number of overnight stays in hotels, apartments hotels, tourist apartments, tourist villages, motels, bed and breakfasts, inns, guesthouses, and camping parks of domestic and international tourists as tourism variable proxies. Meanwhile, Li et al. (2016) examined the influence of tourism on regional economic growth in coastal and inland China, using time series data from 1997–2010. They used the first-differenced generalized method of moments as well as total tourism receipts and total number of hotel rooms as a proxy for tourism variables. Their result indicates that tourism development in China has a positive effect on regional economic growth and can reduce regional economic disparities in the country. In addition, inland areas (inland areas or less developed regions) grow faster (have faster conditional convergence) than coastal areas (coastal areas or underdeveloped areas). In addition, Li et al. (2016) also examined the relationship between tourism and regional economic growth in 30 provinces in China from 1997–2010, by using the autoregressive spatiotemporal method. The tourism variables used in their study include total tourism receipts and total number of hotel rooms. Their results show that tourism development contributes significantly to the reduction of regional economic imbalances, where domestic tourism contributes more than international tourism.

From the literature review above, we can clearly see that tourism can play a valuable role in stimulating higher growth, reducing regional asymmetry, creating jobs and bringing about positive externalities that affect (directly or indirectly) other economic activities. Next, this paper will focus on the impact of tourism on regional growth by adopting a convergence approach.

3. Data and Methodology

3.1. Data Description

This study uses convergence analysis as a means of analyzing tourism as a driver of economic growth, using annual data from 2010–2016 from 33 provinces in Indonesia. This specific period is selected because of the regional expansion that occurred before 2010, making it difficult to determine the number of provinces to be studied. The data are collected from the Indonesian Central Bureau of Statistics (BPS) and the Ministry of Culture and Tourism of Indonesia.

This study uses regional gross domestic product (RGDP) per capita as a proxy of economic growth as well as investment ratio to RGDP, population growth rate, the population ratio of those who completed secondary and higher education to the total population, and tourism accommodation as proxy variables for tourism.

3.2. Model Specification

In this research, we use the commonly used concepts of convergence sigma (σ) and beta convergence (β) (Barro and Sala-i-Martin, 2004).

3.2.1. σ-Convergence

Here, σ-convergence is analyzed by measuring the dispersion rate of RGDP per capita and calculating the standard deviation of the RGDP per capita logarithm value. Convergence occurs when the dispersion between economies decreases with time.

3.2.2. β-convergence

β-convergence consists of two hypotheses, namely, absolute convergence and conditional convergence. Absolute convergence occur when there exists a negative relationship between the initial RGDP per capita and the average of RGDP per capita growth over the period under study. Barro dan Sala-i-Martin (1992) used absolute convergence in inter-regional studies in one country. Whereas by conducting a conditional convergence hypothesis test, we can gain greater benefits as it is able to identify what determinants of factors affect the ate of regional economic growth in the long term. The conditional convergence model used in this research is given by

$$\ln(y_{i,t}) = \gamma_i + b\ln(y_{i,t-1}) + a_1\ln(s_{i,t}) + a_2\ln(n_{i,t}+g+\delta) + a_3\ln(h_{i,t}) + a_4\ln(P_{i,t}) + u_{i,t},$$

where $y_{i,t}$ is the RGDP per capita at 2010 constant prices, $s_{i,t}$ is the ratio of real capital stock to real GDP, and $n_{i,t}+g+\delta$ is the population growth rate, $h_{i,t}$ is human capital, and $P_{i,t}$ is tourism.

The convergence coefficients, b, at absolute convergence and conditional convergence represent the speed of convergence, which indicates the speed of an area reaching its steady state point. This is expressed using the formula

$$\beta = \frac{[\ln[(b+1)]]}{T},$$

where T is the time period.

Using the value of β, we can calculate the half-life of convergence or the time taken to cover half of the initial economic inequality that occurs. The formula is given by

$$t = \frac{-\ln(0{,}5)}{\beta} \text{ or } t = \frac{\ln(2)}{\beta}.$$

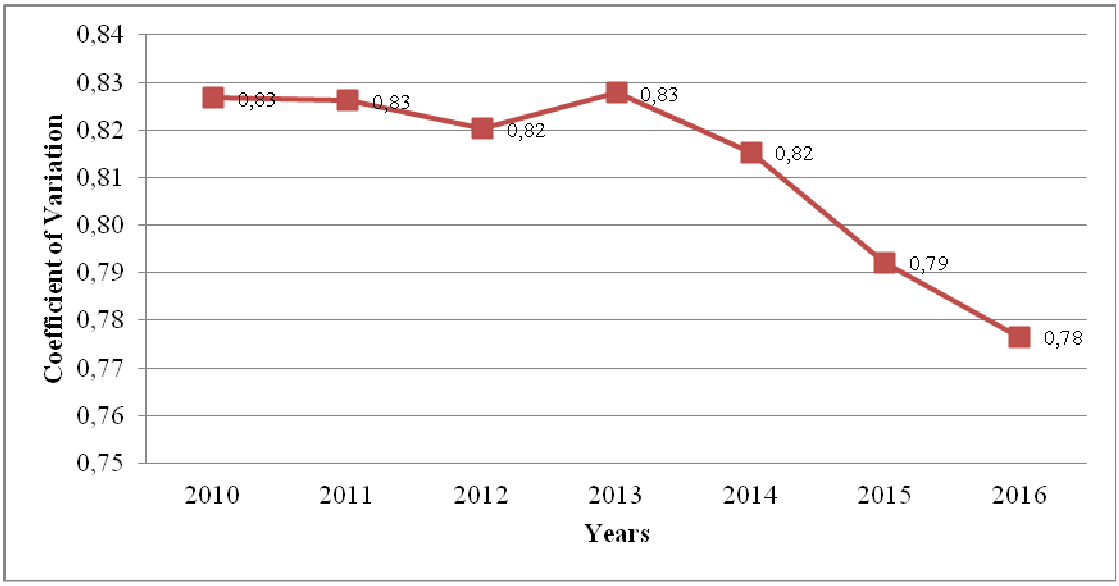
The half-life of convergence has an annual unit. The first procedure to be performed to test the beta convergence (β-convergence) is to find out whether there exists absolute convergence, and then test conditional convergence. If absolute convergence does not occur, and other variables of convergence are included, then the convergence becomes conditional convergence.

4. Results and Discussion

4.1. Convergence Analysis

Here, σ-convergence is analyzed by measuring the dispersion rate of the RGDP per capita. Figure 1 illustrates the development of differences in per capita income among the provinces in Indonesia during the period 2010–2016, using the coefficient of variation (σ-convergence). This coefficient measures the per capita income revenues over time. Declining values indicate a decrease in gap between regions, whereas an increasing value indicates a widening gap between regions in terms of per capita income.

Figure 1. Dispersion of Per capita Income among Provinces in Indonesia, 2010–2016



The main purpose of this study is to examine the impact of tourism activities on regional economic growth and understand how tourism affects the process of convergence among the provinces in Indonesia. Following Soukiazis and Proença (2008), the tourism indicator used in the current study is the tourism accommodation capacity, expressed by the number of beds available to travelers. According to Soukiazis and Proença (2008), there are two reasons why the capacity of accommodation can be used as a proxy for measuring the impact of tourism on economic growth: (1) accommodation capacity is the most significant variable explaining tourism flows (Proenca and Soukiazis, 2008), and (2) accommodation capacity can be assumed to be exogenous, thus avoiding the problem of endogeneity biases that may arise in the process of estimating the convergence equation.

The present study uses panel data estimation technique by combining data for 33 provinces for the period 2010–2016, resulting in 231 observations. Table 1 shows the estimation results. The first part of the table presents the results of absolute convergence, whereas the second part presents the results of conditional convergence to test the significance of tourism accommodation capacity as a conditioning factor for higher regional growth. The following panel data estimation methods are used: the fixed effects method (LSDV), the random effects method (GLS), and the GMM estimator. The fixed effects method assumes certain individual effects captured by the dummy of each region. The random effects method assumes that regional special effects are random, and the GMM estimator method uses an Arrelano–Bond estimator.

The first part of Table 1 presents the estimates of economic growth without any other structural factors affecting economic growth. This is useful in determining whether there is absolute or no convergence. As can be seen, the convergence coefficient is positive and statistically significant for all estimation methods. This means that there is no absolute convergence in Indonesia during the observation period.

The objective focus of this research is to analyze the importance of tourism as one of the factors of regional economic growth in Indonesia. The second part of Table 1 above presents the estimation results for this analysis. According to Arellano and Bond (1991), two criteria can be used for finding the best dynamic panel model estimator: first, the instrument used must be valid and, second, the estimator must be consistent. The Sargan test is used to determine the validity of the use of instrument variables, whose numbers exceed the number of parameters suspected (overidentifying the restriction conditions). Table 1 shows the results of the Sargan test with a chi-square value of 17.05838 and p-value of 0.2531, which is greater than the real level of 5%; thus, the null hypothesis is not rejected. This means that the condition is overidentifying the restriction in a valid model estimator.

Table 1. Estimated Results of Convergence of Economic Growth in Indonesia, 2010–2016

Variables	LSDV fixed effects	GLS random effects	GMM estimator
Absolute Convergence: $\ln y_{i,t} = \gamma_i + b \ln(y_{i,t-1}) + u_{i,t}$			
Constant	0.5689428 (2.90)*	0.1673936 (3.58)*	0.591502 (12.59)*
$\ln(y_{i,t-1})$	0.9483119 (49,42)*	0.9875397 (216.23)*	0.9461395 (206.37)*
R^2	0.9371	0.9371	
Number of observations	198	198	165
Degrees of freedom			
F test–Wald test	F(1,164) = 2442.72 Prob [0.0000]	Wald chi^2(1) = 46757.51 Prob [0.0000]	Wald chi^2(1) = 42589.90 Prob [0.0000]
Sargan test			Chi2(14) = 18.53244 Prob [0.1836]
Test for second order serial correlation AR(2)			z = 0.8662 Prob [0.3864]
Conditional Convergence: $\ln y_{i,t} = \gamma_i + b \ln(y_{i,t-1}) + a_1 \ln(s_{i,t}) + a_2 \ln(n_{i,t} + g + \delta) + a_3 \ln(h_{i,t}) + a_4 \ln(P_{i,t}) + u_{i,t}$			
Constant	0.8809244 (2.62)*	0.1404715 (2.70)*	0.6469588 (4.31)*
$\ln(y_{i,t-1})$	0.8523631 (24.43)*	0.9882348 (212.01)*	0.9186825 (50.66)*
$s_{i,t}$	–0.142812 (–2.16)*	0.0317459 (1.01)	–0.57964 (–1.48)
$n_{i,t} + g + \delta$	0.1355786 (0.56)	–0.1123388 (–0.48)	0.0720315 (0.98)
$h_{i,t}$	0.000648 (1.22)	–0.000258 (–1.04)	0.0004079 (2.81)*
$P_{i,t}$	0.0702238 (3.73)*	0.003308 (1.05)	0.0214514 (2.27)*
R^2	0.9445	0.9362	
Number of observations	198	198	165
Degrees of freedom			
F test–Wald test	F(5, 160)=544.32 Prob [0.0000]	Wald chi^2(4) = Prob [0.0000]	Wald chi^2(5)=20195.07 Prob [0.0000]
Sargan test			Chi^2(14) = 17.05838 Prob [0.2531]
Test for second order serial correlation AR(2)			z(1)= -1.5698 Prob [0.1165] z(2) = 0.93498 Prob [0.3498]

Next, the estimator consistency is tested with the Arellano–Bond test. Consistent estimators have residual components that do not experience second order serial correlation in the equation of the first difference. Table 1 shows the first order z value of–1.56 with a p-value of 0.1165; thus, the null hypothesis is rejected. This means that there is an autocorrelation in the first-order first difference residuals. In the second order the z value is 0.93 with a p-value of 0.3498 so that the null hypothesis is accepted. This means that there is no autocorrelation in the second-order first difference residuals. Testing with the Arelano-Bond test showed consistent results so that the residuals in the model did not experience autocorrelation.

Based on Table 1 above, the equation for tourism models and economic growth is obtained as follows:

$$\ln y_{i,t} = 0.6469588 + 0.9186825 \ln(y_{i,t-1}) - 0.57964 \ln(s_{i,t}) + 0.0720315 \ln(n_{i,t} + g + \delta) + 0.0004079 \ln(h_{i,t}) + 0.0214514 \ln(P_{i,t}) + u_{i,t}.$$

In accordance with the above equation, the coefficient of economic growth variable lag has a positive sign of 0.9186825. The investment coefficient of –0.57964 means that if there is an investment increase of 1%, this can lead to a corresponding decline in economic growth of 0.57%. For the population growth rate variable having coefficient of 0.0720315, it means that the increase of population growth by 1% will be responded by the increase of economic growth equal to 0.07%. Human capital variable has a coefficient of 0.0004079, meaning that the increase in human capital by 1% can lead to a corresponding 0.00041% increase in economic growth. Finally, the variable of tourism accommodation has a coefficient of 0.0214514, meaning that an increase of tourism accommodation by 1% can lead to a corresponding 0.021% increase in economic growth.

The estimation result of tourism and economic growth is in accordance with the initial hypothesis that tourism can encourage economic growth (tourism-led growth hypothesis). Using a dynamic model approach allows us to estimate the lag coefficient of the GDP per capita, a value that indicates the extent to which the current per capita GDP is determined by the value of the previous per capita GDP. Based on Table 1 above, the coefficient of GDP per capita lag is 0.85. The value of the coefficient explains that if there is an increase in GDP per capita in the previous period or year by 1%, can lead to a corresponding of 0.85% increase in the GDP per capita in the next period. However, a positive sign on the variable lag of GDP per capita shows that there is no indication of convergence among provinces in Indonesia.

5. Conclusions

The purpose of this study was to test the impact of tourism on economic growth, using a dynamic panel data estimation approach and convergence analysis, in order to provide evidence indicating the impact of tourism on economic growth among Indonesian provinces. Using annual data from the period 2010–2016 for 33 provinces, this study uses convergence analysis as a means of analyzing tourism as a driver of economic growth in Indonesia. The selection of this period is due to the fact that, before 2010, there are still some regional expansions that happened, making it difficult to determine the number of provinces to be studied. This study also uses the RGDP per capita as a proxy of economic growth, investment ratio to RGDP, population growth rate, population ratio of those who completed secondary and higher education to the total population, and tourism accommodation as proxy variables for tourism.

The main purpose of this study is to examine the impact of tourism activities on regional economic growth and understand how tourism affects the process of convergence among provinces in Indonesia. Following Soukiazis and Proenca (2008), the tourism indicator used in this study is the tourism accommodation capacity, which is expressed by the number of beds available to travelers. According to Soukiazis and Proenca (2008), there are two reasons for using this as a proxy for measuring the impact of tourism on economic growth: first, accommodation capacity is the most significant variable explaining tourism flows (Proença and Soukiazis, 2005) and, second, accommodation capacity can be assumed to be exogenous, thus avoiding the problem of endogeneity biases that may arise in the process of estimating the convergence equation.

The results show that tourism and economic growth are linked, in accordance with the initial hypothesis that tourism can encourage economic growth; however, there is no indication of convergence among provinces in Indonesia. Therefore, tourism can be considered as an alternative source for stimulating economic growth in the country, but only if the supply characteristics of this sector are improved.

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DOES INDONESIA AS THE WORLD LARGEST PALM OIL PRODUCING COUNTRY DETERMINE THE WORLD CRUDE PALM OIL PRICE VOLATILITY?

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Abstract

This study contributes to the existing literature on the current phenomena of a higher level of world palm oil volatility by exploring the bivariate causal relationship between Indonesian and Malaysian CPO exports, the world crude and soybean oils, exchange rate, and the world CPO price volatility using the bivariate Granger causality analysis. It also attempts to explore the extent to which shocks in these variables influenced the world CPO price volatility using the impulse response functions and variance decomposition analyses over the period from January 2008 to December 2017. The study found that the world CPO price volatility is mainly Granger-caused by the changes in the real exchange rate. The Indonesian CPO export only found to have a bidirectional Granger causal relationship with the Malaysian CPO export, while the Malaysian CPO exports are Granger-caused by the world CPO price volatility, world crude oil price, and world soybean oil price. Our findings suggested that macroeconomic policy harmonization on the CPO price and production as well as exchange rate policy should be innovatively designed between Indonesia and Malaysia through the existing Council of Palm Oil Producing Countries (CPOPC) if these counties intend to gain more revenue from their CPO exports in the future.

Keywords: Dynamic causality; World CPO price volatility; World commodity markets; Macroeconomic policy harmonization; International CPO trade

JEL classification: C53, F42, L13, Q17, Q37

1. Introduction

As the largest palm oil producing country, Indonesia is the world's largest crude palm oil (CPO) exporting country (Sulaiman et al., 2011) with a share of 47.16% of the world palm oil markets (The Ministry of Plantation Industries and Commodities of Malaysia, 2015). Despite its largest market share of the world palm oil market, Indonesia has been unable to control the world CPO price since last few decades. Instead, the world CPO price is determined by the global commodity price and Indonesia is the price taker (Haron and Salami, 2015) and simply benchmarks its CPO price to the world CPO market.

Lately, agricultural products such as CPO, their prices have been more volatile than the prices of other manufactured products globally (Jacks et al., 2011). The higher level of volatility of world CPO price has been a major problem for Indonesia since the country had relied its exporting CPO price primarily on the movement of world CPO prices and its determinants. Moreover, the campaign of unhealthy palm oil that creates deforestation,

greenhouse gas emissions, and human rights violations (Corciolani et al., 2019) propagated by few parties resulted in a more instability of the world CPO price. The fierce competition between palm oil, vegetable oil, and soybean oil in the European countries (Bergmann et al., 2016), the aggressive CPO price competition between Indonesia and Malaysia as the largest and second largest oil producing countries, and the CPO price speculation in the Chinese futures market have further triggered volatility of the CPO price globally (Bohl et al., 2018).

As the largest producing palm oil country in the world, the palm oil has become one of the leading agricultural commodities in Indonesia that had contributed to national economic development (State Secretary of Indonesia, 2004). It also has been a source of income for millions of farming families that offers million of job opportunity, triggers the growth of new economic centers, and as a driver of the development of the palm oil-based downstream industry (Secretariat General of the Ministry of Agriculture, 2014). Due to the pivotal role of palm oil to the national economy of Indonesia, thus it is timely and extremely urgent to explore the determinants of the volatility of the world CPO price. To what extent the volatility of world CPO price is interlinked to the volatility of world CPO supply, the world price of soybean oil, world crude oil price, and exchange rate?. Do the shocks in the volatility of world crude oil price, world CPO supply, the world price of soybean oil, and exchange rate cause the world CPO price to become more volatile?. If yes, to what extent the shocks in these variables are responded by the changes in the world CPO price? Thus, these questions would be the main focus of our study.

There have been many studies investigated the world CPO price volatility using both qualitative and quantitative methods. For example, Go and Lau (2018) explore the relationships between prices and volumes of world CPO during the pre-crisis, during-crisis and post-crisis periods in the world futures market. Ceballos et al. (2017) investigate the short-term price volatility transmission of the major 41 domestic food products in 27 countries in Africa, Latin America, and South Asia using the multivariate generalized autoregressive conditional heteroscedasticity (GARCH) approach. Arianto et al. (2010), Cabrera and Schulz (2016), Carolina et al. (2016), and Buyung et al. (2017) examine short-term and long-term relationships between the volatility of world CPO and soybean oil and found that the prices of soybean oil and CPO are positively related as these products are substitutable. Asmara et al. (2012) investigate the volatility of world CPO prices and their impacts on the performance of Indonesia's manufacturing sector. Meanwhile, some studies explore the influence of exchange rate fluctuation on the volatilities of food and biofuel prices (Abdelradi and Serra, 2015), and CPO exports (Sarwedi, 2010; Ginting, 2013; Aprina, 2014; and Nasution, 2016).

Unlike the previous studies that investigated both short-run and long-run relationships between the CPO price, soybean oil price, exchange rate, and its interlinks to other selected macroeconomic determinants, this study empirically explore the bivariate causal relationships between the volatility of world CPO price, world CPO supply, world price of soybean oil, world crude oil price, and exchange rate using Granger causality approach. The second contribution of our study is its focus on analyzing the impact of shocks in the foreign macroeconomic determinants, namely the world CPO supply, world price of soybean oil, world crude oil price, and global exchange rate on the volatility of the world CPO price using the impulse response functions and variance decomposition approaches. Finally, unlike the previous studies that mainly focus its analysis on the global CPO market, this study mainly focuses its analysis on the volatility of the CPO price and its determinants for the case of the largest CPO producing country, Indonesia. Comparing to its largest world CPO market share, the availability of existing empirical evidence on the volatility of CPO price and its determinants for the case of Indonesia has been meager compared to the existing empirical evidence on the global CPO market. Thus this study intends to fill this gap by providing latest empirical evidence on the effects of Indonesian CPO export on the volatility of world CPO price using the monthly data over the period from January 2008 to December 2017 (120 number of observations).

The findings of this study are hoped to shed some lights for CPO producers, palm oil plantation companies, investors, and downstream palm oil industry in making their decision to risk hedging and mitigation. The findings of this study are also useful for the governments of

the CPO producer countries, particularly Indonesia in designing the international trading policy related to the CPO price and its export.

The rest of this study is structured as follows. Section 2 reviews relevant literature to the CPO price and its determinants, while Section 3 provides the data and empirically estimated models as the basis for further analyses. Section 4 discusses the findings and their implication. Finally, Section 5 concludes the study.

2. Literature Review

Price volatility is a measure of the level of undirected price changes (Gilbert and Morgan, 2013). A relatively higher price change due to a decline in supply and an increase in demand is called as price volatility. In general, price volatility shows how much and how fast a price changes over time, for example, the CPO price. Furthermore, Gilbert and Morgan (2013) also explained that price volatility is a measurement of price dispersion. Statistically, he economists commonly measure price variation or price volatility using standard deviation.

Cabrera and Schulz (2016) examine the volatility of CPO price and its relation to the price of biodiesel. As a source for biodiesel, changes in soybean oil contribute changes in the CPO price and its exports. Comparing to CPO price, the price of soybean oil in the domestic market is more responsive to changes in market dynamics (Carolina et al., 2016). The changes in the price of soybean oil cause changes in the CPO price.

Furthermore, Asmara et al. (2012) found that changes in the world crude oil price have a different influence on economic sectors. The volatility of world oil prices tends to more impact on the performance of the industrial sector than the agricultural sector. The changes in the price of crude oil directly affect the volatility of food prices through agricultural production inputs, such as fertilizer and transportation, but it indirectly affects the prices of food commodities through increasing biofuel production. As an oil importing country, Indonesia is vulnerable to food price shocks because volatility in crude oil prices would trigger fluctuations in domestic food prices.

The movement of world CPO prices is also influenced by the volume or value of CPO exports (Azizah, 2015). In her study, Azizah (2015) find that Indonesia's CPO exports to the European zone is not affected by the changes in the world CPO prices. However, the CPO export prices are positively related to export volume, meaning that if export CPO prices rise then CPO export increases (Maygirtasari and Yulianto, 2015). In contrast, an increase in domestic CPO prices causes the level of Indonesian palm oil exports to decline (Riskayanto, 2013).

Furthermore, the changes in exchange rate contribute to the higher level of volatility of food and biofuel prices (Abdelradi and Serra, 2015). Changes in the exchange rate have a positive influence on the CPO exports in the long run, but it negatively affects the CPO price in the short-run (Sarwedi, 2010). Specifically, the decline in the exchange rate of the domestic currency (depreciation) encourages more exports in the short-run, but it gradually causes the reduction of the CPO export in the long-run. However, according to Ginting (2013), the depreciation of the exchange rate has a negative influence on the Indonesian CPO export both in short- and long-run. An increase in the level of CPO prices, either directly or indirectly through the monetary sector, is proven to cause an appreciation of the real exchange rate (Aprina, 2014). The higher the growth of world CPO prices, the higher the level of inflation, and the greater the appreciation of the real exchange rate. The sharp increase in world CPO price together with the depreciation of the IDR cause the CPO producers to export as much as possible. Consequently, this leads to the shortage of the CPO to meet domestic needs that, in turns, drive the domestic prices to soar (Nasution, 2016).

Finally, the volatility of the world CPO price is also affected by the changes in prices of its substitutable products such as soybean oil and other vegetable oil. Theoretically, as for the substitutable products, as the price of the CPO increases, consumers will demand more its substitutable product of soybean oil, similar to the finding of the study by Arianto et al. (2010) over the period 2004-2008 in Indonesia. Additionally, the movement of the CPO price would follow the movement of other vegetable oils because the producers of these products were competing to gain higher global market share of global vegetable oil. However, Arianto

et al. (2010) and Buyung et al. (2017) find that an increase in soybean oil price reduces the price of CPO in Indonesia during the periods 1980-2003 and 2005-2015, respectively.

The above-reviewed studies show that the volatility of the world CPO price is influenced by changes in the world CPO supply, world crude oil price, the price of its substitutable products, and the exchange rate. Thus, this study investigates the causal relationship between the variables and explore the extent to which the shocks in the determinants of the world CPO price is responded by the changes in the world CPO prices using Granger bivariate causality, the IRFs, and VDC.

3. Research Method

3.1. Data

Monthly data of world CPO price volatility (WCV), the Indonesian CPO export (ICX), the Malaysian CPO price (MCX), world crude oil price (WCP), world soybean oil price (WSP), and real effective exchange rate (RER) over the period from January 2008 to December 2017 were utilized in the study. The WCV is measured from the standard deviation of the monthly average price of world CPO based on the Rotterdam market in the USD per metric ton. The ICX and MCX are measured from the monthly average values of Indonesian and Malaysian CPO exports in the Indonesian Rupiah (IDR) and Malaysian Ringgit (MYR), respectively. The WCP and WSP are measured from monthly average prices of world crude oil and soybean oil in the USD per barrel. Finally, the RER is measured by the monthly nominal cross rate of the IDR against the USD Dollar multiplied by the ratio of the Indonesian consumer price index to the US consumer price index.

The data of the values of Indonesian CPO exports, nominal exchange cross rate of the IDR against the USD, Indonesian consumer price index, and the US consumer price index are gathered from the reports of Central Bank of Indonesia, Bank Indonesia (BI). The data on prices of the world CPO, soybean oil, and world crude oil is collected from the reports of the World Trade Organization (WTO). Finally, the data of values of Malaysian CPO exports is gathered from the reports of the Central Bank of Malaysia, Bank Negara Malaysia (BNM).

3.2. Empirical framework

To explore the causality between the variables and the impact of shocks in one variable on another variable, the following main econometric model is estimated:

$$WCV_t = \alpha_0 + \alpha_1 ICX_t + + \alpha_2 MCX_t + \alpha_3 WCP_t + \alpha_4 WSP_t + \alpha_5 RER_t + \varepsilon \quad (1)$$

where WCV is the world CPO price volatility, ICX is the Indonesian CPO export, MCX is the Malaysian CPO price, WCP is the world crude oil price, WSP is the world soybean oil price, and RER is the real effective exchange rate, (RER), α is the estimated value of each coefficient; and ε is the error correction term.

Prior to the analysis of the causal relationship, the unit root test is conducted first to ensure all variables are stationary regression. The regression findings become invalid and spurious while the non-stationary variables are used (Thomas, 1997). Basically, stationary shows that the mean, variance, and covariance of variables are constant over time. To check for the stationarity, the following standard ADF (Dickey and Fuller, 1979 and 1981) is adopted.

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \gamma_i \sum_{i=1}^{m} \Delta y_{t-1} + \varepsilon_t \quad (2)$$

where Δy_t is the first difference of y, β_1 is the constant, β_2 is the predicted coefficient for a trend, δ is the predicted coefficient for lagged y, γ is the predicted coefficient for difference of the lagged y, ε is the error term, m is the number of lag, and t is the time period. In the stationary test, when the null hypothesis (H_0: $\delta = 0$) of a unit root is rejected, it indicates the variables to be stationarity and vice versa.

In the next step, the Granger causality test is conducted to explore the causal bivariate relationships between the variables within the vector autoregression (VAR) framework. The following VAR empirical models are estimated:

$$\Delta WCV_{1t} = \alpha_{10} + \sum_{i=1}^{k} \alpha_{11i}\Delta WCV_{1t-1} + \sum_{i=1}^{k} \alpha_{12i}\Delta ICX_{2t-1} + \sum_{i=1}^{k} \alpha_{13i}\Delta MCX_{3t-1} + \sum_{i=1}^{k} \alpha_{14i}\Delta WCP_{4t-1} + \sum_{i=1}^{k} \alpha_{15i}\Delta WSP_{5t-1} + \sum_{i=1}^{k} \alpha_{16i}\Delta RER_{6t-1}\varepsilon_{1it} \quad (3)$$

$$\Delta ICX_{2t} = \alpha_{20} + \sum_{i=1}^{k} \alpha_{21i}\Delta ICX_{1t-1} + \sum_{i=1}^{k} \alpha_{22i}\Delta WCV_{2t-1} + \sum_{i=1}^{k} \alpha_{23i}\Delta MCX_{3t-1} + \sum_{i=1}^{k} \alpha_{24i}\Delta WCP_{4t-1} + \sum_{i=1}^{k} \alpha_{25i}\Delta WSP_{5t-1} + \sum_{i=1}^{k} \alpha_{26i}\Delta RER_{6t-1}\varepsilon_{2it} \quad (4)$$

$$\Delta MCX_{3t} = \alpha_{30} + \sum_{i=1}^{k} \alpha_{31i}\Delta MCX_{1t-1} + \sum_{i=1}^{k} \alpha_{32i}\Delta WCV_{2t-1} + \sum_{i=1}^{k} \alpha_{33i}\Delta ICX_{3t-1} + \sum_{i=1}^{k} \alpha_{34i}\Delta WCP_{4t-1} + \sum_{i=1}^{k} \alpha_{35i}\Delta WSP_{5t-1} + \sum_{i=1}^{k} \alpha_{36i}\Delta RER_{6t-1}\varepsilon_{3it} \quad (5)$$

$$\Delta WCP_{4t} = \alpha_{40} + \sum_{i=1}^{k} \alpha_{41i}\Delta WCP_{1t-1} + \sum_{i=1}^{k} \alpha_{42i}\Delta WCV_{2t-1} + \sum_{i=1}^{k} \alpha_{43i}\Delta ICX_{4t-1} + \sum_{i=1}^{k} \alpha_{44i}\Delta MCX_{4t-1} + \sum_{i=1}^{k} \alpha_{45i}\Delta WSP_{5t-1} + \sum_{i=1}^{k} \alpha_{46i}\Delta RER_{6t-1}\varepsilon_{4it} \quad (6)$$

$$\Delta WSP_{5t} = \alpha_{50} + \sum_{i=1}^{k} \alpha_{51i}\Delta WSP_{1t-1} + \sum_{i=1}^{k} \alpha_{52i}\Delta WPV_{2t-1} + \sum_{i=1}^{k} \alpha_{53i}\Delta ICX_{3t-1} + \sum_{i=1}^{k} \alpha_{54i}\Delta MCX_{4t-1} + \sum_{i=1}^{k} \alpha_{55i}\Delta WCP_{5t-1} + \sum_{i=1}^{k} \alpha_{56i}\Delta RER_{6t-1}\varepsilon_{5it} \quad (7)$$

$$\Delta RER_{6t} = \alpha_{60} + \sum_{i=1}^{k} \alpha_{61i}\Delta RER_{1t-1} + \sum_{i=1}^{k} \alpha_{62i}\Delta WCV_{2t-1} + \sum_{i=1}^{k} \alpha_{63i}\Delta ICX_{3t-1} + \sum_{i=1}^{k} \alpha_{64i}\Delta MCX_{4t-1} + \sum_{i=1}^{k} \alpha_{65i}\Delta WCP_{5t-1} + \sum_{i=1}^{k} \alpha_{66i}\Delta WSP_{6t-1}\varepsilon_{6it} \quad (8)$$

To test for bivariate statistical causality, the F-statistic values of α_{ii} are referred. The rejection of the null hypothesis indicates the presence of Granger cause from one variable to another variable. From this test, four patterns of causal relationships between variables could be detected, namely: (i) a unidirectional Granger causality from the independent variable to the dependent variable; (ii) a unidirectional Granger causality from the dependent variable to the independent variable; (iii) a bidirectional Granger causality between the independent and dependent variables; and (iv) non-causal Granger relationship between the independent and dependent variables.

The lag length included in the Equations (3) to (8) is determined based on the Akaike (1969) Information Criteria (AIC). As the study uses time series analysis, the study carries out the required pre-testing to resolve the stationary properties of the data series adopting a widely unit root test of the standard Augmented Dickey-Fuller (ADF) as in the Equation (2).

Finally, based on the above VAR models, the study generate the Impulse Response Functions (IRFs) and the Variance Decomposition (VDC) to explore how the shocks of independent variables are responded by the dependent variable and to estimate the error variance of a variable to measure how much the difference between variance before and after shock. Specifically, the IRFs quantify the time profile of the impact of shocks at a specified point in time on the (expected) future values of variables in a dynamic scheme (Pesaran and Shin, 1998). This technique is well-suited in the study since it quantifies the relative strength of the diverse shocks in terms of their contributions to variations in a certain variable of interest and discovers the pattern and direction of the transmission of shocks. Thus, the duration of the influence of the shock of a variable on other variables until its effect disappears or returns back to the equilibrium point could be identified using the IRFs.

Meanwhile, the VDC measure the percentage of estimated errors of variables explained by other variables, or in other words the relative impact that one variable has on other variables. It identifies the estimated error variance of a variable to measure how much the difference between variance before and after shock. In short, the VDC can determine the magnitude of the contribution of independent variables in explaining the dependent variable when a shock occurs.

4. Findings and Discussion

Since most of the macroeconomic variables are non-stationarity (Serletis, 1992), thus to avoid from the spurious regression that results in non-robust and invalid empirical findings (Thomas, 1997), the study conduct first the test of stationarity using the standard Augmented Dickey-Fuller and Phillips-Perron (PP). The findings of stationary tests from both the ADF and PP are reported in Table 1.

Table 1. The ADF and PP tests for stationarity

Variable	Level		First Difference	
	ADF	PP	ADF	PP
WPV	-2.8731	-2.4745	-7.4330***	-7.4547***
ICX	-0.4837	-0.8938	-13.6072***	-39.1431***
MCX	-0.4298	-0.4887	-14.7422***	-14.9041***
WCP	-2.6503	-2.1510	-6.1975***	-6.1017***
WSP	-2.6179	-2.2321	-7.3331***	-7.2844***
RER	-2.1190	-2.2388	-10.2131***	-10.5786***

Note: The figures show the p-values of the ADF and PP tests. *** indicates significance at the 1% level.

As illustrated in Table 1, the study found that all variables (i.e., WPV, ICX, MCX, WCP, WSP, and RER) were non-stationarity at the level, *I*(0) both using the ADF and PP tests. Thus, to ensure for their stationarity, all variables are tested their stationarity at the first difference. The tests showed that all variables become stationarity after taking their first difference, *I*(1) both using the ADF and PP tests. These findings showed that for further analyses of causal bivariate relationships and impact of shocks in one variable on another variable, the *I*(1) variables should be used to arrive at the robust and valid empirical findings.

After confirming all data were stationarity at the *I*(1), in the next step, the study determine the optimal lag-length to be included in the model using the lag-length criterion of Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwartz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ). Referring to these lag-length criteria, the lag-length of 4 is found to be the optimal lag-length included in our estimated model. Thus, for further analyses, the lag-length of 4 is incorporated in the estimated model.

As stated earlier, to explore the causal bivariate relationship between the variables, the Pairwise Granger causality test based on the VAR framework is conducted. The findings of the bivariate causal relationships are reported in Table 2.

As observed from Table 2, the study found that the world CPO price volatility is only Granger-caused by the real exchange rate (RER) and Granger caused the Malaysian CPO export (MCX) and world crude oil price (WCP). These proved that the world CPO price volatility caused the changes in the Malaysian export and drive the world crude oil price to change, while the changes in real effective exchange are found to be the only factors Granger caused the world CPO price volatility. As the world economy moving towards more integrated into the globalization era (Karim and Majid, 2009, 2010; Kassim et al., 2011; and Majid and Kassim, 2009, 2010), thus any changes in the real exchange rate would cause the price of the world CPO to become more volatile. This further indicates that to stabilize the world CPO price it is extremely important to ensure the stability of the exchange rate globally.

Table 2. The bivariate Granger causal relationships between the variables

Null Hypothesis	F-Statistic	Prob.	Null Hypothesis	F-Statistic	Prob.
ICX ≠ WPV	0.3912	0.6772	ICX ≠ WSO	0.2688	0.7648
WPV ≠ ICX	1.4759	0.2330	RER ≠ ICX	1.9603	0.1456
MCX ≠ WPV	0.1608	0.8517	ICX ≠ RER	0.7159	0.4910
WPV = MCX	5.2431***	0.0067	WCP = MCX	8.3110***	0.0004
WCP ≠ WPV	0.2982***	0.7428	MCX ≠ WCP	0.0501	0.9511
WPV = WCP	5.1704	0.0071	WSP = MCX	6.9755***	0.0014

Null Hypothesis	F-Statistic	Prob.	Null Hypothesis	F-Statistic	Prob.
WSP ≠ WPV	0.2350***	0.7909	MCX ≠ WSP	0.9404	0.3935
WPV ≠ WSP	1.6188	0.2027	RER ≠ MCX	0.6936	0.5019
RER = WPV	4.9809	0.0085	MCX ≠ RER	0.2439	0.7840
WPV ≠ RER	1.7751	0.1742	WSP ≠ WCP	1.4664	0.2352
MCX = ICX	2.9338	0.0573	WCP ≠ WSP	0.1674	0.8460
ICX = MCX	2.7503	0.0682	RER = WCP	4.5554	0.0125
WCP ≠ ICX	0.4605	0.6321	WCP = RER	7.2389	0.0011
ICX ≠ WCP	2.1631	0.1198	RER = WSP	4.6648	0.0113
WSP ≠ ICX	0.65783	0.5200	WSP ≠ RER	2.0035	0.1397

Note: = indicate the presence of bivariate Granger causal relationship, while ≠ indicates the absence of bivariate Granger causal relationship. ***, **, and *indicate significance at the 1%, 5%, and 10% levels, respectively.

Interestingly, the Indonesian CPO export (ICX) only found to have a bidirectional Granger causal relationship to the Malaysian CPO export (MCX), while other variables were found no significant effect on the Indonesian CPO export. As the major competitive trading partner, Malaysia is the second largest producer CPO country after Indonesia, thus any changes of CPO export in these countries would cause the world CPO supply, which in turns, affect their CPO exports. This finding further implies that to gain greater benefits from their CPO exports, these two largest CPO producing countries should engage in a more cooperative way of determining their CPO supply. In addition, ass Indonesia is a more isolation economy from the rest of the world (Majid et al., 2008, 2009, 2018), thus the changes in other variables have no significant effect on the Indonesian CPO export.

Unlike the Indonesian CPO export (ICX), the Malaysian CPO export (MCX) is Granger caused by the world CPO price volatility (WPV), world crude oil price (WCP) and world soybean oil price (WSP). This indicated that the Malaysian CPO export is more exposed to world commodity prices. The Malaysian effort to embark its palm oil industry into renewable energy, thus the changes in the Malaysian export would affect the world crude oil price (Abdulrazik et al., 2017). These findings further imply that to promote the values of CPO export, Malaysian government could design its owned specific macroeconomic stabilization policy, as the findings suggested the significant influences of the Malaysian CPO export on the world commodity markets.

Furthermore, the study documented that the world crude oil price (WCP) is Granger caused by the world CPO price volatility (WCV), indicating the significant role of changes in world CPO price in determining the world oil price. Since the palm oil is one of the renewable energy sources (Loh, 2017; and Giwa et al., 2017), thus increase in the world CPO and other agricultural commodity prices would cause the rise in world crude oil price (Nazlioglu and Soytas, 2012). In addition, the study documented a bidirectional causal relationship between the world crude oil price (WCP) and world soybean oil price (WSP) with the real effective exchange rate (RER), similar to our earlier findings on the significant causes of exchange rate on the price of world CPO. These findings further confirmed the important role of the exchange rate in determining the stability of world commodity price (Yang et al, 2017; and Alley, 2018). Thus, managing the stability of the exchange rate is the most crucial strategy in stabilizing the world commodity markets. Macroeconomic harmonization among the country in the globe is extremely important for stabilization of the world economy, including the world CPO market.

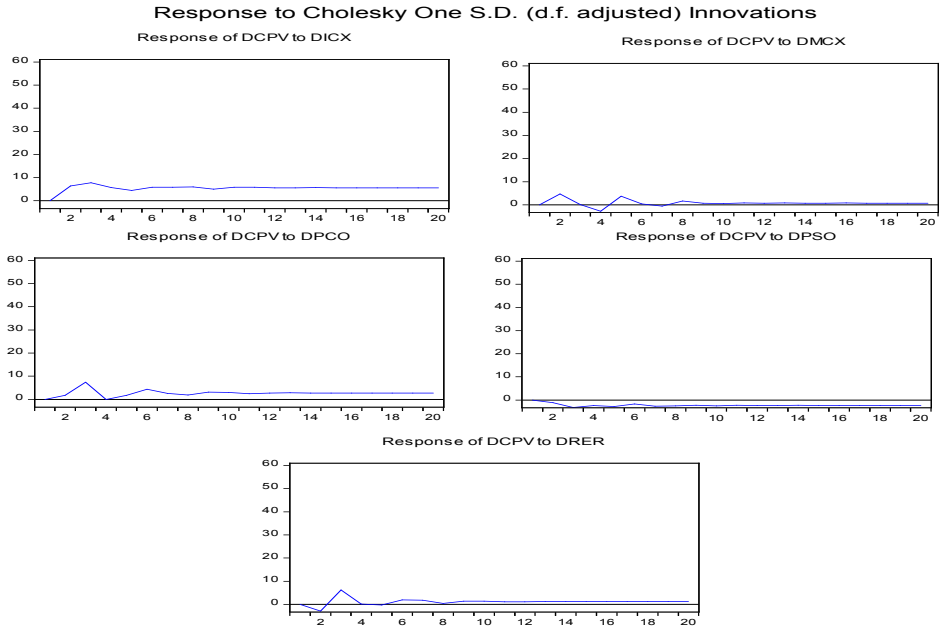
After discussing the findings from the Granger bivariate causalities among the variables, the study now presents and discusses how the variable is responded to the shocks in other variables using the Impulse Response Functions (IRFs) and Variance Decomposition (VDC) analyses. Figure 1 reported the findings from the IRFs based on one standard deviation for a 20-month time horizon.

Referring to Figure 1, the study found that, in the first period, the shocks in the Indonesian CPO exports (ICX) have no effect on the world CPO price volatility (WPV). However, in the

next periods, the shocks in the Indonesian CPO export caused the world CPO price volatility for a few months before its return to the equilibrium point. This finding is in line with the finding by Buyung et al. (2017), who found that an increase in the world CPO price encouraged the exporting countries to increase their exports to gain higher benefits from international trading activities.

In addition, the study found that the shocks in the Malaysian CPO export caused a one standard deviation changes in the world CPO price. Although during the first period, the shocks in the Malaysian CPO price did not cause the world CPO price volatility, but in a few months later, the world CPO price has been become more volatile due to the shocks in the Malaysian CPO exports. During the second-, third-, fifth-, and six-month period it has a positive response, while starting from the third-to the fourth-month and during the sixth-month period, the response was negative. However, during the seventh-month period onwards, the changes in the world CPO prices responded positively to the Malaysian CPO exports.

Figure 1. Responses of world CPO price volatility to the shocks in other variables



Furthermore, the study documented that the shocks in the world crude oil price (WCP) only caused the changes in the world CPO price starting from the second month period. During the second- and the third-month period the changes in world crude oil price responded positively by the changes in the world CPO price and then it turned back to the equilibrium point. However, the world CPO price has again responded positively to the changes in the world crude oil price after the fourth-month period onwards. This is due to the fact that palm oil is one of the renewable energy sources, thus any changes in the world crude oil prices would be positively responded by an increase in the world CPO price.

Finally, the shocks in the world soybean oil prices (WSP) and real exchange rate (RER) caused the world CPO price to become more volatile starting from the second-month period onwards. This could be due to the success of the black campaign by the vegetable oil producing countries on the negative externality caused by the palm oil plantation and industry which resulted in the reduction of world market demand for palm oil. This finding is in harmony with our previous finding on the negative effect of the world price of soybean oil on the world CPO prices. Unlike the shocks in the world soybean oil price that has an adverse effect on the world CPO price over the 20-month time horizon, the shocks in the real exchange rate have a mixed effect on the world CPO price volatility. In the second period, shocks in the real exchange rate are negatively responded by the world CPO price, while during the fourth to the fifth period it turned back to the equilibrium position.

To support our findings based on the IRFs, we further conduct the Variance Decomposition (VDC) analysis to find out how much the shocks in independent variables could explain the changes in the dependent variable. The findings of the VDC are reported in Table 3. Table 3 showed that the changes in the world CPO price is predominantly explained

by its owned shocks (98.57%), while the shocks in other variables only explained less than 2% of the world CPO price volatility [i.e., the Indonesian CPO export (1.73%), the world crude oil price (0.85%), real exchange rate (0.70%), the Malaysian CPO export (0.42%), and the world soybean oil price (0.28%)].

Table 3. Variance in the dependent variable due to the independent variables' shocks

Variable	WPV		ICX		MCX		WCP		WSP		RER	
WPV	(2)	98.57	(9)	3.23	(2)	2.48	(10)	26.42	(10)	62.89	(5)	4.80
ICX	(10)	1.73	(1)	98.57	(5)	1.77	(3)	1.06	(5)	1.86	(10)	4.10
MCX	(5)	0.42	(10)	9.66	(1)	97.84	(4)	0.17	(5)	0.93	(6)	0.94
WCP	(3)	0.85	(9)	2.59	(10)	0.30	(1)	83.27	(10)	10.61	(10)	13.11
WSP	(10)	0.28	(7)	3.75	(3)	2.98	(3)	0.25	(1)	33.77	(1)	10.64
RER	(3)	0.70	(5)	6.07	(8)	0.26	(3)	0.81	(2)	1.07	(1)	87.17

Note: (.) indicates the period with the highest value.

Furthermore, the shock in the Indonesian CPO export is also explained primarily by its owned shocks by 98.57%, while the shocks in other variables only explained between 2.59% to 9.66% changes in the Indonesian CPO export. However, the shocks in the Malaysian CPO export (9.66%) is found to explain the largest changes in the Indonesian CPO export, finding further supported our earlier findings on the important role of Indonesia and Malaysia in determining changes in the world CPO price through their CPO supply as these countries are the two largest CPO producing countries in the world.

Similarly, the changes in the Malaysian CPO export is also primarily explained by its owned shocks by 97.87%, while the shocks in other variables could only explain about 0.26% to 2.98% changes in the Malaysian CPO export. Although the shocks in the world crude oil price are dominantly explained by its owned shocks by 83.27%, but the changes in the world CPO price explained 26.42% changes in the world crude oil price. The shocks in other variables could only explain less than 1% changes in the world crude oil price. This finding further confirmed the crucial role of palm oil as a raw material for renewable energy. To ensure the stability of world CPO price, thus it could be materialized through the use of palm oil as a source of renewable energy. Following the Indonesian government's success in implementing the B20 palm oil program, the government agenda to implement the B100 program since August 2018 to anticipate the decline in the world CPO price should be taken seriously.

Interestingly, the changes in the price of world soybean oil are explained more by the shocks in the world CPO price (62.89%), followed by the shocks in its own variable (33.77%), the world crude oil price (10.61%), the Indonesian CPO export (1.86%), the real exchange rate (1.07%), and the Malaysian CPO export (0.93%). The large contribution of the changes in world CPO prices in explaining the shock in the world soybean oil price was due to these commodities is substitutable to each other. However, this finding indicated the superior of palm oil to soybean oil due to its potential sustainability and low production costs as compared to the soybean oil production. Thus, the campaign to the discrimination of palm oil from other types of vegetable oil has been more of the agenda of business politics.

Finally, the changes in the exchange rates is dominantly explained by its own shocks (87.17%), while the shocks in other variables, i.e., the world crude oil price, the world soybean oil price, the world CPO price, the Indonesian CPO export, and the Malaysian CPO export explained the changes in the exchange rate by 13.11%, 10.64%, 4.80%, 4.10%, and 0.94%, respectively. These findings further confirmed our earlier findings that the world economy is very much dependent on the stability of crude oil prices as the most important source of energy. The recent higher volatility of world crude oil price has adversely impacted the Indonesian economy, especially due to the instability of the world CPO prices and the IDR.

As the largest palm oil producing country, Indonesia would not enjoy higher benefits from its CPO export unless the Indonesian government could design proper strategy to stabilize the domestic crude oil price, managing the stability of the IDR, and enhance more macroeconomic policy harmonization with its neighboring country of Malaysia as the second largest palm oil producing country. Combining the CPO exports of Indonesia and Malaysia, these countries could capture 87% of the world palm oil market share (The Ministry of

Plantation Industries and Commodities of Malaysia, 2015). Having a macroeconomic policy harmonization between the countries, Indonesia and Malaysia could easily enjoy greater benefits from international palm oil trading activity that consequently contribute more towards their sustainable development.

5. Conclusions and Recommendations

The recent phenomena of the higher level of the world CPO price volatility influence the value of the CPO export of Indonesia as the world's largest palm oil producing country that captures 47.16% of the world palm oil markets (Sulaiman et al, 2011). The ability of Indonesia to control over the world CPO price would maximize its revenue from international trading activities. This study provided the latest empirical evidence on the bivariate causal relationship between Indonesian and Malaysian CPO exports, the world crude and soybean oils, exchange rate, and the world CPO price volatility using the bivariate Granger causality analysis. It also attempted to explore the extent to which the shocks in the Indonesian and Malaysian CPO exports, the world crude and soybean oils, and exchange rate influenced the world CPO price volatility using the Impulse Response Functions (IRFs) and Variance Decomposition (VDC) analyses over the period from January 2008 to December 2017.

The study found that the world CPO price volatility is only Granger-caused by the changes in the real exchange rate, while other variables were found to have no significant effect. The shocks in the exchange rate are responded differently by the world CPO price volatility, depending on whether the exchange rates were depreciating or appreciating. On the other hand, the world CPO price volatility Granger caused the Malaysian CPO export and world crude oil price. Interestingly, the Indonesian CPO export only found to have a bidirectional Granger causal relationship to the Malaysian CPO export as these two countries contributed 87% to the world palm oil markets. The shocks in the Indonesian CPO export is positively responded by the world CPO price volatility and world crude oil prices, while the shock in the world price of soybean oil is negatively responded by the world CPO prices. Moreover, the Malaysian CPO exports are Granger-caused by the world CPO price volatility, world crude oil price, and world soybean oil price. The world crude oil price is Granger caused by the world CPO price volatility. Finally, the study found a bidirectional causal relationship between the world crude oil price and world soybean oil price with the real effective exchange rate, indicating the important role of exchange rate in determining the stability of world commodity price.

Our findings suggested that to gain greater benefits from its CPO export, Indonesia should engage in a more cooperative way in determining their CPO prices and supply with Malaysia as the second largest palm oil producing country after Indonesia. Macroeconomic policy harmonization on the CPO price and production as well as exchange rate policy should be innovatively designed between Indonesia and Malaysia through the existing Council of Palm Oil Producing Countries (CPOPC) if these counties intend to gain more revenue from their CPO exports in the future. Additionally, maintaining higher domestic CPO prices is needed as it could promote the palm oil-based downstream industry to diversify palm oil-based products of high economic value. More efforts should be done to implement advanced technologies to utilize palm oil as a major source of renewable energy. Following the success in implementing the B20 palm oil program, the B100 palm oil agenda that has been introduced since August 2018 should be implemented seriously to anticipate the decline in the world CPO price. Thus, more efforts should be done to implement advanced technologies to utilize palm oil as the major source of renewable energy

To provide more comprehensive findings on the world CPO price volatility, further studies on this issue might incorporate not only the economic determinants of the CPO price and production, but also cover political, social, environmental, legal, and technological factors both from the demand-side and supply-side perspectives. Both short run and long run non-linear relationships between the world CPO price and production and its economic, political, social, environmental, legal, and technological determinants could also provide a broader picture and enriched empirical evidence on the recent phenomenon of the higher level of volatility of the world palm oil price.

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DETERMINATION OF DEGREE OF THE INFLUENCE OF THE REGIONAL SCIENTIFIC ENVIRONMENT ON THE PERFORMANCE OF SCIENTIFIC ORGANIZATIONS

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Abstract

The article analyzes the influence of various factors of the regional scientific environment on the performance of scientific organizations. 541 research institutions located on the territory of 65 Russian Federation' subjects were selected as the study's object. The study used the statistical data of the Federal Monitoring System of Scientific Organizations (FMSSO), Federal State Statistics Service, the Ministry of Justice and other open sources. The indicators proposed in the methodology of the FMSSO were used as indexes of scientific organizations performance. According the methodology three types of scientific organizations were distinguished - scientific organizations-leaders; stable scientific organizations that demonstrate satisfactory performance; and scientific organizations that have lost their scientific profile and development prospects. Data analysis showed that performance of scientific organizations is greatly influenced by such factors as a set of material, technical and financial conditions of the development of scientific activity.

Keywords: regional scientific environment, scientific organization, factor analysis, performance of scientific activity

JEL classification: R19

1. Introduction

The development of the national scientific and technological complex, the systematic creation and introduction of new knowledge and technologies in modern conditions are a necessary factor in the socio-economic development of the regions. In addition, the current

foreign policy situation has escalated the need to ensure Russia's technological independence. In this context the development of science and technology, increasing the socio-economic importance of research, scientific, technical and innovation activities became a particular relevant.

Only through the organization of effective public administration in the scientific and technical sphere, including at the level of the Russian Federation' subjects, the conditions for carrying out fundamental scientific studies, scientific and technical activities and translating their results into an innovative product can be created (Lepskiy, 2018).

The support ways of the science field at the regional level are varied - the popularization of science among young people, the financing of scientific research, the coordination of scientific activities, etc.

Thus, one of the support way of scientific and technological development at the regional level is the promotion of various forms of intellectual integration (Maltseva, 2014). Currently in the regions there are a large number of educational and scientific collaborations of various sizes, the number of organizations and research topics (Maltseva, et al., 2015).

Under the new conditions, some regions are actively switching to a new model of organizing and supporting science and technology, including through the harmonization of institutions and the effective adaptation of best international practices to regional conditions.

In this regard, the purpose of this article is to identify the factors of a regional scientific environment that influence the development of scientific organizations based on the analysis of empirical data. At the same time, scientific organizations are institutions for which research is the main activity.

2. Literature background

This article analyzes the impact of various exogenous factors on the performance of scientific organizations, including the training of personnel reserve, the infrastructure basis for research, the organization of interaction with external stakeholders, including government bodies, etc.

The authors were guided by a systematic approach for solving research problems in the framework of this article. Within this approach a scientific organization is viewed not in isolation, but in interaction with the external environment, serving, on the one hand, as a source of resources, including personnel, and, on the other hand, serving as the sphere of application of the results of activities in the form of goods and services.

The concept of Bronfenbrenner's ecological systems (2009) which allows to describe the systemic nature of the mutual influence of various environmental factors can serve as the conceptual basis of the article. By interpreting this theory into the development of a scientific organization, it can be argued that a regional scientific environment is a mesosystem which includes various elements, among them objects of regional innovation infrastructure, for example, technology parks, youth innovation technology centers, engineering centers, etc., influence development and performance of a scientific organization.

At the same time, the article did not set out the task to identify and determine the degree of influence of the macrosystem factors, for example, national science and technology policy, federal centers of science support, etc., on the performance of scientific institutions. Determining the nature, direction of interaction of various factors of micro, meso and macrosystems is a promising research task that has to be solved in the future.

It is possible to identify several hypotheses about the influence of various factors of the regional environment on the performance of scientific organizations based on the analysis of the literature:

Hypothesis 1. The performance of scientific organizations is influenced by the conditions for promoting the involvement of young people in science and raising awareness of science careers.

Knowledge is one of the main products of research organizations. Accordingly, the mission of scientific institutions is to disseminate knowledge through publications, as well as, in some cases, to commercialize the results of applied research. In this regard, the ability to generate knowledge becomes the main competitive advantage of scientific institutions. The search for talents, that is, people who possess a certain set of competencies and are capable of

generating new knowledge has the particular importance for research organizations (Akhilesh, 2014).

Numerous studies proves the need to attract young people to science and innovation. At the same time, an increase of the number of young people who have opted for a career in STEM areas is considered not only as a factor of growing the country's competitiveness, strengthening its technological leadership (Promising practices for strengthening the regional STEM workforce development ecosystem, 2016), but also as an important resource of region's modernization (Leonidova et al., 2016).

Hypothesis 2. The performance of scientific organizations is influenced by the set of material, technical and financial conditions of the scientific activity development.

In addition to human capital, an important resource necessary for the scientific organization to implement its mission is the availability of funds and the material conditions of research, including equipment (Best Practices in Assessment of Research and Development Organizations, 2012).

The amount of R&D expenditures in both absolute and relative terms (for example, R&D/GDP intensity) is an indicator that characterizes the level of science support at the national and regional levels by various sectors of the economy and is reflected in the documents of strategic development of territories, countries and supranational entities (for example, the most well-known is the goal of the European Union, which implies an increase in total investment in R&D to 3% of GDP by 2020 (Communication from the commission. Europe 2020. A strategy for smart, sustainable and inclusive growth, 2010)). In the researchers, conducted on the basis of cross-country analysis, a close relationship was found out between the performance of the applied research sector, the amount of its targeted financing and the growth of the economy in individual sectors (Dranev et al., 2018).

At the same time, studies show that the performance of scientific organizations (in terms of scientometric indicators) is influenced not only by the amount of funding, but also by its source (Coccia et al., 2015). Moreover, business-supported think-tanks are widely used in Western countries, which in some cases act as lobbyists, conducting research and in their interests (Kotler, 2017).

Hypothesis 3. The performance of research organizations is influenced by the conditions for communication and collaboration between researchers, the commercialization of research and development.

The process of transferring the knowledge gained by scientific organizations to the private sector of the economy is carried out, as is the case with universities (Roesler and Broekel, 2017) through the creation of small innovative enterprises, performing contract R&D, the conducting joint research projects with enterprises, the transferring of intellectual property and the assignment of rights to their use, etc. (De Fuentes and Dutrenit, 2012). At the same time, researchers proved that collaborations between academic institutions and enterprises has a positive impact on the innovative activities of companies that specialize in product and process innovations (Pippel and Seefeld, 2016). An important role in the development of cooperation is also played by the geographical proximity of partner organizations. It has been found out that the company's choice in favor of a nearby partner organization allows an enterprise to reduce the risks associated with evaluating partner resources and ensuring control over the progress of work during the implementation of joint projects (Martinez-Noya, and Narula, 2018). Thus, the presence of such channels for the scientific organizations' knowledge transfer to the real economy sector as clusters, technology parks, small innovative enterprises has an impact on the performance of research institutions.

Hypothesis 4. The performance of scientific organizations is influenced by the system of management and coordination of scientific activities in the region.

The state's role in scientific and technological development is not limited to issues of research funding, determining its priority areas, but also includes policies aimed at increasing the prestige of scientific professions, developing the mechanisms for transferring knowledge and technology from the public to the private sector, etc. Using the example of analyzing the effectiveness of biotechnological projects, including those ones that were performed on the budget funds, it was shown that in Korea, public research institutions were ahead of research and development organizations in scientometric indicators (Park and Shin, 2018). In addition, Chinese researchers have identified the positive influence of state science and technology

policy on the development of collaborations between government research institutions, universities and enterprises (Zhang, et al., 2016). At the same time, the role of regional authorities, according to researchers, is to create conditions for the development of the economy on an innovative basis, including using the potential of research institutions (Lewandowska and Stopa, 2018). In this regard, the policy of regional authorities to create mechanisms to support researchers is considered as a factor of improving the performance of scientific organizations.

Hypothesis 5. The performance of scientific organizations is influenced by the conditions for the integration of Russian science into international space.

Currently, the concept of local buzz and global pipelines (Bathelt, et al., 2004) is widely used in scientific literature. According to the concept, the exchange of knowledge between organizations located in a certain area (local buzz) leads to the development of technology in the case when these regional networks are the part of global pipelines. In recent years, this concept has been revised to reflect country specifics. So, based on empirical data, it was shown that the development of regional cooperation is influenced by investment in R&D while international cooperation depends largely on the availability of skilled labor (Fitjar and Rodriguez-Pose, 2015). Thus, it can be assumed that there is a feedback between the performance of scientific organizations and the conditions for the integration of Russian science into international space.

3. Results

We made the regression analysis using the R package to assess the impact of the regional scientific environment on the performance of scientific organizations.

For the regional environment, the indicators, that are its components, were divided into groups: “Conditions for promoting the involvement of young people in science and raising awareness of science careers”, “A set of logistical, technical and financial resources to promote knowledge generation”, “Conditions for communications and collaborations between researchers, commercialization of R&D”, “Effective system of management and coordination of scientific activities in the region” and “Conditions for the integration of Russian science into international space”. Used indicators are given in table. 1. Regression analysis was made separately for each group in order to identify the factors that has the greatest impact.

The dependent variable was a category of scientific organization assigned in accordance with the results of monitoring the performance of scientific organizations performing research, development and technological works for civil purposes in accordance with the data of the FMSSO(Minutes of the meeting from 03.22.2018of the Interdepartmental Commission for the Evaluation of the Performance of Scientific Organizations performing research, development and technological works for civil purposes). The sample includes 541 organizations that received the FMSSO rating. The number of regions where scientific organizations are geographically located and has been rated is 65.

For the convenience of interpreting the results, the categories of organizations were inverted (3 - the highest category, 1 - the lowest one). The calculation of the average category of organizations by region was made using the following formula:

$$\mathbf{x}_{reg} = \frac{\sum_{\mathbf{reg}}[(\mathbf{x}]_{\mathbf{i}} \cdot \mathbf{s}_{\mathbf{i}})}{\mathbf{s}_{\mathbf{reg}}},$$

where $\mathbf{x}_{\mathbf{i}}$ - the category of the i-th organization in the region, $\mathbf{s}_{\mathbf{i}}$ - the number of employees of the i-th organization, $\mathbf{s}_{\mathbf{reg}}$ - the total number of employees for all scientific organizations in the region, $\mathbf{x}_{\mathbf{reg}}$ - the average category of scientific organizations in the region, summation was performed for all scientific organizations in the region.

The weighted average indicator provides comparability of data regarding the number of their staff.

The variables that are used as the basis for building models and are indicators included in the assessment system of the regional scientific environment are below (Table 1).

Table 1. - Indicators of the regional scientific environment

Indicator	Identification

Conditions for promoting the involvement of young people in science and raising awareness of science careers	
Number of created children's technoparks Kvantorium	x1
Number of established Centers for Youth Innovation Creativity	x2
Number of types of regional awards in science	x3
Number of types of individual scholarships for regional researchers	x4
Number of types of regional scholarships and competitions for young scientists	x5
Grade point average of Unified State Exam passed by school leavers who are accepted to state-funded places in regional higher educational establishments	x6
Average annual number of winners of the all-Russian schoolchildren's competition per 1000 high school grads	x7
Number of grantees and holders of the scholarships of the President of the Russian Federation for young scientists per 100 researchers with an academic degree	x8
Number of graduate students and doctoral candidates per 10,000 persons of the population	x9
A set of logistical, technical and financial resources to promote knowledge generation	
Number of established engineering centers per 1,000 research and development organizations	x10
Number of established centers for collective use of scientific equipment per 1, 000 research and development organizations	x11
Number of unique scientific installations per 10,000 researchers	x12
Availability of project competition in the field of basic scientific research administered by Russian Foundation for Basic Research (RFBR) in conjunction with the authorities of the entities of the Russian Federation	x13
Availability of regional funds to support research activities	x14
Amount of regional funds budgeted for fundamental and applied research per one researcher, thousand rubles	x15
The proportion of the region's budget, provided for supporting of program activities for the development of scientific activity and the conducting of basic and applied scientific research,%	x16
The proportion of the budget of the Russian Federation's subject and local budgets in financing domestic expenditures on R&D,%	x17
The number of winners of the competitions of the Russian Science Foundation per 100 organizations engaged in R&D	x18
The number of winners of the Federal Targeted Program "Research and Development" per 100 organizations engaged in R&D	x19
Internal costs of research and development on average per 1000 organizations, thousand rubles	x20
Number of advanced production technologies created (developed) by subjects of the Russian Federation per 100 organizations engaged in R&D	x21
Conditions for communications and collaborations between researchers, commercialization of R&D	
Number of created clusters per 1000 organizations engaged in R&D	x22
Number of created technology parks per 10,000 researchers	x23
Innovative activity of organizations	x24
Number of created small innovative enterprises per 100 organizations engaged in R&D	x25
Number of winners of the mega-grants program per 1000 organizations engaged in R&D	x26
The number of winners of the competition for the development of cooperation of Russian universities, research institutions and manufacturing enterprises, per 1000 organizations engaged in R&D	x27

Indicator of the number of potentially commercialized patents per 1000 researchers	x28
Effective management and coordination system of scientific activities in the region	
The presence of subdivision responsible for scientific activities in the structure of the region executive authorities	x29
The presence of a coordinating structure (council) for scientific activities	x30
The presence of the actual regulatory legal act on scientific activities	x31
The number of state programs in the region, including the main activities to support scientific research	x32
The presence of the vector of scientific and technological development for the purposes and objectives of the strategy of socio-economic development	x33
Participation in the development and testing of the regional model of the National Technology Initiative	x34
The number of personnel engaged in R&D per 10,000 population	x35
Average salary in the research and development sector, thousand rubles	x36
The number of high-performance jobs created in the research and development sector, in the total number of high-performance jobs in the region,%	x37
Conditions for the integration of Russian science into the international space	
The number of foreign scientists working in scientific organizations and universities of the region per 100 organizations engaged in R&D	x38
The number of regional universities, participants of "5-100"project	x39
The number of researchers assigned to work in leading Russian and international scientific and scientific-educational organizations per 100 researchers	x40
The number of created results of intellectual activity having legal protection outside the Russian Federation for 10,000 researchers	x41
Cumulative number of publications in the Scopus database per 100 people engaged in R&D	x42
Cumulative number of publications in the Web of Science database per 100 people engaged in R&D	x43
Cumulative citation of publications in the Web of Science database per 1 organization engaged in R&D	x44
Cumulative citation of publications in the Scopus database per 1 organization engaged in R&D	x45
The number of articles prepared jointly with foreign organizations, per 1 organization engaged in R&D	x46
The number of agreements on the export of technology and technical services per 100 organization engaged in R&D	x47
Dependent variable	
Category of scientific organizations in the region	y

Source: Authors' calculations

Within the framework of the study, it is proposed to use regression analysis, for which additive multiple regression models are used:

(1)y=a1*x1+a2*x2+a3*x3+a4*x4+a5*x5+a6*x6+a7*x7+a8*x8+a9*x9+C1

(2)y=a10*x10+a11*x11+a12*x12+a13*x13+a14*x14+a15*x15+a16*x16+a17*x17+a18*x18+a19*x19+a20*x20+a21*x21+C2

(3)y=a22*x22+a23*x23+a24*x24+a25*x25+a26*x26+a27*x27+a28*x28+C3

(4)y=a29*x29+a30*x30+a31*x31+a32*x32+a33*x33+a34*x34+a35*x35+a36*x36+a37*x37+C4

(5)y=a38*x38+a39*x39+a40*x40+a41*x41+a42*x42+a43*x43+a44*x44+a45*x45+a46*x46+a47*x47+C5

To eliminate the problems associated with the possible multicollinearity of variables in regression models, the variance inflation factors (VIF) were calculated (Table 2).

Table 2. - The results of multicollinearity test for models

Indicator	VIF	Indicator	VIF	Indicator	VIF	Indicator	VIF	Indicator	VIF
x1	1,24	x10	1,48	x22	1,22	x29	1,14	x38	1,68
x2	2,24	x11	1,52	x23	1,20	x30	1,12	x39	1,31
x3	1,04	x12	1,08	x24	1,27	x31	1,31	x40	1,92
x4	1,14	x13	1,14	x25	1,29	x32	1,52	x41	1,05
x5	1,41	x14	1,89	x26	1,26	x33	1,16	x42	7,19
x6	1,99	x15	3,62	x27	1,25	x34	1,77	x43	9,26
x7	2,47	x16	1,92	x28	1,07	x35	6,73	x44	27,18
x8	1,25	x17	3,98			x36	1,53	x45	26,21
x9	2,16	x18	3,32			x37	6,12	x46	3,34
		x19	3,89					x47	1,92
		x20	1,74						
		x21	1,17						

Source: Authors' calculations

As the table show, most of the variables have the value VIF<5 and, therefore, does not have a linear relationship between themselves. The only exceptions are x35 and x37 for the fourth and x42, x43, x44, x45 for the fifth models. This requires the elimination of variables with a high degree of correlation.

To determine the excluded variable in the fourth model, a correlation matrix was built, table 3.

Table 3. - Correlation matrix for the fourth model

	x29	x30	x31	x32	x33	x34	x35	x36	x37
x29	1,000	-0,044	0,282	0,011	0,082	0,152	0,056	0,049	0,107
x30	-0,044	1,000	0,162	0,203	-0,010	0,040	0,174	-0,021	0,105
x31	0,282	0,162	1,000	0,327	0,182	0,109	0,263	0,244	0,208
x32	0,011	0,203	0,327	1,000	0,106	0,220	0,473	0,365	0,304
x33	0,082	-0,010	0,182	0,106	1,000	0,066	0,180	0,005	0,051
x34	0,152	0,040	0,109	0,220	0,066	1,000	0,547	0,300	0,645
x35	0,056	0,174	0,263	0,473	0,180	0,547	1,000	0,531	0,878
x36	0,049	-0,021	0,244	0,365	0,005	0,300	0,531	1,000	0,432
x37	0,107	0,105	0,208	0,304	0,051	0,645	0,878	0,432	1,000

Source: Authors' calculations

Since the x35 variable has higher correlation coefficients with other variables than x37, than x35 variable is excluded from the final equation. The final multicollinearity test, demonstrating the compliance of all indicators with the VIF<5 criterion, is presented in the Table 4.

Table 4. - The results of multicollinearity test for the fourth model

Indicator	x29	x30	x31	x32	x33	x34	x36	x37
VIF	1,13	1,09	1,31	1,33	1,05	1,75	1,38	1,98

Source: Authors' calculations

Thus, the final version for the fourth model is:

(4) $y=a29*x29+a30*x30+a31*x31+a32*x32+a33*x33+a34*x34+a36*x36+ +a37*x37+C4$

Similarly, the correlation matrix for the fifth model is given in the Table 5.

Table 5. Correlation matrix for the fifth model

	x38	x39	x40	x41	x42	x43	x44	x45	x46	x47
x38	1,000	0,224	0,426	0,066	0,318	0,388	0,438	0,454	0,497	0,380
x39	0,224	1,000	-0,019	-0,013	-0,015	0,039	0,424	0,407	0,416	0,331
x40	0,426	-0,019	1,000	-0,027	0,442	0,559	0,291	0,319	0,201	-0,013
x41	0,066	-0,013	-0,027	1,000	0,016	-0,040	-0,054	-0,043	-0,043	-0,091
x42	0,318	-0,015	0,442	0,016	1,000	0,911	0,304	0,319	0,258	0,118
x43	0,388	0,039	0,559	-0,040	0,911	1,000	0,437	0,429	0,376	0,150
x44	0,438	0,424	0,291	-0,054	0,304	0,437	1,000	0,976	0,798	0,526
x45	0,454	0,407	0,319	-0,043	0,319	0,429	0,976	1,000	0,781	0,566
x46	0,497	0,416	0,201	-0,043	0,258	0,376	0,798	0,781	1,000	0,581
x47	0,380	0,331	-0,013	-0,091	0,118	0,150	0,526	0,566	0,581	1,000

Source: Authors' calculations

Studying these tables data, you can see that the number of publications strongly correlates with the number of citations in the corresponding citation systems (x42-x43 and x44-x45 pairs). At the same time, x43 (the number of WoS publications) and x44 (aggregate citation in WoS) have the greatest correlation with other indicators. Thus, in the final scorecard there are indicators of the number of publications of citations in the Scopus database.

The test for multicollinearity is presented in the table 6.

Table 6. - The test results for multicollinearity for the fifth model

Indicator	x38	x39	x40	x41	x42	x45	x46	x47
VIF	1,68	1,30	1,61	1,03	1,33	3,12	3,00	1,79

Source: Authors' calculations

The remaining indicators in the fifth model have VIF<5 and, therefore, are not multicollinear. Thus, the final version for the fifth model is:

(5) y=a38*x38+a39*x39+a40*x40+a41*x41+a42*x42+a45*x45+a46*x46+
+a47*x47+C5

The results of the regression analysis of each of the above models using the basic function lm of the statistical package R are below.

1. Model of the dependence of the performance of scientific organizations in the region on the conditions for promoting the involvement of young people in science and raising awareness of science careers:

lm(formula = y ~ x1…x9, data = ModelData1)

Residuals:

Min	1Q	Median	3Q	Max
-0.97292	-0.34263	0.06938	0.34388	1.24271

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.339682	1.068425	0.318	0.7517	
x1	-0.087490	0.096221	-0.909	0.3672	
x2	0.002562	0.018530	0.138	0.8906	
x3	0.129381	0.056203	2.302	0.0251	*
x4	0.031596	0.031551	1.001	0.3210	
x5	0.029198	0.051174	0.571	0.5706	
x6	0.017524	0.018167	0.965	0.3389	
x7	0.021016	0.059634	0.352	0.7259	
x8	0.005122	0.010298	0.497	0.6209	
x9	0.020230	0.023052	0.878	0.3840	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5207 on 55 degrees of freedom
Multiple R-squared: 0.261, Adjusted R-squared: 0.1401
F-statistic: 2.158 on 9 and 55 DF, p-value: 0.03945

From the presented listing it is clear that the model explains only 26.1% of the total number of factors affecting the performance of scientific organizations. The model itself, according to the Fisher criterion, describes the available data well (F = 2.158, p = 0.039), but most of the variables are not significant (p> 0.05). The only significant variable is x3 ("Number of types of regional awards in science"). It can be concluded that the factor "Conditions for promoting the involvement of young people in science and raising awareness of science careers" has a weak influence on the performance of scientific organizations. Therefore, hypothesis 1 is rejected.

(1) y=0.087*x1-0.003*x2-0.129*x3-0.032*x4-0.029*x5-0.018*x6--0.021*x7-0.005*x8-0.020*x9+3.660

2. Model of the dependence of the performance of scientific organizations in the region from the set of logistical, technical and financial resources to promote knowledge generation

lm(formula = y ~ x10…x21, data = ModelData2)

Residuals:

Min	1Q	Median	3Q	Max
-0.82974	-0.22027	0.01336	0.26398	0.97994

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	1.841e+00	1.434e-01	12.839	<2e-16	***
x10	-6.046e-03	2.872e-03	-2.105	0.0402	*
x11	4.376e-04	6.352e-04	0.689	0.4939	
x12	9.549e-03	4.092e-03	2.334	0.0235	*
x13	-2.425e-01	1.183e-01	-2.050	0.0454	*
x14	-7.112e-02	9.228e-02	-0.771	0.4443	
x15	-1.796e-03	2.176e-03	-0.825	0.4130	
x16	4.707e+00	4.115e+01	0.114	0.9094	
x17	-7.775e-03	1.231e-02	-0.631	0.5305	
x18	1.968e-03	1.383e-03	1.423	0.1608	
x19	2.800e-03	3.191e-03	0.877	0.3844	
x20	3.538e-07	5.911e-07	0.599	0.5520	
x21	-1.438e-04	8.374e-04	-0.172	0.8643	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.446 on 52 degrees of freedom
Multiple R-squared: 0.4874, Adjusted R-squared: 0.3691
F-statistic: 4.12 on 12 and 52 DF, p-value: 0.000163

Dependent variables explain 48.7% of the performance assessment in the total number of factors, the model describes the available data well (F = 4.12, p = 1 $*10^{-4}$). Significant variables are only x10 (Number of established engineering centers per 1,000 research and development organizations), x12 (Number of unique scientific installations per 10,000 researchers) and x13 (Availability of project competition in the field of basic scientific research administered by Russian Foundation for Basic Research (RFBR) in conjunction with the authorities of the entities of the Russian Federation). Thus, the logistical, technical and financial resources to promote knowledge generationis significantly affects the performance of scientific organizations. Therefore, hypothesis 2 is accepted.

(2) $y=0.006*x10-0.0004*x11-0.009*x12+0.243*x13+0.071*x14+$
$+0.002*x15-4.707*x16+0.008*x17-0.002*x18-0.003*x19-$
$-3*10^{-7}*x20+0.0001*x21+2.159$

3. Conditions for communications and collaborations between researchers, commercialization of research and development

lm(formula = y ~ x22…x28, data = ModelData3)

Residuals:

Min	1Q	Median	3Q	Max
-0.91347	-0.26247	0.09008	0.31516	1.21090

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	1.8032019	0.1920636	9.389	3.6e-13	***
x22	0.0004469	0.0011926	0.375	0.7093	
x23	-0.0108368	0.0091063	-1.190	0.2390	
x24	0.0069314	0.0186196	0.372	0.7111	
x25	-0.0009898	0.0014439	-0.685	0.4958	
x26	0.0037379	0.0016080	2.324	0.0237	*
x27	0.0003517	0.0010418	0.338	0.7369	
x28	-0.0009293	0.0088073	-0.106	0.9163	

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5423 on 57 degrees of freedom
Multiple R-squared: 0.1693, Adjusted R-squared: 0.06725
F-statistic: 1.659 on 7 and 57 DF, p-value: 0.1377

The impact of the conditions for communications and collaborations between researchers, the commercialization of research and development on performance is very weak (16.9%). The model is not statistically significant (F = 1.659, p = 0.14). The only significant variable is x26 (Number of winners of the mega-grants program per 1000 organizations engaged in R&D). It can be concluded that the factor “Conditions for communications and collaborations between researchers, the commercialization of research and development” does not have a significant impact on the performance of scientific organizations. Therefore, hypothesis 3 is rejected.

(3)$y=-0.0004*x22+0.011*x23-0.007*x24+0.001*x25-0.004*x26-$
$0.0004*x27+0.001*x28+2.197$

4. Effective management system and coordination of scientific activities in the region

lm(formula = y ~ x29…x37, data = ModelData4)

Residuals:

Min	1Q	Median	3Q	Max
-0.97739	-0.23516	0.07575	0.31220	1.23108

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	1.6895695	0.2820674	5.990	1.58e-07	***
x29	-0.1089097	0.1563081	-0.697	0.4888	
x30	-0.0211853	0.1799795	-0.118	0.9067	
x31	-0.0369386	0.1555543	-0.237	0.8132	
x32	0.0742386	0.0536846	1.383	0.1722	
x33	0.2793225	0.1464072	1.908	0.0615	.
x34	-0.0405645	0.2214751	-0.183	0.8553	
x36	-0.0005732	0.0049357	-0.116	0.9080	
x37	5.8856510	3.5039213	1.680	0.0986	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5393 on 56 degrees of freedom
Multiple R-squared: 0.1929, Adjusted R-squared: 0.07762
F-statistic: 1.673 on 8 and 56 DF, p-value: 0.1254

The variables explain 19.3% of the performance assessment of the total number of factors affecting the performance. The model is not statistically significant (F = 1.673, p = 0.13), there are no significant variables. Thus, the factor "Effective management system and coordination of scientific activities in the region" does not have a significant impact on the performance of scientific organizations. Therefore, hypothesis 4 is rejected.

(4) y=0.109*x29+0.021*x30+0.037*x31-0.074*x32-.0279*x33+
+0.041*x34+0.001*x36-5.886*x37+2.310

5. Conditions for the integration of Russian science into the international space
lm(formula = y ~ x38…x47, data = ModelData5)

Residuals:

Min	1Q	Median	3Q	Max
-0.91808	-0.33271	0.07664	0.28793	1.20143

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	1.6463274	0.1290810	12.754	<2e-16	***
x38	-0.0002269	0.0006815	-0.333	0.740	
x39	-0.0017122	0.1882227	-0.009	0.993	
x40	-0.0005626	0.0084120	-0.067	0.947	
x41	0.0001461	0.0003717	0.393	0.696	
x42	0.0008564	0.0014809	0.578	0.565	
x45	0.0002547	0.0002709	0.940	0.351	
x46	0.0056119	0.0074619	0.752	0.455	
x47	0.0019331	0.0017240	1.121	0.267	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5329 on 56 degrees of freedom
Multiple R-squared: 0.2119, Adjusted R-squared: 0.09935
F-statistic: 1.882 on 8 and 56 DF, p-value: 0.08104

Conditions for the integration of Russian science into international space explain 21.2% of the performance assessment of the total number of factors, there are no significant factors. The model is not statistically significant (F = 1.882, p = 0.08). It can be concluded that the factor "Conditions for the integration of Russian science into international space" does not have a significant impact on the effectiveness of scientific organizations. Therefore, hypothesis 5 is rejected.

(5) y=0.0002*x38+0.002*x39+0.001*x40-0.0001*x41-0.001*x42-
-0.0003*x45-0.006*x46-0.002*x47+2.354

Since the total number of factors is very large (47), the building of a generalized model with the aim of highlighting significant factors was made using inverse step-by-step regression. The essence of this method comes down to the fact that initially all the available indicators are included in the model, then at each step an exception or inclusion of one of the previously excluded indicators in the model is made. The indicator is selected based on the Akaike Information Criterion (AIC):

$$AIC = 2K + n[\ln(\sigma^2)],$$

where K is the number of model parameters, n is the number of observations, $\hat{\sigma}^2 = \frac{SSE}{n-2}$ is the dispersion of the excesses, SSE is the sum of the squares of the excesses. It is believed that the best model corresponds to the minimum value of the Akaike criterion. The steps are made until the exclusion or addition of the indicator don't stop the decreasing of AIC. The resulting set of indicators is considered optimal. This method is made in the step function of the statistical package R, which was used to calculate the parameters of the model.

Multicollinear variables were excluded from the original model based on the calculation of the variance inflation factors (VIF) by analogy with previous calculations. The final variables of their VIF are shown in the table 7.

Table 7. - Variables of the resulting model

Indicator	VIF	Indicator	VIF	Indicator	VIF
x1	1,95	x16	3,54	x32	3,28
x3	1,50	x17	4,71	x33	2,58
x4	2,35	x20	3,90	x34	2,53
x5	3,35	x21	2,46	x36	2,71
x6	4,75	x22	2,13	x38	3,06
x7	4,96	x23	1,72	x40	3,59
x8	2,74	x24	3,51	x41	2,29
x10	3,07	x25	3,40	x43	4,82
x11	2,96	x27	3,09	x46	4,59
x12	4,02	x28	4,04	x47	3,30
x13	2,08	x29	1,96		
x14	4,41	x30	1,93		
x15	4,85	x31	2,62		

Source: Authors' calculations

The execution of the inverse step-by-step regression consisted of 22 steps, on the each of which the effect of excluding or including variables was evaluated. As an example, a part of the listing is given (step 10):

```
Step:  AIC=-110.55
y ~ x1 + x3 + x4 + x5 + x6 + x8 + x10 + x12 + x13 + x14 + x15 +
    x17 + x21 + x22 + x23 + x25 + x27 + x28 + x30 + x31 + x32 +
    x33 + x34 + x36 + x38 + x43 + x46

Df Sum of Sq    RSS      AIC
- x33   1   0.01164 5.0250 -112.398
- x17   1   0.02245 5.0358 -112.258
- x27   1   0.03452 5.0479 -112.103
- x8    1   0.03821 5.0515 -112.055
- x14   1   0.04746 5.0608 -111.936
- x34   1   0.08455 5.0979 -111.461
- x30   1   0.08863 5.1020 -111.409
- x15   1   0.09470 5.1080 -111.332
- x1    1   0.11088 5.1242 -111.127
- x22   1   0.12082 5.1342 -111.001
- x25   1   0.14873 5.1621 -110.648
<none>              5.0133 -110.549
- x31   1   0.16939 5.1827 -110.389
- x5    1   0.17493 5.1883 -110.319
- x38   1   0.17633 5.1897 -110.302
- x46   1   0.19656 5.2099 -110.049
+ x7    1   0.01449 4.9988 -108.737
+ x20   1   0.01397 4.9994 -108.730
```

```
+ x47   1   0.01263 5.0007 -108.713
+ x41   1   0.00215 5.0112 -108.576
+ x24   1   0.00167 5.0117 -108.570
+ x11   1   0.00060 5.0127 -108.556
+ x40   1   0.00042 5.0129 -108.554
+ x29   1   0.00025 5.0131 -108.552
+ x16   1   0.00004 5.0133 -108.549
- x43   1   0.33936 5.3527 -108.291
- x6    1   0.38930 5.4026 -107.687
- x12   1   0.40510 5.4184 -107.498
- x4    1   0.41545 5.4288 -107.374
- x21   1   0.46944 5.4828 -106.730
- x23   1   0.49677 5.5101 -106.407
- x28   1   0.67682 5.6902 -104.317
- x36   1   0.79870 5.8120 -102.940
- x10   1   0.94831 5.9617 -101.288
- x32   1   1.26660 6.2799  -97.907
- x13   1   1.63164 6.6450  -94.234
- x3    1   1.78645 6.7998  -92.737
```

All steps are summarized in the table 8.

Table 8. - Stages of inverse step-by-step regression ("- x29" means elimination of the variable "x29")

Step	Variable	AIC
0		-93.351
1	- x29	-95.351
2	- x40	-97.338
3	- x24	-99.295
4	- x16	-101.231
5	- x11	-103.164
6	- x41	-105.130
7	- x7	-106.979
8	- x48	-108.730
9	- x20	-110.549
10	- x33	-112.398
11	- x17	-114.183
12	- x8	-115.762
13	- x14	-117.102
14	- x34	-118.319
15	- x5	-119.173
16	- x25	-120.176
17	- x30	-121.449
18	- x31	-122.150
19	- x1	-123.029
20	- x22	-123.890
21	- x12	-124.560
22	- x38	-125.525

Source: Authors' calculations

After completing the inverse step-by-step regression, the resulting regression equation was obtained. The calculation of the coefficients and significance of the variables is shown in the following listing:

```
lm(formula = y ~ x3 + x4 + x6 + x10 + x13 + x15 + x21 + x23 +
x27 + x28 + x32 + x36 + x43 + x46, data = ModelData)
```

```
Residuals:
    Min      1Q  Median      3Q     Max
-0.59658 -0.16816 -0.01141  0.19616  0.74936

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.3619723  0.8081056  -0.448  0.65614
x3           0.1617020  0.0394012   4.104  0.00015 ***
x4           0.0450795  0.0210854   2.138  0.03743 *
x6           0.0404422  0.0135979   2.974  0.00451 **
x10         -0.0101984  0.0020693  -4.928 9.51e-06 ***
x13         -0.4873941  0.1021543  -4.771 1.63e-05 ***
x15         -0.0024019  0.0009062  -2.650  0.01074 *
x21         -0.0011036  0.0006362  -1.735  0.08897 .
x23         -0.0099746  0.0057623  -1.731  0.08962 .
x27          0.0011418  0.0006918   1.650  0.10513
x28         -0.0246862  0.0074043  -3.334  0.00162 **
x32          0.0851483  0.0352422   2.416  0.01938 *
x36         -0.0075662  0.0034223  -2.211  0.03165 *
x43          0.0092052  0.0016191   5.685 6.72e-07 ***
x46         -0.0103010  0.0046909  -2.196  0.03276 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3447 on 50 degrees of freedom
Multiple R-squared:  0.7056, Adjusted R-squared:  0.6232
F-statistic:  8.56 on 14 and 50 DF,  p-value: 5.304e-09
```

The resulting regression equation takes into account 70.56% of all factors affecting the performance of scientific organizations. The model describes the available data well ($F = 8.56$, $p = 5.3*10^{-9}$).

It should be noted that x3 ("Number of types of regional awards in science"), x10 (Number of established engineering centers per 1,000 research and development organizations) and x13 (Availability of project competition in the field of basic scientific research administered by Russian Foundation for Basic Research (RFBR) in conjunction with the authorities of the entities of the Russian Federation) are included in both intermediate and final regression equation. In addition to them, important factors include: x4 (Number of types of individual scholarships for regional researchers), x6 (Grade point average of Unified State Exam passed by school leavers who are accepted to state-funded places in regional higher educational establishments), x15 (Amount of regional funds budgeted for fundamental and applied research per one researcher, thousand rubles), x28 (Indicator of the number of potentially commercialized patents per 1000 researchers), x32 (The number of state programs in the region, including the main activities to support scientific research), x36 (Average salary in the research and development sector, thousand rubles), x43 (Cumulative number of publications in the Web of Science database per 100 people engaged in R&D) and x46 (The number of articles prepared jointly with foreign organizations, per 1 organization engaged in R&D).

Final regression equation:

$$y=0.162*x3+0.045*x4+0.040*x6-0.010*x10-0.487*x13-0.002*x15-0.001*x21-0.010x23+0.001*x27-0.025x28+0.085*x32-0.008*x36+0.009x43-0.010*x46-0.36$$

4. Conclusion

Thus, the analysis of empirical data showed that the performance of scientific organizations is influenced by a set of logistical, technical and financial resources to promote knowledge generation. At the same time, the data does not allow to found out a direct

correlation between other factors of the scientific environment on the performance of scientific institutions. In this regard, it can be argued that the publication and patent activity of scientific institutions depend on the level of financial support for research from the region, as well as on the availability of research infrastructure. The material and technical conditions create the opportunity for scientific institutions to fulfill their main mission - the generation of new knowledge and its dissemination.

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EFFECT OF COMMODITY PRICES ON INFLATION PERSISTENCE: PARTIAL ADJUSTMENT APPROACH

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Abstract

The objective of this study is to measure the inflation persistence level in Aceh Province. By using the autoregressive model, the level of persistence counted in general and the level of inflation persistence of commodity groups counted from forming consumer price index (CPI). In addition, this study also explores the source of inflation pressure from these commodity groups by using a partial adjustment model (Partial Adjustment Model). The observation period is the year 2005-2014 using monthly data. The results of this study found that the inflation persistence rate in Aceh Province was relatively low. However, there are several inflation rate variables for CPI commodity groups that exceed the inflation persistence level in common. The source of inflationary pressure discovered also comes from two variables with relatively high persistence levels from other variables, namely foodstuff commodity group variables (BM) and housing, water, electricity, gas, fuel (PERAL) commodity groups. These variables represent the components of inflation of volatile foods and administered price inflation. This study provides recommendations to relevant policymaker in coordinating, preventing, and overcoming the effects of volatile foods and administered prices on inflation by maintaining the supply of goods (supply stock) and regulating prices that are in line with people's purchasing power

Keywords: Inflation Persistence, Autoregressive, Commodity Prices
JEL classification: C22, E31, E52

1. Introduction

The study of inflation is one of the most important things to achieve economic stability in a country. In the monetary system, the inflation rate has become the most important indicator in an economy, both to measure economic growth, price stability, and other fundamental variables. The most obvious impact when the inflation rate is high is the decline in people's real income, thereby reducing the amount of public consumption. Unstable inflation will also create uncertainty for economic actors in making decisions. Empirical experience shows that unstable inflation will complicate people's decisions in carrying out consumption, investment and production, which in turn will reduce economic growth.

Economic growth in the economy can be influenced by inflation conditions, Zhang (2011) explains that without any effort determined by the monetary authority to manage inflation expectations, inflation calm in China over the past decade can return to the era of high inflation. Inflation persistence is closely related to the monetary system, Gerlach & Tillmann (2012) in their research revealed that the persistence tends to decline following the adoption of inflation targeting and inflation targeting has been performed well in Asia. However, not only in Asia but also in the Euro Area, the persistence of inflation has significantly decreased (Meller & Nautz, 2012). Developing countries with high inflation persistence need to adjust macroeconomic policies in a way that is significant for price shocks (eg, with a substantial reduction in output) because this shock can affect expectations and inflation for a much longer period (Gaglianone, Guillén, & Figueiredo, 2018).

Bank Indonesia as the authorized holder of the monetary system in Indonesia as mandated in law no.4 of 2003 has the duty to maintain the stability of the rupiah against goods and

services, namely inflation stability. Basically, a low and stable inflation rate is the main objective of monetary policy to achieve sustainable economic growth. According to research conducted by Arimurti and Trisnanto (2011), they explained that the response of monetary policy is not only determined by the level of inflation to be achieved but also by the behavior of inflation itself. This determines the amount and timing of monetary policy responses that need to be applied in order to achieve the desired inflation. The embodiment of inflation behavior has a very close relationship with the persistence of inflation or the length of time the inflation rate to return to the natural level (equilibrium) after the shock or shock.

A high degree of persistence means that the inflation rate will take a long time to return to its natural value after a shock, whereas a low degree of persistence indicates that after a shock in the economy it does not take long for the inflation rate to return to its natural level.

Tabel 1.1 Inflation Target and Real Inflation in Indonesia

Year	Inflation target (%)	Real inflation (%)
2001	4 – 6	12,55
2002	9 – 10	10,03
2003	9 ± 1	5,06
2004	5,5 ± 1	6,40
2005	6 ± 1	17,11
2006	8 ± 1	6,60
2007	6 ± 1	6,59
2008	5 ± 1	11,06
2009	4,5 ± 1	2,78
2010	5 ± 1	6,96
2011	5 ± 1	3,79
2012	4.5 ± 1	4,30
2013	4.5 ± 1	8,38
2014	4.5 ± 1	8,36

Source: Bank Indonesia

In Table 1.1, it can be seen that Indonesia's actual inflation rate from 2001 to 2014 generally missed the inflation target set by Bank Indonesia. Actual inflation in accordance with the inflation target only occurred in 2004, 2006 and 2007 with the remainder, not in accordance with the set targets. Even in 2001, 2005, 2008, 2013 and 2014 the actual inflation rate far missed the inflation target set in those years. This was caused by various effects of shocks in the economy such as the global financial crisis, and increases in prices of basic commodities caused by the increase in fuel prices.

This phenomenon is evidence that the Indonesian economy is very vulnerable to shock or shock to various macroeconomic variables with high inflation persistence. As in the research conducted by Alamsyah (2008), he concluded that the degree of Indonesian inflation persistence, in general, was very high, but it tended to decline in the period after the crisis. Although several studies reveal that Indonesia's inflation persistence rate has declined after the economic crisis, the Indonesian economy is currently still potentially exposed to various effects of the world economic shock because the Indonesian economy is still facing various problems such as a very weak manufacturing structure, limited fiscal space especially for infrastructure spending, weak energy security, limited funding, and various other limitations that make the Indonesian economy very vulnerable to external shock. Therefore Indonesia should have strengthened the resilience of the domestic economy in various ways including formulating new policy instruments.

One of Bank Indonesia's policies in safeguarding financial stability and inflation is to produce macroprudential policy packages, namely policies that map and monitor risks to continue to the stage of selecting the necessary policy instruments. To perfect the macroprudential policy framework in macroeconomic monitoring, in 2008 Bank Indonesia formed the Regional Inflation Control Team (TPID) as a coordination forum to maintain

inflation stability at the regional level whose duty is to monitor prices, and maintain supply stock and accelerate the implementation of the national inflation control roadmap. This shows that the inflation rate in each region has a contribution that must be monitored towards the formation of inflation at the national level, and each region also has inflationary behavior and the characteristics of different problems. Based on POKJANAS TPID data in 2014, national inflation is formed by regional inflation of 81 percent outside DKI Jakarta.

The province of Aceh as a province that has specialization in regulating government including regulating fiscal policy (UUPA No. 11 of 2006) is also inseparable from the problem of high inflation rates. Based on the index results released by the Aceh Central Statistics Agency (BPS) in 2014, the dominance of the causes of the inflation rate in Aceh Province is the component of commodities whose prices are regulated by the government, which is 18.68 percent, followed by volatile components of 11.52 percent and only 4,43 percent of inflation due to the core inflation component. This means that in an effort to stabilize the inflation rate in Aceh Province it will be more effectively implemented through a fiscal policy approach.

The average inflation rate of Aceh Province is still relatively higher compared to the national inflation rate. Empirically, the behavior of inflation in the province of Aceh is also very susceptible to shock caused by various things, both due to government-regulated price increases and disruption of supply distribution. The source of inflation pressure which causes inflation persistence in Aceh province needs to be analyzed more deeply so that the sources of fundamental inflationary pressure can be distinguished or sources of inflationary pressure that are only temporary (temporary). Monetary policy cannot be used fully to respond to inflationary pressure from shock on the supply side. Sectoral and regional policies are needed to reduce inflationary pressure from non-fundamental factors.

Figure 1.1 Fluctuation of Commodity Prices in Aceh (Monthly 2014)

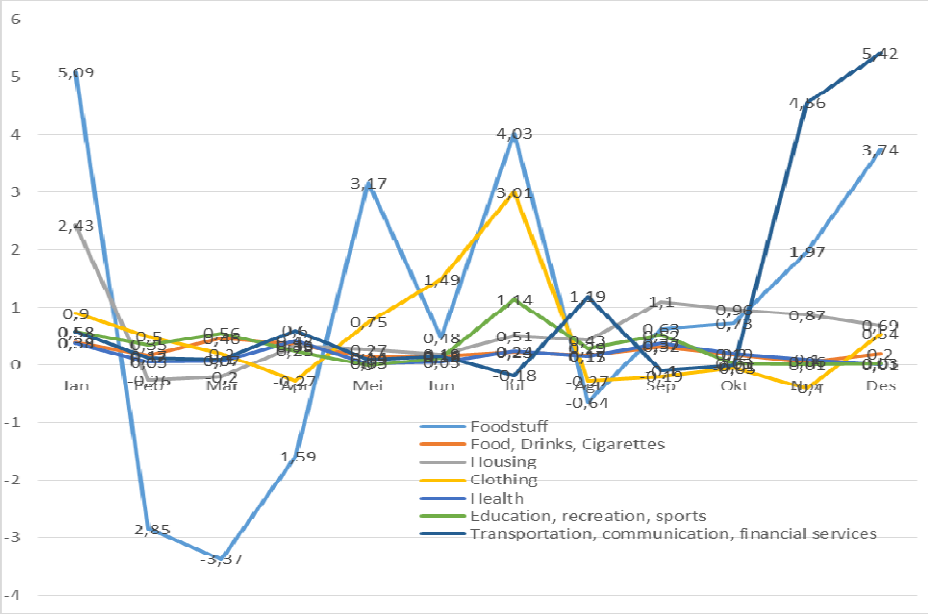


Figure 1.1 shows the condition of the monthly inflation rate of seven commodity groups in the province of Aceh in 2014. In general, the most volatile inflation rate in 2014 was the inflation rate in the foodstuffs group. The foodstuffs group at the beginning of 2014 had the highest inflation compared to other commodity groups at 5.09 percent. Furthermore, in March it experienced the highest deflation of 3.37 percent, then again inflation in May also reached 3.37 percent. The inflation rate fluctuations in the foodstuffs group continued until December and got the highest inflation rate among other commodity groups with an inflation rate of 3.74 percent.

From the 2014 data sample, it can be concluded that the foodstuffs group is the commodity group most vulnerable to shock. However, it cannot yet be ascertained whether the shock that causes inflation is persistent and continues to affect future prices or not because there has not been a specific study of how the inflation persistence rate in Aceh Province, especially inflation from the side of commodity groups forming the CPI. A high level of persistence

indicates that the monetary policy framework in implementing the ITF (Inflation Targeting Framework) has not been fully successful. The application of the ITF in Aceh Province is very necessary to determine the behavior of inflation itself through the calculation of the degree of persistence so that it can know the time needed for each component of inflation to return to its natural level. Thus, policymaker can adjust the amount and timing of responses that need to be applied in order to achieve the desired inflation.

This research will examine how the behavior of inflation by measuring the inflation persistence level in Aceh province. Consequently, The event of a shock can become information for policymaker and can produce appropriate and targeted policy formulations in overcoming the problem of inflation in the economy in Aceh Province.

2. Literature Review

In simple terms, inflation can be explained as a tendency to increase prices in general and continuously. The price level in the definition of inflation conceptually is the level of the weighted average price of goods and services in the economy. In practice, the price level is measured by the price index, both the consumer price index (CPI) and the producer price index (PPI). The opposite of inflation is deflation, which is a decrease in the general price level (Samuelson and Nordhaus: 1997).

The policy in maintaining the stability of the inflation rate is carried out by the establishment of an expansionary monetary policy (Monetary Expansive policy) which is often referred to as loose monetary policy or Monetary contractive policy or tight monetary policy. Both policies are implemented with various instruments which are the authority of Bank Indonesia. According to Moreno and Villar (2008), the tight and looser monetary policy is based on the degree of inflation persistence or inflation behavior itself.

Sbordone (2007) defines inflation persistence as the length of time needed for the disappearance of inflation shock or the return of inflation to natural levels, as well as Gadzinski and Orlandi (2004) who interpret inflation persistence as slow inflation to return to the target value set by the central bank when there is a change in the achievement of these objectives or because of other shocks. Batini (2002) explains that there are three types of inflation persistence, namely: First, the serial correlation is positive on inflation. Second, there is a lag between the actions of systematic monetary policy and their effect on inflation. Third, the lag of response from inflation to unsystematic monetary policy. Thus, inflation persistence can not only increase but also decrease from its natural value. If the inflation persistence position is at its natural value, then the inflation persistence value will be positive, whereas if the persistence position is below its natural value, the persistence value will be negative. In the various existing literature, the discussion of inflation persistence mostly focuses on the increase alone, where the studies aim to find out how quickly or slowly the decline in inflation can return to its natural value.

Marques (2004) states that inflation persistence is usually assessed in two approaches. The first study defines and evaluates inflation persistence in the context of simple univariate time-series representations while the second uses structural econometric models that aim to explain the behavior of inflation. Several previous studies have explained the behavior of inflation in Indonesia, both backward looking and forward looking. Research conducted by Harmanta (2009) found that the persistence of backward-looking inflation in the ITF era decreased, while those that were forward-looking had increased. However, the study needs to be supported by regional studies, in the sense of looking deeper into regional inflation persistence. This is also motivated by the understanding that national inflation is formed from regional inflation.

The determinant of inflation can be seen from two sides, namely Core Inflation and non-core inflation. Core inflation is inflation which is influenced by fundamental factors such as demand-supply interactions, external environments such as exchange rates, international commodity prices, inflation of trading partners and inflation expectations from traders and consumers. Whereas non-core inflation is inflation which is influenced by other than fundamental factors. Like Volatile Food Inflation. (Shocks-influenced inflation in foodstuffs such as crops, natural disturbances, disease disorders) and Administered Prices Inflation (inflation affected by shocks in the form of Government price policies, such as fuel prices, electricity tariffs, transportation fares, etc). In this study, persistence and the source of

inflation are focused on inflation originating from the supply side, namely the inflation rate caused by changes in the prices of goods and services of the Consumer Price Index (CPI) constituent component.

3. Method of Analysis

3.1. Data Stationarity Test

In econometrics, the data to be used must be stationary especially for time series data. Test of stationary data is needed to see whether over time the data or variable will tend to return to a fixed long-term trend. In this study the stationarity test of data using the Augmented Dickey Fuller-Test (ADF-Test) and the Phillips-Peron test. The optimal length of lag in the ADF test is determined based on the minimum AIC (Akaike Information Criterion) value and the maximum value of (Harris, 1995). Stationarity tests on all variables are carried out starting with a constant (drift) and trend, with a constant (drift) and a random walk equation.

3.2. Autoregressive (AR)

In this study, the measurement of persistence degrees uses a univariate approach by emphasizing aspects of time series data. The model that will be used is the Autoregressive (AR) time series model. With the AR model, the inflation persistence rate is measured from the sum of the lag coefficients of the dependent variable. The method of summing the coefficients is the best way of persistence scalar measurement according to Andrews and Chen (1994) AR formula with order ρ can be described as follows:

$$\pi_t = \mu + \sum_{j=1}^{k} \alpha_j \mu_{t-j} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For estimation ρ, determine the number of lags of the corresponding K dependent variable using the Akaike Information Criterion (AIC) and or Schwarz 'Bayesian Information Criterion (SBIC). The inflation persistence rate is calculated by summing the AR coefficients ($\rho = \sum_{j=1}^{k} \alpha_j$). Inflation persistence is said to be high if the current inflation rate is strongly influenced by its lag value, so the coefficient is close to 1. In this case, inflation is said to approach the unit root process. Measuring the level of inflation persistence with a univariate approach in some previous literature assumes that the natural inflation rate, in the long run, is constant (Vasilika, 2011). The natural inflation rate is the inflation rate in equilibrium conditions

To measure how long the inflation persistence (inflation returns to the natural level after a shock) can use the Koyck Model by calculating the Mean Lag. Mean Lag value is the magnitude of the average value of Lag influence (different times) on the dependent variable which can be expressed in the formula as follows:

$h = \frac{\rho}{1-\rho}$ where p is the coefficient of AR (Gujarati, 2003).

3.3. Partial Adjustment Model (PAM)

The causes of the source of inflation pressure can be known by using Partial Adjustment Model (PAM), also known as Stock Adjustment Model, basically, this model is a form of rationalization of the Koyck Model developed by Mark Nerlove in 1958. The Koyck model is a simple method used in estimating the relationship of dependent variables with independent variables which in the equation accommodate lags (Gujarati, 1995).

Partial Adjustment Model (PAM) is also an Autoregressive model. The criteria that must be fulfilled from the PAM model are the lagged coefficient of the dependent variable

(dependent variable) located 0 <β <1 and β must be statistically significant with the coefficient sign positive (Insukindro, 2006). This model assumes that the Y non-free variable expected in period t is written (Yt *) cannot be observed directly. The Yt * variable will depend on the current Xi free variable. The general forms of PAM models are as follows (Gujarati, 2003):

$$Yt=\gamma\beta_0+\gamma\beta_0 X_t+(1-\gamma)\,Y_{t-1}+vt \quad \text{where } v_t=\delta et \qquad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

To form a PAM model that will be used in this study the first step that must be done is to form a functional relationship between the independent variable and the dependent variable. The decline in the PAM model in this study is as follows:

$$\pi = f(\text{BM, MMR, PERAL, SDG, KSH, PRO, TKK}) \qquad \ldots\ldots\ldots\ldots (3)$$

Where π shows the inflation rate, BM is food ingredients, MMR is food, drinks, cigarettes, then PERAL is Housing, water, electricity, gas, SDG fuel is Clothing and KSH are Health, PRO is Education, recreation, sports, and TKK is transportation, communication, financial services. In the PAM model, equation (3) can be explained through the following equation:

$$\pi_t^* = \beta_0 + \beta_1 BM_t + \beta_2 MMR_t + \beta_3 PERAL_t + \beta_4 SDG_t + \beta_5 KSH_t + \beta_6 PRO_t + \beta_7 TKK_t + e_{1t} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

π_t^* is an unobservable variable, to eliminate the variable equation (4) is derived into the following equation:

$$\pi_t - \pi_{t-1} = \delta\,(\pi_t^* - \pi_{t-1}) \qquad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\pi_t = \delta\,(\pi_t^* - \pi_{t-1}) + \pi_{t-1} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$\pi_t = \delta\,\pi_t^* + (1-\delta)\,\pi_{t-1} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where:

$\pi_t - \pi_{t-1}$ is Actual change in the inflation rate, $\pi_t^* - \pi_{t-1}$ is Change in inflation rate according to the desired time, and δ is the adjustment coefficient ($0 < \delta \leq 1$).

By substituting equation (7) into equation (4), the equation can be used for estimation as follows:

$$\pi_t = \delta\beta_0 + \delta\beta_1 BM_t + \delta\beta_2 MMR_t + \delta\beta_3 PERAL_t + \delta\beta_4 SDG_t + \delta\beta_5 KSH_t + \delta\beta_6 PRO_t + \delta\beta_7 TKK_t + \delta e_{1t} + (1-\delta)\pi_{t-1} \quad \ldots\ldots (8)$$

Because:

$\gamma_0 = \delta\beta_0$, $\gamma_1 = \delta\beta_1$, $\gamma_2 = \delta\beta_2$, $\gamma_3 = \delta\beta_3$, $\gamma_4 = \delta\beta_4$, $\gamma_5 = \delta\beta_5$, $\gamma_6 = \delta\beta_6$, $\gamma_7 \delta\beta_7$, and $v_t = e_{1t}$

So in general equation (8) can be written as equation (9) below:

$$\pi_t = \gamma_0 + \gamma_1 BM_t + \gamma_2 MMR_t + \gamma_3 PERAL_t + \gamma_4 SDG_t + \gamma_5 KSH_t + \gamma_6 PRO_t + \gamma_7 TKK_t + (1-\delta)\pi_{t-1} + v_t \quad \ldots\ldots (9)$$

The operational definitions in this study are as follows: Inflation rate (π) is the dependent variable measured by the index of a consumer price index (CPI). Foodstuff (BM) is an independent variable obtained by measuring the inflation rate by using the component index of the prices of goods included in the food ingredients. Fast food, drinks, cigarettes (MMR) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in food, drinks, and cigarettes.

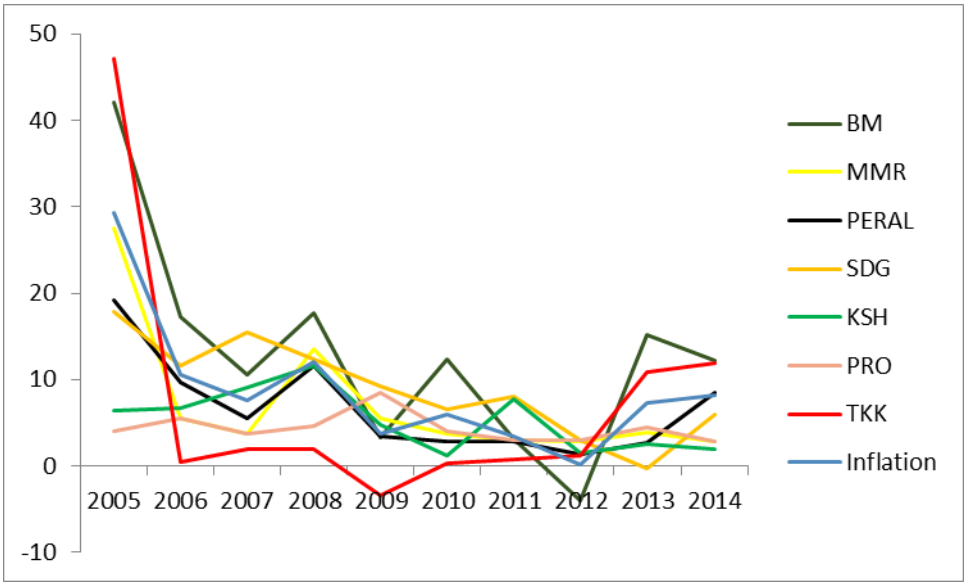
Housing, water, electricity, gas, fuel (PERAL) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in Housing, water, electricity, gas, and fuel Clothing (SDG) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in clothing items Health (KSH) is an independent variable obtained by measuring the inflation rate by using the component index of the prices of goods and services included in health goods and services. Education, recreation, sports (PRO) is an independent variable obtained by measuring the inflation rate by using a component index of prices of goods and services included in goods and services of education, recreation, and sports. Transportation, communication, financial services (TKK) are independent variables obtained by measuring the inflation rate by using a component index of prices of goods and services included in goods and services of transportation, communication, and finance.

4. Results and Discussion

The economic structure that continues to evolve and continues to change makes economic fluctuations increasingly difficult to assess. Not surprisingly, in the measurement of various economic indicators or variables continue to experience changes and developments in accordance with ongoing economic conditions. The inflation rate as one of the indicators to determine changes in prices in general also continues to develop in the calculation process. Measuring the level of inflation is done by using a price index of a group of goods and services that are general needs and can represent the price level as a whole. Therefore to calculate the price index, goods, and services whose prices are used to calculate the index also change as well as the base year of price changes.

In this study, of course, it will not discuss the mechanism of these calculations, but it should be noted that in the Aceh Province the inflation rate which is currently a reference for economic agents is also not immune from changes. The inflation rate in Aceh Province released by the Central Bureau of Statistics has undergone two years of basic measurement of price indexes during the data period of this study, namely in 2009 with the base year 2007 and in 2014 with the base year 2012. Changes to this base year have several reasons important as the presence of new goods whose prices are feasible to be included in the index scales. In general, inflation and fluctuations of commodities price in Aceh Province from 2005 to 2014 can be seen in the following figure:

Figure 4.1 Inflation and Fluctuations of Commodities Price in Aceh Province From 2005 To 2014



The description of the inflation rate fluctuations seen in Figure 4.1 shows the highest average inflation rate occurred in 2005. The price changes that occurred in 2005 experienced a significant increase from the previous year. Based on the results of the release of the Central Bureau of Statistics, the earthquake and tsunami disaster in Aceh Province on December 26, 2004, greatly affected the price increase in 2005.

While the lowest average inflation rate occurred in 2012. This is because the economic condition of Aceh Province in 2012 was quite good supported by improved infrastructure, and the distribution of goods and services that were increasingly smooth.

4.1. Stationarity Test Results

In conducting data stationarity tests, the thing that must be considered is the probability value. If the probability value is below α = 1 percent, α = 5 percent, or α = 10 percent, then there is no unit root. Conversely, if the probability value above is α = 1 percent, α = 5 percent, or α = 10 percent, then the result indicates a unit root occurs. In addition to knowing the stationarity of data can also be done by comparing the value of t-statistics and critical values to determine whether there is a null hypothesis that can be rejected or not (Rachman Hakim et al, 2012). Unit root testing in this study is based on Augmented Dickey-Fuller (ADF) test at the level and first difference.

From the results of the stationarity test, it was found that the data to be used in this study is not stationary at the level which is proven by the probability value of several variables greater than α. This means that the variables in this study are not stationary at α = 1 percent, α = 5 percent, and α = 10 percent. The results of the comparison between the t-statistics and critical values show the same thing. The t-statistic value is not smaller than the critical value both at α = 1 percent, α = 5 percent, or α = 10 percent. That is, the null hypothesis that the root unit is accepted. The test results can be seen in Table 4.1 below:

Table 4.1 Stationarity Test

Variables	ADF Statistic	critical value of Mc Kinnon			Prob*	ADF Statistic	critical value of Mc Kinnon			Prob*
		1%	5%	10%			1%	5%	10%	
π	-3,0384	-3,4937	-2,8892	-2,5816	0,0346	-8,8768	-3,4937	-2,8892	-2,5816	0
BM	-3,2575	-3,4931	-2,8889	-2,5815	0,0194	-8,7277	-3,4931	-2,8889	-2,5815	0
MMR	-1,2616	-3,5007	-2,8922	-2,5832	0,6447	-8,1157	-3,4931	-2,8889	-2,5815	0
PERAL	- 1,3783	-3,5007	-2,8922	-2,5832	0,5898	-8,8575	-3,4931	-2,8889	-2,5815	0
SDG	-1,0468	-3,5007	-2,8922	-2,5832	0,7337	-9,8247	-3,4931	-2,8889	-2,5815	0
KSH	-1,4124	-3,4925	-2,8887	-2,5813	0,5737	-9,6244	-3,4931	-2,8889	-2,5815	0

Variables	ADF Statistic	critical value of Mc Kinnon			Prob*	ADF Statistic	critical value of Mc Kinnon			Prob*
		1%	5%	10%			1%	5%	10%	
PRO	-2,3666	-3,5007	-2,8922	-2,5832	0,1539	-3,6540	-3,5007	-2,8922	-2,5832	0,0064
TKK	-4,6869	-3,4931	-2,8889	-2,5815	0,0002	-9,0043	-3,4931	-2,8889	-2,5815	0

The data is not stationary at the level, it needs to be differencing, namely first difference and the determination of the number of lags of dependent variables using the Schwarz Bayesian Information Criterion (SBIC) because the number of lags is required to remember the data that is not long enough. At first difference, all variables are stationary both seen from the probability value that is smaller than the value of α and the t-statistical value smaller than the critical value at α = 1%, α = 5%, and α = 10%. That is, the null hypothesis of unit root is rejected.

4.2. Persistence of Inflation in Aceh Province

After ensuring that all variables are stationary, then the estimation process can be done. Because the estimation used is the autoregressive model, the measure of inflation persistence is the value of the autoregressive coefficient. The estimation results show that the inflation persistence of Aceh Province is very low with an AR coefficient of 0.095. This result shows that the inflation rate of Aceh Province is almost not influenced by its lag value and only requires a short time to return to its natural value (equilibrium).

Table 4.2 Inflation persistence in Aceh Province (2005-2014)

Variable	Coefficient	Std. Error	t-Statistic
C	-0.1552	0.1641	-0.9454
DINF(-1)	0.0954	0.0969	0.9850

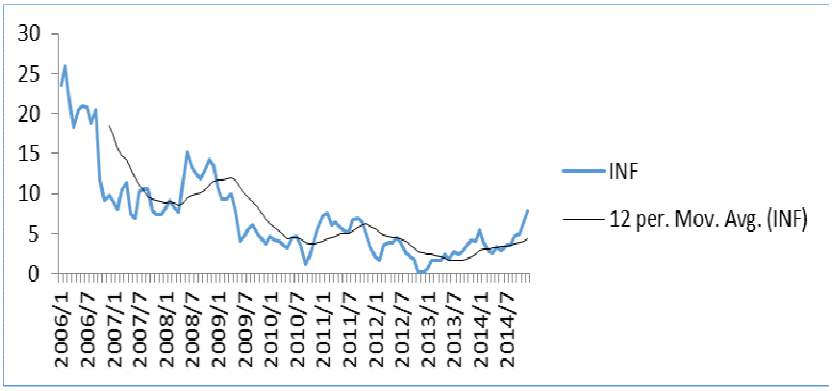
This result is certainly not as expected (Table 4.2). Although inflation in Aceh Province is very prone to shock, the inflation rate that is generated is not persistent and the shock that occurs is absorbed quickly towards returning to the average value of inflation during the research period from 2005 to 2014. These results provide information that price changes the prices of commodities forming CPI in Aceh Province, in general, do not follow the magnitude of past price changes.

The magnitude of the price change (inflation) in Aceh Province is more influenced by various factors formed in the current period. In other words, the behavior of inflation in Aceh Province is more influenced by other things that are seasonal or temporary because in each period in the study the inflation rate in Aceh Province has a different pattern and very little influence from the previous period on inflation formation in the next period. Empirically, the shock of prices of goods and services in Aceh Province is often caused by the large demand for goods and services in certain seasons, such as *maulid* celebrations, *Ramadhan* month, and other holidays which are identical to the social conditions in Aceh Province. This also greatly influences the changing patterns of inflation in the Province. This situation is theoretically called Demand-Pull Inflation, which is inflation caused by an increase in the amount of demand for goods but not offset by an increase in output produced, generally, prices will rise.

Because of the increase in the demand for goods and services in certain seasons often prices that have generally risen will return to decline (correction) after reaching the highest price in the season even though in the long run prices continue to increase. Perhaps this is what causes the inflation persistence rate in Aceh Province to be low because of the often corrected price level to return to the previous price. The relatively low level of inflation persistence in Aceh Province, which is different from the inflation persistence rate in other provinces, can also be caused by the most influential source of inflation pressure in Aceh Province. However, to draw conclusions like this, more in-depth research is needed, including in observing price behavior.

In line with the opinion of Marques (2004) which states that there is a tradeoff between the level of inflation persistence and the flexibility of the natural inflation rate. If the natural inflation rate is constant, it will produce a high level of inflation persistence and vice versa if the natural inflation rate is more flexible and changing, the inflation persistence level will tend to be low. Aceh Province with a low inflation persistence rate has an average inflation value that is quite varied during the study period as shown in Figure 4.2 below:

Figure 4.2 Inflation rate and moving average



In Figure 4.2, it can be seen in each year that the inflation rate cuts several times the balance point. In other words, the inflation rate in Aceh Province is very fast returning to the average value. If the length of time needed for the inflation rate of Aceh Province is calculated to return to its natural level by calculating the Mean Lag value the results are as follows:

$$h = \frac{0{,}095}{1-0{,}095} = 0{,}104$$

The average length of time required for the general inflation rate to return to its natural level in Aceh Province is 0.104 years (the length of time in the study period is 12 months) which is about 1.2 months. This can be said to be a relatively short time to return to the average value of inflation after the shock.

Aceh Province which has economic relations that are quite close to the province certainly has the same inflationary behavior. So that the results of inflation persistence in the relatively low province of Aceh could be influenced by a very active trade flow, both imports, and exports, especially agricultural commodities between these two provinces. The low inflation persistence level of the Province of Aceh means that in general the current value of inflation is very little influenced by the value of its past so that the effect of shocks or shock on inflation will return to its natural level in a relatively short time. This was reinforced by Gaglianone, Guillén, & Figueiredo (2018) who explained that the shock that occurs when inflation is higher, has a greater dissipation time than the shock that occurs when inflation is lower.

4.3. Persistence of inflation in the form of CPI commodities

Inflation persistence in general in Aceh Province has a relatively low degree. Nevertheless, this study also tries to calculate the inflation persistence of each CPI-forming commodity group, namely seven other variables mentioned earlier. This calculation is also considered very important because inflation, in general, is a calculation of the average value of seven commodity groups forming the Consumer Price Index (CPI) so that the results of this calculation can provide a more detailed explanation of how the inflation persistence rate in Aceh Province in each price group. The results of estimating the degree of inflation persistence in Aceh Province based on the group of CPI-forming commodities are presented in the following table.

Table 4.3 Inflation persistence for commodities group

No	Groups	Degree of Persistence
1	Foodstuff	0,161356
2	food, drinks, cigarettes	0,305003
3	housing, water, electricity, gas, fuel	0,138980
4	Clothing	0,037643
5	Health	0,06569
6	Education, recreation, sports	0,071837
7	Transportation, communication, financial services	0,109759

The results of the calculation of the inflation persistence level of the CPI composing commodity groups in Aceh Province are attached in Table 4.3. The commodity group with the highest persistence level is the group of processed food, drinks, cigarettes (MMR) with a persistence value of 0.30, followed by the foodstuff commodity group (BM) with a value of 0.16, the next highest commodity group is housing, water, electricity, gas, fuel (PERAL) with a value of 0.13, then a group of commodities for transportation, communication and financial services (TKK) with a value of 0.1. While the three other commodity groups are the clothing group (SDG), the health group (KSH), and the education, recreation, and sports groups (PRO) which have persistence levels below 0.1.

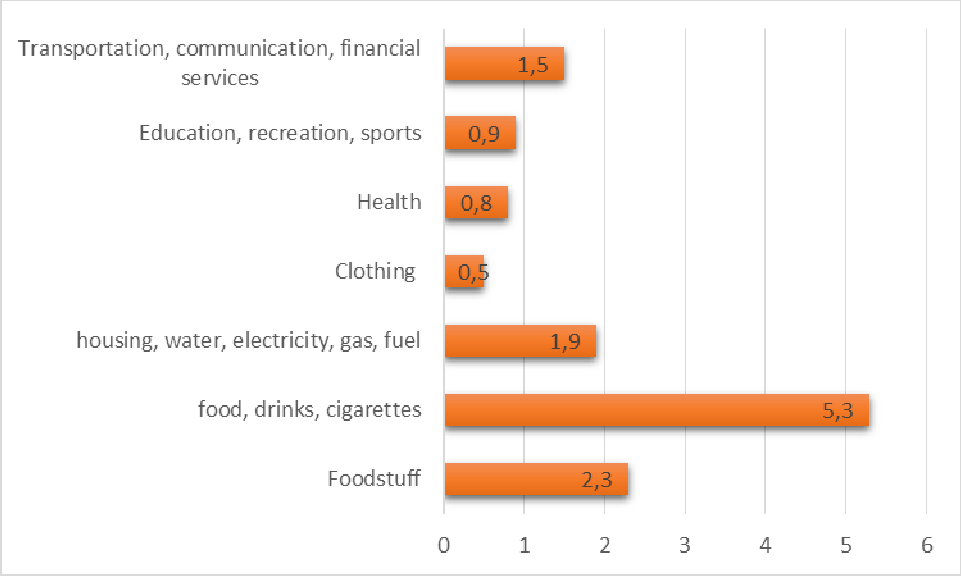
When viewed to the level of the commodity group, the biggest contributor to the persistence of inflation is the processed food, beverages, and cigarettes group. This gives the view that in Aceh Province in controlling the inflation rate must be careful with the type of inflation that comes from outside the Aceh region or often referred to as imported inflation, because commodity groups with the highest persistence level are processed food, beverage and cigarette commodities almost certainly comes from outside Aceh (not Aceh products).

Foodstuff commodity group (BM) occupied the second position of the highest inflation persistence rate. Prices of foodstuffs that continue to increase and very often experience limited supply, perhaps the cause of this commodity group tend to be a high level of persistence from several other commodity groups. Inevitably the crisis of food stock in Aceh Province often has to be covered by importing from outside the region to meet demand, plus the amount of food demand in certain seasons makes prices of these commodity groups continue to soar as during the day celebrations. Islamic big day.

The next commodity group that was felt to be quite influential in contributing to the inflation persistence level in Aceh Province was the housing, water, electricity, gas, fuel commodity group (PERAL). To overcome the problem of inflation caused by this commodity group is a little more difficult than the two previous commodity groups. Because most of the commodity prices incorporated in this group are determined by policies at the central government level and very few commodities can be intervened in price formation at the regional level.

For some other commodity groups, namely clothing (SDG), health (KSH), education, recreation, sports (PRO), and transportation, communication, financial services (TKK), during the study period, the results of persistence levels were relatively very low. In general, commodity groups with a low persistence level mean that changes in prices do not occur continuously for changes in prices in the past (the effect of small lags). However, a low persistence level does not become a barrier for these commodity groups to contribute to the inflation rate in each period. Discussion of the source of the influence of inflation will be discussed in the next sub-heading. For more details, the following is explained by the calculation of the length of time the inflation rate to return to its average value after a shock in the overall inflation rate of the commodity group above.

Figure 4.3 Inflation persistence level to natural level (monthly)



Overall the results shown in Figure 4.3 show the time needed by the inflation rate to return to relatively fast average values as a result of the calculation of the general inflation persistence level discussed earlier. The length of time ranges from 0.5 to 5.3 months. The commodity group that most quickly absorbs shock is the clothing group, which only takes 0.5 months. In other languages, the average inflation rate of commodities joined in this group only takes about 15 days to absorb shocks that occur in commodities in this group.

While the longest time needed to return to the average value is the inflation rate in the processed food, beverage and cigarette commodity groups, which is for 5.3 months or reaches a quarterly one. By knowing the length of the persistent inflation rate in each group of commodities, in terms of taking policy stakeholders need to pay attention to the right timing in taking the policy so that it can achieve the desired inflation target.

4.4. Sources of Inflation Pressure in Aceh Province

As stated in the previous discussion, to calculate the effect of each variable (CPI commodity group) will be calculated using a partial adjustment model (PAM). This model includes a dynamic model that accommodates the lag value of the dependent variable. The following estimation results using the partial adjustment model.

Table 4.4 The Source of the Causes of Inflation

Variables	Coefficient	Std. Error	t-Statistic
C	-0.053980	0.083498	-0.646480
DBM	0.235836	0.018230	12.93646
DKSH	0.075560	0.075966	0.994663
DMMR	0.086570	0.086999	0.995074
DPRO	0.028357	0.070951	0.399666
DTKK	0.132023	0.024887	5.304795
DSDG	0.072993	0.044370	1.645111
DPERAL	0.330454	0.069447	4.758394
DINF(-1)	0.023650	0.042489	0.556616

From the results of the estimation of the PAM model, the source of the causes of inflation from the supply side is shown in Table 4.4. To see the effect of the independent variables on the dependent variable is to look at the coefficients of each independent variable. The variables that have the biggest to the smallest influence on the inflation rate in Aceh Province if sorted are as follows: (1) housing, water, electricity, gas, fuel group with a coefficient of

0.330454, (2) foodstuff with a coefficient of 0.235836 , (3) transportation, communication, financial services groups with a coefficient of 0.132023, (4) processed foods, beverages, cigarettes with a coefficient of 0.086570 (5) health groups with a coefficient of 0.075560, (6) clothing and value groups coefficient of 0.072993, (7) education, recreation, sports group with a coefficient of 0.028357. The results provide information that variables with a low persistence level can contribute greatly to the magnitude of the inflation rate in Aceh Province. As attached to the following table:

Table 4.5 Level of Persistence and the Effect to Inflation

Ordering	Variables	Persistence	Ordering	Variables	The effect on inflation
1	MMR	0,305003	1	PERAL	0,330454
2	BM	0,161356	2	BM	0,235836
3	PERAL	0,138980	3	TKK	0,132023
4	TKK	0,109759	4	MMR	0,086570
5	PRO	0,071837	5	KSH	0,075560
6	KSH	0,06569	6	SDG	0,072993
7	SDG	0,037643	7	PRO	0,028357

Table 4.5 shows that the commodity groups that occupy the top three ranks with the highest persistence level and the magnitude of the influence on the inflation rate, namely food commodity groups and housing, water, electricity, gas, fuel commodity groups. Therefore, the two commodity groups are recommended to be the focus of policymaker in controlling the inflation rate in Aceh Province, by anticipating the possibility of inflation in this commodity group and also overcoming the impact of inflation caused by this commodity group.

Each of these variables represents the volatile foods component and administered price component. The BM variable represents the volatile foods component because this variable is the inflation rate of food ingredients such as rice, meat, beans, fruits and others that are prone to shocks such as natural disasters and crop failures. Whereas the PERAL variable represents the administered price component because this group is more dominated by needs whose prices are determined by the government, such as the basic electricity, fuel, and water rates.

5. Conclusion

The results of this study get some conclusions that can be a reference for controlling inflation in Aceh Province. In general, the inflation persistence level in Aceh Province is relatively low in contrast to some previous studies in various other regions even in Indonesia in general which have a high inflation persistence rate. In Aceh Province, it took a long time for the general inflation rate to return to an average (natural) value after the shock of only 1,2 months. Furthermore, the inflation persistence level of the commodity group of the Consumer Price Index (CPI) has a time span in absorbing shock from 0,5 months to 5,3 months. The three groups of commodities with the highest persistence in inflation are processed food, beverages, cigarettes, foodstuffs, and housing, water, electricity, gas, and fuel groups.

With reference to the estimation of the PAM model, it was found that the three groups of commodities with the greatest influence on the inflation rate were housing, water, electricity, gas, fuel, foodstuffs, and transportation, communication and financial services. When viewed from the disaggregation, this result provides information that in terms of controlling inflation in Aceh Province, it must have a main focus in preventing and reducing the impact of volatile foods inflation and administered price inflation represented by foodstuffs and housing groups, water, electricity, gas, fuel. To reduce the impact of price increases on volatile foods, the government must maintain the supply of goods (supply stock) in various ways. Among them by opening new agricultural land, encouraging people to be more productive in producing agricultural products, plantations, and other food ingredients. Such a policy certainly must also be followed by revamping agricultural infrastructures such as irrigation, dams, and other infrastructure that can facilitate the community or producers to optimize their production. The

government can also strive to provide subsidies for raw materials for the production of foodstuffs such as fertilizers, agricultural seeds, livestock breeds, and so forth.

Meanwhile, the impact of inflation caused by the administered price component, the government must immediately find a solution to the energy crisis problem. The solution is to find other energy sources that are renewable and cheaper and more efficient for use by the community because the inflation rate in these components is strongly influenced by energy-related prices. If this is difficult, the government can strive to reduce the impact of inflation on this component by providing public facilities that can reduce the amount of energy consumption by the community such as public transportation, closer access roads, and other policies that can reduce energy needs. Therefore, to achieve the inflation target desired by the government as a stakeholder, it must strengthen coordination and synergize with all relevant parties so that the inflation rate in Aceh Province continues to be stable and on target.

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STRATEGIES OF SMALL ENTERPRISES DEVELOPMENT IN AFRICAN COUNTRIES

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Abstract
The article describes the basic concepts and classification icons/symbols of small enterprises. Small enterprises are defined by the author as irreplaceable drivers of economic development, which are a source of economic growth and a tool for resources redistribution. This study analyzes the current strategies of small enterprises development in African countries such as Morocco, SAR and Tunisia, which made it possible to formulate conclusions and recommendations.

Keywords: African country, SMEs, entrepreneurship, small enterprises development strategies, competitiveness.
JEL classification:

1. Introduction

The relevance of the study is determined by the need of increasing the productivity of small businesses in Africa, as a catalyst for progress on this continent. On the African continent small enterprises make up 90% of private companies and provide 66% of workplaces, while micro-enterprises make up 70%. The low level of socio-economic status and political instability in Africa are obstacles in the acceleration of economic development.

The aim of the article is to analyze the existing strategies of small enterprises development in African countries (Morocco, SAR, Tunisia).

Increasing of small business productivity and creating programs for its development can be a catalyst for the progress in Africa, which determines the relevance and promptness of this study.

2. Concept and classification of small enterprises

In the scientific literature "small enterprises" are defined as "entrepreneurial activities carried out by subjects of a market economy in certain cases established by laws, government agencies or other representative private or public organizations" [1]. The economic, social and cultural aspects of a country are reflected in the characteristics of small enterprises. That is why the definitions of small businesses change over time and in accordance with the certain geographic region. For example, some countries do not distinguish between legal and statistical definitions. This applies to Canada, Greece, Portugal, Mexico and Slovakia. In this case, the definition may be based on an income threshold, such as in Canada, or on labor rates such as in the UK, the Slovak Republic or Mexico. Also, the evaluation of small business can be based on two criterias: the number and qualifications of employees (e.g. in Portugal). The countries of the European Union have accepted the differences between legal and statistical definitions. The main criteria for determining statistical target is the number of employees; in a legal definition – consideing the number of employees, annual turnover, total balance and degree of autonomy (Table 1).

Table 1. Criteria of small enterprises in European Union

Companies	Number of	Annual	Total balance	Autonomy

	employees	turnover (euros)	(euros)	
Micro-enterprises	From 1 to 9	Less than 2 million	Less than 2 million	25% and more from the capital or the vote from another company
Small enterprises	From 10 to 49	Less than 10 million	Less than 10 million	

In Morocco, there are the following small business criterias: a workforce of at least 90 full time employees and annual turnover, excluding tax, at least 50 million dirhams and/or a total balance limited to 60 million dirhams. For new small enterprises the law provides that they must have an initial investment program of less than 10 million dirhams and take into account the ratio of investment and employment to less than 100,000 dirhams [5].

Regarding the definition of small business in the Democratic Republic of Congo, several definitions are formulated either according to financial capital, or according to labor, or according to the nationality of the owner or the specialized management method. There are four definitions.

Law No. 073-011 of January 5, 1973, establishing the Office for the Development of Small Congolese Enterprises, defines small enterprises as agricultural, commercial, industrial and service enterprises owned by individuals Congolese citizens or companies whose capital belongs to the majority, individuals or legal entities of the Congolese citizenship in which all management functions, i.e. management, finance, production, marketing and supply are carried out by the head of the company. It is worth noting that this definition has a generalizing character and does not demonstrate the necessity of small business. Table 2 presents the classification of small enterprises.

Table 2. Characteristics of a small enterprise [2, p.268].

Business activity	Businexx-sections	Legal forms	Company orogin
Commersial enterprise	Primary (agricultural enterprises and possibly mining)	State company	African
Banks or similar financial institutions	Secondary (industrial enterprises)	Private company	
Administration	Tertiary (service companies: transport, commerce, banking etc.)	Company anonymously (SA)	
Industrial enterprise	Informal	Individual business (EI)	Foreign
Service companies		Limited Liability Company «Interpersonal Limited Liability Company» (EURL)	
		Limited Liability Company (SARL)	

3. Characteristics of small enterprises development strategies

Let us analyze the strategies of small enterprises development in certain African countries.

3.1. Small enterprises development strategies in Morocco

To ensure the efficiency and sustainable development of small business, the government of Morocco introduces a policy for supporting small businesses. The state has established institutions and funds designed to assist and modernize small businesses. The Central Guarantee Fund provides access to financing and the National Agency for the Promotion of

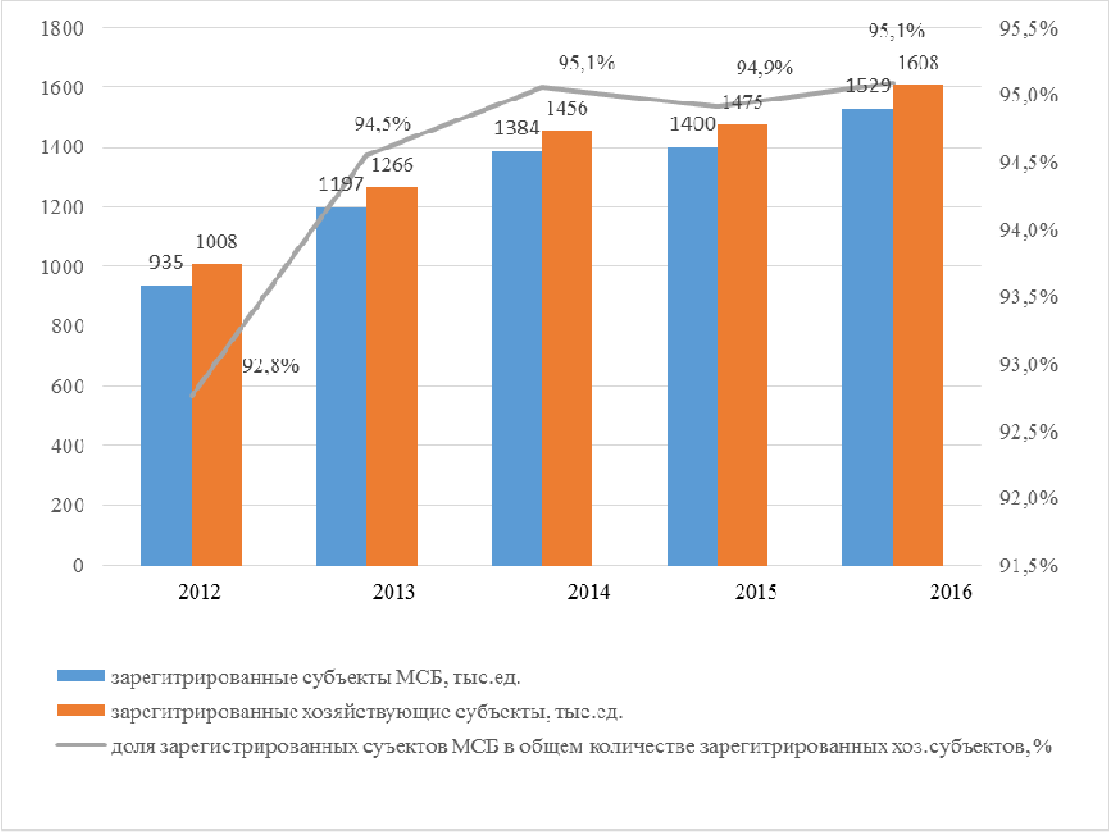
Small Enterprises for the pilot implementation of the national program of small businesses modernization.

The government of Morocco is implementing a number of programs (MICNT, INTILAK, TATWIR, Innov'Act) aimed at improving the competitiveness of small business through three initiatives: small business growth, strengthening its competitiveness and creating the competitiveness of new small businesses.

The Imtiaz program is one of the measures taken by the National Industrial Development Pact (PNEI), which aims to support small businesses by strengthening its financial and non-material assets. Analysis of the distribution of small business by regions in Morocco showed that the largest number of it are in the city of Casablanca – 220.4 thousand or 14.4%, Tangier-Tetouan – 213.9 thousand or 14.0%, and Rabat-Sale – 186.0 thousand or 12.2%. The smallest quantity of small business subjects are in North-Moroccan region – 40.8 thousand (2.7%), West-Moroccan region – 45.3 thousand (3.0%) and Menes-Fez – 49.4 thousand (3.2%) [9]. This is due to the agrarian orientation of the regions and small volumes of production.

Among the registered subjects of small and medium businesses the largest number of legal entities are in the city of Casablanca – 77.8 thousand (31.4%), Tangier-Tetouan – 34.8 thousand (14.0%), South Moroccan region – 22.2 thousand (9.0%) and Rabat-Sale – 16.8 thousand (6.8%). Figure 1 shows the dynamics of the number of registered SMEs and their unit weight in the structure of the total number of economic entities of Morocco [8].

Fig. 1 Dynamics of the number of registered SMEs and their unit weight in the structure of the total number of economic entities of Morocco[9]



In 2016, the number of active SMEs were increased by 6.9%. At the same time, in the structure of SMEs the share of active individual entrepreneurs were 73.3%, peasant (farmer) entities – 18.2%, legal entities of small and medium-sized business – 8.4%.

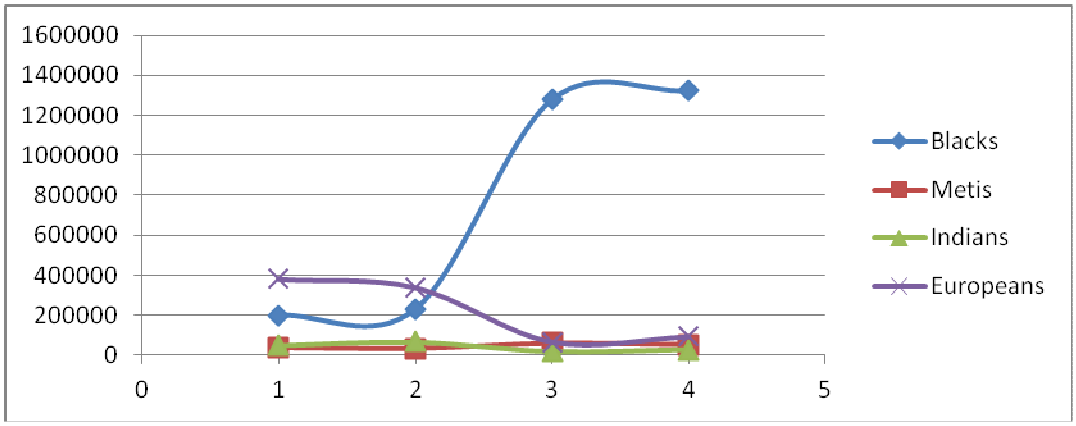
3.2. Strategies of small enterprises development in SAR

The characteristics of South African small enterprises are very different from those of other developing countries because of the apartheid heritage. A new economic sequence is a sufficient condition for the revival of small business economy. The elimination of apartheid

(if necessary) is not enough to master the full potential of small business economy. Structures inherited from apartheid make a major contribution to economy that has two sides, characterized not only by a high level of productivity (modern), but also by another (informal) sector with low productivity and little interaction between the two sectors. There is also a division by race [16]. The transitional stage is marked by political uncertainty and significant crimes and violence that have a negative impact on direct investment in the business sector.

Most small business owners (71%) in South Africa are African and followed by Europeans (20%). The number of white homeowners declined in the period 2008-2015. Indians and blacks were the only groups of people who emphasized an increase in the share of small business ownership. The number of small enterprises owned and operated by Indians increased by 47% in the period 2008-2015, while the number of small enterprises owned by blacks increased by 5% (Figure 2).

Fig2. Dynamics of structure of small enterprises owners in SAR in 2011-2015 [13]



The national structure of local economic development in South Africa aims to support the development of a sustainable economy through integrated government action. This government action is aimed at planned development, it stimulates the "heart" of the economy, which includes small enterprises operating in local municipalities [4]. It is based on an assessment of economic development practice and on the current context and problems of South Africa. The entry into force of the Small Enterprises Act since 1996 officially recognized the existence of small business in South Africa, which served as the basis for creation and promotion of small business at all levels of public administartion. Many informal small enterprises provided means of subsistence for people in South Africa. That is why the creation of local economic development units requires an understanding of various forms that can be implemented in this area, including the development of small business.

Let us regard the distribution of small enterprises between 9 regions of South Africa (Table 3).

Table 3. Placing of small enterprises in South Africa [15]

Small enterprises	The number of small enterprises in 2008				The number of small enterprises in 2015			
Sector	general	Formal	Informal	Other	general	formal	informal	other
General	2182823	666501	1420933	95389	2251821	667433	1497860	86528
Western Cape	223933	114976	95212	13745	230324	110107	110188	10030
Eastern Cape	218865	56579	154631	7655	197366	50670	141739	4957
Northern Cape	29894	11450	11768	6676	20611	8534	9058	3019
Independent states	114949	31040	76127	7783	96846	26224	60816	9806
Kwazulu-Natal	418406	102591	289347	26468	373434	74976	283165	15293
North-West	109860	25817	76855	7188	112856	27430	79153	6273
Gauteng	687556	270093	405180	12283	785321	306231	465100	13989
Mpumalanga	193259	29760	156814	6685	185399	35208	141129	9063

Small enterprises	The number of small enterprises in 2008				The number of small enterprises in 2015			
Sector	**general**	**Formal**	**Informal**	**Other**	**general**	**formal**	**informal**	**other**
Lompopo	186101	24193	155001	6907	249663	28054	207512	14098

From 2008 to 2015 the number of small enterprises in South Africa increased by only 3%. As recorded the highest rate of growth in the number of small business (34%) was among the Limpopo regions, and second place goes to Gauteng (14%). Northern Cape lost the most (31%), after it the rest of the independent states (16%) [19].

The ratio of GDP and small business is an indicator of the economic environment in which small enterprises operate. Of the 2.2 million small enterprises in South Africa, the overwhelming majority (944.5 thousand) are in the domestic trade (wholesale and retail trade) and residential sectors, followed by the public and social services sector [11]. However, the turnover of small enterprises in different sectors varies greatly.

Taxes paid by small enterprises increased significantly between 2010 and 2015. In 2010 the economy had just "recovered" after the Great Recession, after which companies recovered a little in subsequent years. Currently, most corporate taxes are paid by enterprises in the trade and manufacturing sectors.

Financial services are a general process of providing basic financial opportunities such as loans, grants and donations. Small enterprises need to build relationships with relevant financial service providers. Issues of managerial literacy in small enterprises of SAR have a number of problematic aspects in terms of the availability of business knowledge, lack of management skills, inadequate planning and staff inexperience [6]. Dependence on the sole ownership of the majority of small enterprises leads to inefficient use of human resources, where there are no new qualified personnel.

Today South Africa focuses on how to ensure effective economic development so that most citizens enjoy the benefits of the country's economic activities. Leaders in the economic sphere of the country adhere to the fact that sustainable economic activity is necessary for the well-being of the society.

South Africa has provided many initiatives to find answers to development problems. Interventions to promote local economic development include different initiatives such as public-private partnerships and small business promotion [12].

3.3. Strategies of small enterprises development in Tunisia

The small business development strategy in Tunisia for the coming period is based on the implementation of a new generation of economic and social reforms by consolidating the foundations of management and improving the climate of the economy. Priorities are business, the development of economic structure, the deepening of integration into world markets and the development of partnerships in addition to developing the financing system, upgrading infrastructure, ensuring a balance between regions, maintaining human and social resources, and strengthening sustainable development. The new management policy is aimed at consolidating the principles of democracy and increasing the efficiency of the administration in addition to improving the management of public funds and facilitating access to information [3].

The development of the small business sector is a top priority considering the potential of this sector, which calls for the need to accelerate the recovery of the sphere, liberalization of service sector and supporting of promising small enterprises in this section.

The economy of Tunisia is considered one of the most diversed and stable economies in Africa.

The new industrial strategy for 2025 (what does it have specifically for the development of the SB?) demonstrates the country as a pole of innovation for the future in the Euro-Mediterranean region. The new industrial policy is based on the creation and development of small business, as well as on investments in research and development of technological innovations in the conditions necessary for increasing attractiveness and competitiveness at

the international level (Agency for the Promotion of Industry and Innovation, 2016) [17]. The main objectives of the strategy of the Tunisian industry by 2025 are:

- increase in exports of the industrial sector of Tunisia to 50 billion dinars by 2025 compared with 23.7 billion dinars in 2014;
- increase in added cost of export sectors from 15% at present to 20% by 2020;
- growth in the share of sectors with high technological content from 20% of GDP in 2015 to 30% in 2020;
- growth rate of investment to 25% of GDP in 2020.

Despite of the development of small business in Tunisia, many of these small enterprises face significant challenges. First, there is the difficulty of accessing funding sources during the company's long-term operation or after obtaining working capital.

The small business of Tunisian industry is the first major program implemented in Africa. The results of this program are very encouraging, and in Tunisia remains the relatively dynamic economy of Africa [10, pp. 116-125].

In Tunisia, small businesses provide more workplaces than large enterprises. According to the government of Tunisia, small enterprises in the informal sector employ more labor. The development of the informal sector is associated with several problems, such as for example laws on bank financing for small business with the exception of cases of renewed banking credit conditions.

With the discovery of Tunisian economy in the European market small enterprises have proven their role in the development of economic activity, workplaces creation and the reduction of poverty and inequality. Since 1995 Tunisian officials have been trying to promote this role and are now forced to intervene in order to facilitate the receipt of credit by small enterprises, which despite the various mechanisms and institutions created to adapt to their needs remain a very important part of economic life. This means that the fundamental economic role of the bank is not clearly defined in Tunisia. Domestic credit provided to the private sector and non-financial public enterprises accounts for about 70% of Tunisia's GDP, while in the EU it averages 120% [7].

4. Conclusion

The study presented leads to a number of conclusions.

1. In the context of globalization and increasing competition the study of new markets is becoming a necessity especially for small business. In Africa, there are opportunities for the development of small enterprises that they want to export to a number of European countries.
2. In Morocco in order to ensure the efficiency and sustainable development of small business the government is implementing a policy aimed at its support. The state has established institutions and funds designed to assist and modernize small businesses. The Central Guarantee Fund provides access to financing and the National Agency for the Promotion of Small Enterprises – for the pilot implementation of the national program for modernizing small businesses.
3. The national structure of local economic development in South Africa aims to support the development of a sustainable economy by encouraging and supporting small enterprises.
4. The economy of Tunisia is the most diversed in Africa, and therefore small business has great potential for development. The government of Tunisia wants to liberalize the service industry.

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THE LABOUR MARKET IMPACT IN THE DOURO VITICULTURE: A FUZZY CLUSTER DISTRIBUTION APPROACH

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Abstract

Demography and the labour market dynamics are recognized as a key factor for the development of a region. Performing labour market insights can be even more disjointed on mountain and steep slope regions where the hand labour is usually sparse and scarce. This study intends to find the labour influence into the core variables of a vineyard productive system such as production or overall revenues and realize their importance in the sustainability of the Douro region. Simultaneously, the sensibility of each variable upon external shocks was determined. The data was collected performing face-to-face inquiries directly from 50 Douro vine-farms and the Fuzzy Average with Fuzzy Cluster Distribution methodology was used for rank the variables. The results have shown that the labour costs seem to be the most influential variable on the vineyard production followed up by the steepness and terrain orientation. Nonetheless, the familiar labour also gains some prominence when the revenues are selected as the core variable. This study showed that the labour force plays an important role on the grape farm output and due to the current demographic trend in the region, the hand labour availability might be an alarming problem that threatens the sustainability of the Douro.

Keywords: Douro Region, fuzzy cluster distribution, labour influence, population dynamics, sustainable development

JEL classification: J43, Q12, Q19

1. Introduction

Agriculture can be characterized as a very heterogeneous sector, not only regarding the type of productive systems but also concerning the farm structure with expressive regional differences on farm size, topographic conditions, production and incomes (Bogdanov 2014). Simultaneously, there is a substantial contrast among regions in their demography and available hand labour. Within the agriculture umbrella lies the grape production towards wine making, an activity that gets fairly attention worldwide with, Italy, France and Spain capping the frontline of the world production (OIV, 2018). In Portugal, the wine business holds a large position of the agricultural sector, representing by the year 2016, 11% of added-value and providing 8% of employment to the population (INE, 2017).

Even though there were a lot of agricultural improvements during recent years due to the heavy mechanization and technological breakthroughs such activity still requires a fair amount hand labour. In fact, that requirement is even more pronounced in steep mountain viticulture when sometimes the task mechanization is substantially complex and troublesome which increases the hand labour requirements (Moreira and Guedes de Pinho, 2011). Such concern is very prominent in the Douro Demarcated Region (DDR), located in the Northeast of Portugal, where the steep slope vineyards are dominant.

It is also known that the labour market is closely related to the demographic dynamics and in this region there was a substantial reduction with the available labour force above 5%, between 2011 and 2016 (INE, 2017). Such fact is particularly explained with the exodus of the young people towards urban areas (Jan van der Laan, 2016) and also related to the agricultural low wages, leading the available workers to seek better paid activities that simultaneously increase their social prestige (Marta-Costa, 2010). Rebelo (2018) regards this trend as one of the major threats and challenges that the DDR will face in near future. Unfortunately, according to these authors, it is expected that such problem and trend might intensify in the next years with the expectation of a decaying active population of 2.8% for 2021. The lack of active population and following workforce unavailability should over-value the expected salaries or in an extreme scenario the total absence of labour supply and demand agreement. As a core and fundamental variable it is mandatory to address this problem as soon as possible.

Therefore, the labour shortage, nourished by the population dynamics can pose a real threat to the firm's productivity (Hossein et al., 2017). Bogdanov (2014) concluded that the demographic variations among regions may cause significant differences in productivity. So, the long-term depopulation had profound consequences on the agricultural production, leading to land abandonment, the decline of the overall land cultivation and diversification (Bogdanov et al., 2008).

Rebelo (2018) states as an utopic that the DDR wines need to see their overall prices augmented to economically solidify and address the actual concerns. This bold shift could surely allow the producers to pay higher wages and attract workers that otherwise would be unavailable. Other solution may lay on an analogous thought of Gibson and McKenzie (2014) and the New Zealand's Recognised Seasonal Employer (RSE) program. Such program aims to smooth and ease labour shortages on the horticulture and viticulture industries from New Zealand with migration programs from countries with severe unemployment. In this sense, focusing on the vineyards located in southern Italy, Seifert and Valente (2018) found an expressive increase of labour productivity with the 2011 migration wave, motivated by the employment of illegal workers with a significant decrease on the average hourly wages.

The wine sector can present itself as a crucial source of growth and development, contributing to stop the desertification in the rural areas, guaranteeing employment and better living conditions (Jan van der Laan, 2016).

This work aims to determine which are the variables of a grape productive system that have more effect on the farm`s production and revenues and, in this way, realize the real influence of the labour on the business sustainability. The sensibility of these variables upon external changes (such as the rural exodus or migration phenomena's) were also acquainted. To attain further information about the DDR demographic behaviour a time-bounded values were interpolated and a foreseen scenario for 2025 were obtained.

The present study provides the possible effects of labour shortage and the expected demographic changes, which may jeopardize the overall business sustainability. Besides, the results may be used for provide important political insights to solve the actual problem of the sector related with the sparse source of experienced labour. We also suggest an alternative mechanism to mitigate this problem based on temporary or circular migration programs and the labour supply from locations with lower living levels.

2. Data and Methodology

2.1. Surveys' data and methodology

The data was collected by face-to-face surveys of 50 vineyard grape growers in Douro Region applying the survey methodological framework according to Hill and Hill (2002).

The Douro Region has three sub-regions (Cima Corgo, Baixo Corgo and Douro Superior), four urban districts and 21 rural districts. The sample was selected from two rural districts of each sub region, realising a total of six rural districts. This choice was made considering the districts with larger representativeness regarding their total vineyards area. A quota (number of grape growers to be selected) was assembled to each district distributing them into four vineyard class areas to ensure de diversity and heterogeneity of the sample. The considered vineyard class areas were: a) $1 \leq \text{area} < 5$; b) $5 \leq \text{area} < 10$; c) $5 \leq \text{area} < 10$ and d) ≥ 20 ha. The

total sample size was 50, comprising of 16 surveys of the class area a); 17 of the class area b); 12 of the class area c); and 5 of the class area d). The reason why the first classes have a greater number of surveys is related to the small-scale land structure that is predominant in this region.

The variables used for this study are: Production (kg/ha); Revenues (€/ha); Labour costs (€/ha); Familiar Labour (%); Overall Costs (€/ha); Subsidies (€/ha); and the variables linked to the vineyard landscape: Steepness, Training systems which comprises guyot and cordon and Terrain orientation covering walled terraces (socalcos), patamares, vertical planting and plain vineyard. These variables were chosen based on their dominance on the mountain and steep slope Douro productive systems (Magalhães, 2015). Table 1 shows the average of the main variables for a general sample characterization.

Table 1. General information of the inquired sample

Variable	Values[1]
Area (ha)	9,75 ±1,39
Number of plots	4,97 ± 0,46
Production (kg/ha)	5571 ± 339
Revenues (€/ha)	3968 ± 257
Labour costs (€/ha)	3289 ± 287
Familiar Labour (€/ha)	1600 ± 293
Overall Costs (€/ha)	732 ± 64
Subsidies (€/ha)	3575 ± 427

Source: own elaboration

[1] Values are expressed as mean ± SEM (standard error of the mean)

2.2. Cluster methodology

Generally, the cluster analysis refers to a set of tools and methods, which try to subdivide a given dataset *X* into *y* subsets (called clusters). The core idea is to settle a function, which maps each individual point similarity to all the possible clusters (Zadeh, 1965).

The chosen cluster methodology for this study is the Fuzzy c-means clustering algorithm (FCM) developed by Ruspini (1970) and later extended by Dunn (1973) and Bezdek (1981). Lu et al. (2013) states that the FCM algorithm implements the clustering task for a data set by minimizing an objective-function subject to the probabilistic constraint, which accounts that the summation of all the membership degrees of every data point to all clusters must be one.

The classical FCM formulation suits the goals of this study more accurately since the partial membership assumption corroborates this article premise of meshed/ranked results per variable instead of a definitive cluster association typically applied on standard k-means methods. Nonetheless, the problem of this work is not purely an unsupervised problem, the present data structure compiles a well settled structure with dependent and independent variables. The attempts of Hou et al. (2007) and Lin et al. (1995) bundles the FCM approach with similar variable (input-output oriented) environment.

Similarly, to Hou et al. (2007), in this study there is a sample containing *m* data points with a single output variable (production or revenues) and *n* input variables (labour, steepness, terrain orientation, overall costs, training system, familiar labour, subsidies). The input and output data vectors are formed in Equations (1) and (2), respectively, where x_i^j x_i^j represents the *jth* measurement of the input variable x_i (with i=1,2,…,n ; j=1,2,…m).

$$\begin{bmatrix} \mathbf{x}_1 \\ \mathbf{x}_2 \\ \dots \\ \mathbf{x}_n \end{bmatrix} = \begin{bmatrix} x_1^1 & \cdots & x_1^m \\ \vdots & \cdots & \vdots \\ x_n^1 & \cdots & x_n^m \end{bmatrix} \quad (1)$$

Similarly the output vector (2) acquaints that y^j represents the *jth* measurement of the output variable y_j (with j=1,2,…m).

$$\mathbf{y} = [y^1 y^2 \cdots y^m] \tag{2}$$

The goal is to map the relationship between the input and the output variable such as the $x_i - y$ bundle is found (with *i*=1,2,..,*n*). The method of fuzzy curves used by Lin et al. (1995), originally in fuzzy-neural system modelling to settle the initial variable weights, accounts the definition of *m* fuzzy rules bonded to the sampled data (x_i^j, y_j). (x_i^j, y_j) Those fuzzy membership functions for each input variable x_i are Gaussian membership functions centered at x_i^j (Equation 3).

$$\mu_{ij}(x_i) = \exp\left(-\left(\frac{x_i - \bar{x}_i^j}{\sigma}\right).^2\right) \tag{3}$$

While $\bar{x}_i^j$ refers to the center of the membership function, σ σaccounts for the function's width. The result from the produced defuzzification is given in Equation (4).

$$C_i(x_i) = \frac{\sum_{j=1}^{m} y^j \mu_{ij}(x_i)}{\sum_{i=1}^{m} \mu_{ij}(x_i)} \tag{4}$$

The fuzzy-curves are calculated and the variables ranked according to their range. In order to acquaint the sensibility upon external changes, the Jackknife resample method (Rizzo, 2008) is performed in order to obtain 50 new simulations per variable. This method was performed leaving one observation out each time (49 observation) displaying the influence inner variability on the new simulations considering the variable range (maximum influence value minus the minimal influence value). The Jackknife attempts deliver the information about how the featured variable may vary upon new observations. The resampling method should shift the obtained curve (Equation 4) withstanding the information about each variable sensibility upon external shocks. Therefore, the interpretation should rely on the overall obtained range of the newly created 50 fuzzy curves.

With the variables above mentioned, three separated simulations were performed in the open-source R software (version 3.4.1). The selected inputs and output variables for the three simulations are available in Table 2 and the featured R code on Appendix 1.

Table 2: Description of the used variables and their range for the clustering analysis

Variable	Range	Variable description
Production	kg/ha	Average production of each farm per hectare
Revenues	€/ha	Farm overall income
Labour costs	€/ha	Costs with labour per hectare
Familiar Labour	0 to 1	Percentage (%) of familiar labour that each farm owns comparing to their own total labour force
Overall Costs	€/ha	Combines the value spent on electricity, gasoline, taxes, fertilizers and crop protection/pesticides
Subsidies	€/ha	Amount of financial aid that each farm yields
Steepness	1 to 4	Average steepness of each farm
Training system	0 to 1	Value 0 is the % of guyot training system that each farm owns. Value 1 is the percentage of cordon system
Terrain orientation	0 to 2	Value 0 is the plan vineyard landscaping; value 1 the walled terraces and *patamares*; and value 2 the vertical planting

Since the selected variables x_{in} with i=1,2,…9 and m=1,2,…,50 (regarding the 50 observations) acquaint such sparse numerical values, before applying the aforementioned method, they were normalized x_{im}^{n} between 0 and 1 according to Equation 5.

$$x_{im}^{n} = \frac{x_{im} - \min\{x_{im}\}}{\max\{x_{im}\} - \min\{x_{im}\}} \quad (5)$$

3. Results and discussion

Targeting the main goal of gathering information about the labour influence into the core variables of a vineyard productive system such as their production or overall revenues two simulations were made acquainting the dependent variable Production (kg/ha) and Revenues (euro/ha) respectively, while the independent variables remain the same for both simulations. The variables are ordered considering their overall influence on the dependent variable.

The first simulation (Table 3) delivers the labour costs (euro/ha) as the most influential variable from our data-frame followed up by the landscape variables. The straightforward interpretation lays on the fact that those variables are the most influential on the production of the featured 50 farm from the Douro region. In this region, the percentage of the workforce on the total operational costs varies between 70.6% in the mechanized vineyard (patamares) and 93% in traditional non-mechanized vines (Rebelo, 2018). This shows the importance of the labour factor undermined by the rational mechanization of the farm, which should be followed to fulfil the constraints imposed by the registration of the Alto Douro Vinhateiro in the UNESCO Heritage List (Andresen and Rebelo, 2013).

Table 3: Results of simulation 1

Production Simulation			
Rank position	**Variable**	**Influence Level**	**Jackknife Deviation**
1	Labour costs	0.00897	0.00487
2	Steepness	0.00755	0.00165
3	Terrain Orientation	0.00608	0.00083
4	Overall Costs	0.00466	0.00238
5	Training System	0.00375	0.00125
6	Familiar Labour	0.00367	0.00051
7	Subsidies	0.00268	0.00886

Source: own elaboration

The scenario shifts when the dependent variable is the farm revenue (Table 2), since the landscape variables switch places with the labour related one, nonetheless the remaining variables such as the overall costs, subsidies and the chosen training system remain with a peripheral influence on the featured dependent variable. This result is not farfetched at all since it displays the main characteristics highlighted previously on this article (labour intensive and mountain viticulture) that actually burdens the DRD farm production and following revenues.

The family labour is widely used in DDR, due to the large number of small farms, which in turn do not attribute any charge to this type of work. However, considering that the farms usually benefit from both familiar labour and public financial supports, such statement might be a reasonable explanation for the survival of a large number of small farms on this reason (Rebelo, 2018).

The influence levels calculated through the Jackknife methodology are also presented. It is possible observe that in both simulations (Table 3 and 4) the subsidies cap a substantial high value. Therefore, even though that variable doesn't seem to gather that much influence on the 50 featured farms further economic policies (such as lack or cancellation of the current subsidies) may scramble the actual scenario leading the subsidies to influence more positively or negatively the farmer's production/performance. This result corroborates the increasingly dependency on subsidies by the Portuguese agricultural sector with the accession to the European Community fund (Lains, 2016).

Table 4: Results of simulation 2

Revenues Simulation			
Rank position	**Variable**	**Influence Level**	**Jackknife Deviation**
1	Steepness	0.00950	0.00440
2	Terrain Orientation	0.00718	0.00161
3	Familiar Labour	0.00614	0.00208
4	Labour costs	0.00437	0.00152
5	Overall Costs	0.00237	0.00086
6	Training System	0.00211	0.00023
7	Subsidies	0.00149	0.00383

Source: own elaboration

An alternative to the referred dependency is the increase of the selling price of the grapes/wine. Some authors suggested that this bold shift is mandatory to solidify economically the Douro explorations. This audacious step could certainly allow the producers to pay higher wages and get workers easily. In addition, the rise in the price of the wine could lead to an higher income which may allow the farmers to be able to take more risks, as an example the investments in new technologies and innovation (Jan van der Laan, 2016; Rebelo, 2018).

This article highlights the labour force as the main research feature; therefore, we are interested in studying the working environment attributes that actually influences more or less the labour costs. A third simulation was performed, considering the labour costs (euro/ha) as the dependent variable featuring the steepness, the terrain orientation and the selected training system as the independent variable.

The results presented on Table 5 display the steepness as the most influential variable followed by the terrain orientation; the explanation may lay on the fact that those variables can seriously overvalue the labour costs related with the increased task difficulty. The training system remains itself as a substantially innocuous variable over the three simulations highlighting the fact that the decision between guyot and cordon may not be a concern upon the production and revenue levels and labour costs. Nonetheless, this variable may acquire a more meaningful interpretation on a farmer's decision in an expanded timeframe considering the vineyard's lifespan. The Jackknife results also entangle high variability to the most influential variables (the steepness and terrain orientation).

Table 5: Results of simulation 3

Labour Simulation			
Rank position	**Variable**	**Influence Level**	**Jackknife Deviation**
1	Steepness	0.04067	0.00799
2	Terrain Orientation	0.02275	0.00883
3	Training system	0.00608	0.00069

Source: own elaboration

The linear needs of labour consumption for Douro winegrowing are estimated at approximately 14,700 work units per year (AWU) differently distributed in a very asymmetric way throughout the year. For example, a daily requirement of about 19,500 people is estimated for 22 days only for the grape harvesting. Due to the low population density of the Douro wine-growing region and the seasonality of the activity, the labour needs traditionally have been supplied using temporary employment agencies that gather individuals from bordering territories (Rebelo et al., 2018).

With the purpose to attain further information about the Douro demography, Marta-Costa (2018) presented an hypothetical scenario for 2021. In 2011, the Douro had a total resident population of nearly 204 thousand inhabitants, approximately 6% of the North's total but equivalent to a comparing percentage loss of around 7.2 % in to 2001. The downward trend continues in this decade, with the population declining to around 193,000 in 2016. For 2021, Douro will have a population of around 183,000 people in 2025, representing an aggregated decrease of 11% compared to 2011.

In order to attenuate and reverse this trend, political insights are mandatory to create economic opportunities to ensure that the habitants are willing to live and remain in the Douro region.

Lastly, it is recommended that the public organisms encourage the farmer's education and awareness in order to introduce a new sustainability programme inspired by a particular case of the New Zealand's Recognised Seasonal Employer (RSE) program that intend to ease labour shortages, with migration programs from countries with severe unemployment (Gibson and McKenzie, 2014). In this sense, Seifert and Valente (2018) found an expressive increase of labour productivity in Italy with the 2011 migration wave.

4. Conclusions

This article provided a brief introductory endeavour regarding the Portuguese Douro region agricultural landscape, more specifically their grape-growers and wine producers. Supported by the available bibliography we have identified the labour force availability and cost as a key variable to the grape productive system. The FCM methodology was selected in order to rank the labour influence upon other farm variables. The results showed that the labour force plays an important role on the generalized farm output such as their overall production or final revenues. Alongside the previous statement, it was also found that the landscape variables such as the terrain orientation and steepness may also severally influence the output and also the general labour costs. The conclusion gains more relevance when money tangible variables such as the subsidies and overall farm costs (electricity, gas, water) acquire peripheral influence on the farm output. Even though it is well known that the Douro region is haunted by the mountain viticulture increasing difficulties the result overwhelms the fact that those features alongside the labour cost may play a core and important role in this region further survival. The demographic changes and increasing labour costs are quite alarming on such an influential variable.

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Appendix.1

R code

Influence results

```
my_data <- read.table(file = "clipboard",sep = "\t", header=TRUE)
Y <- as.array(my_data[,1])
X <- as.matrix(my_data[,2:ncol(my_data)])
U1 <- matrix(0, nrow(X),ncol(X))
U2 <- c()
for(j in 1:ncol(X)){
  for(i in 1:nrow(X)){
  Rv <- (range(X[,j],na.rm = FALSE))
  R <- Rv[2]-Rv[1]
  U2[i] <- exp(-(X[i,j]-mean(X[,j]))/(R*0.20))
  }
  U1[,j] <- U2
}
C1 <- c()
C2 <- matrix(0, nrow(X),ncol(X))
for(j in 1:ncol(U1)){
for(i in 1:nrow(U1)){
  C1[i] <- (sum(Y[i]*U1[i,j])/sum(U1,j))
}
  C2[,j] <- C1
}
for(i in 1:ncol(C2)){
  print(max(C2[,i])-min(C2[,i]))
}
sort(X[,2], decreasing = FALSE)
plot(X[,2],C1)
```

Jackknife leave one out simulation

```
#jackknife
my_data <- read.table(file = "clipboard",sep = "\t", header=TRUE)
Y <- as.array(my_data[,1])
X <- as.matrix(my_data[,2:ncol(my_data)])
U1 <- matrix(0, nrow(X)-1,ncol(X))
U2 <- c()
Res <-matrix(0, nrow=ncol(X),ncol=50)
C3 <- c()
for(m in 1:50){
  Y1 <- Y[-m]
  X1 <- X[-m,]
  for(j in 1:ncol(X)){
    for(i in 1:nrow(X)-1){
      Rv <- (range(X1[,j],na.rm = FALSE))
      R <- Rv[2]-Rv[1]
      U2[i] <- exp(-(X1[i,j]-mean(X1[,j]))/(R*0.20))
    }
    U1[,j] <- U2
  }
  C1 <- c()
  C2 <- matrix(0, nrow(X)-1,ncol(X))
  for(j in 1:ncol(U1)){
    for(i in 1:nrow(U1)){
      C1[i] <- (sum(Y1[i]*U1[i,j])/sum(U1,j))
    }
    C2[,j] <- C1
  }
  for(i in 1:ncol(C2)){
    C3[i] <- (max(C2[,i])-min(C2[,i]))
  }
  Res[,m] <- C3
}
for(z in 1:nrow(Res)){
  print(max(Res[z,])-min(Res[z,]))
}
```

DEVELOPMENT AND SOLIDARITY ECONOMY STRATEGIES IN BRAZIL: CASE STUDIES

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Abstract

The solidarity economy is guided by the guidelines of sustainable development, presenting the principles of self-management (as a mechanism for valuing freedom), equality between members and the exaltation of solidarity. This article aimed to analyze the development of income generating activities based on solidarity economy strategies, explaining individual and territorial impacts in the State of Amapá, located in the extreme north of Brazil, in order to show the main state development policies adopted. We used a qualitative research, with the selection of four projects for case studies, in order to measure the main advances and challenges that are required in the segment, as well as the impacts of the development policies to the solidarity economy in the projects studied. This study identified the need for restructuring in the formats of management policies of government agencies, which should operate in a harmonious and articulated way, but rather act in isolation and without effective communication between them, impairing the quality and result of the services offered. With regard to the impacts of the solidarity economy for the enterprises, it was verified that the activities investigated achieved financial return, which could be substantially intensified, if there was a better structuring in the development policies.

Keywords: Development, Solidary Economy, Public policy, State of Amapá
JEL classification: R58, L31, I38

1. Introduction

Solidary economy is inserted in a significantly complex and dynamic context, since it appears as a differentiated possibility within a model with exposed fragilities and that tries to make any attempt to change its logic as if it were a foreign body in an organism. The constant crises and disintegrations demonstrated by the capitalist economy are increasingly driving the search for alternatives, either by organized civil society or by the state, as systematizing rules and political actions.

Given the continental nature of the Brazilian territory and the abrupt economic and cultural differences that exist between the regions, the present investigation was delimited in the extreme north of Brazil, specifically in the State of Amapá, which has quite historical and geographical characteristics differentiated and interesting in the national context. Being located within the Brazilian Amazon, and possessing a significantly privileged location in logistic terms, the State of Amapá is bathed by the largest river in the world, in volume of

water and extension, the Amazon, being also cut by the Equator, which allows an equatorial climate, intense sun and periods of heavy rains. It has many riverside communities, settlements that settle on the riverbanks, communities that live on stilts (wooden huts built on the water) and maintained with the natural resources of forests and fishing.

Regarding the objectives, the methodology of this study has two focuses: (i) it has an exploratory character, since it seeks to provide greater familiarity with the research problem, with a view to making it more explicit, involving a bibliographical survey, interviews with people who had practical experiences with the problem researched and analysis of examples that stimulate the understanding (Gil, 2009); (ii) is still explanatory, since it is concerned with identifying the factors that determine or contribute to the occurrence of the phenomena (Gil, 2009). Regarding the second focus, the present research sought to understand the results of the solidarity economy in the daily reality of the associates, and also to understand the impacts of the solidarity economy policy for the appreciated enterprises.

Regarding the approach, the present research is predominantly qualitative, preoccupied with aspects of reality that cannot be quantified, focusing on the understanding and explanation of the dynamics of social relations. It should be noted that in two moments of this research, data analyzes were performed, where previously existing information banks were used.

We chose to use multiple case studies, which according to Gil (2009), jointly study more than one case to investigate a particular phenomenon. They are used to establish comparisons and to test and perfect theories. To select the ventures, we used as a basis the purposively stratified sampling, which is defined by Patton (1990) as the one that focuses on the characteristics of a particular subgroup, to facilitate its comparison with other subgroups, as well as the criteria of case sampling randomly selected, which according to Patton (1990) are more indicated to guarantee reliability to the study.

This article is structured in two parts. The first deals with the themes of sustainable development and solidarity economy, discussing their concepts and conflicts. In the second, the results of the four case studies carried out in enterprises of the solidarity economy in the State of Amapá are presented.

2. Sustainable development and solidarity economy: impasses and challenges

It is perceived that the developmentalist appeal is much more segregated, it excludes, than it attracts social benefits, much more violently than it protects. In this regard, Morin (2000) in *Knowledge in Local and Global Knowledge*, warns that small civilizations with language own wisdom and culture are threatened because they are small and lack the power to defend themselves. Their protection today is very difficult. Protection is not just about making reservations - in zoo design. Protection is not just integration, because it also means disintegration of cultures.

According to Flávia Piovesan (2002), the right to development demands an ethical globalization and solidarity. The development is to be conceived as a process of expanding the real freedoms that people can enjoy, to adopt the design of Amartya Sen. It should be added that the Vienna Declaration of 1993 emphasizes that the right to development as a universal and inalienable right, an integral part of fundamental human rights, and reiterates that this Vienna Declaration recognizes the interdependence between democracy, development and human rights.

According to Singer (2004), the desired development should gradually make the relative strengths of enterprises that do not aim only or mainly to profits and so make it more favorable to the former. When the economy going to have solidarity traits, to be formed by individual enterprises and associated family and self-managed enterprises, and is hegemonic, the direction of technological progress will be another, as will cease to be the product of inter-capitalist competition to aim at the satisfaction of needs considered by the majority to be a priority.

The worldwide disintegration through which capitalism passes, in its neoliberal modality, is a widely discussed and researched reality. Developed countries, with supposed unswerving economies, feel the brunt of such disruption. Indeed, this weight is reflected in different social axes, whether in the financial transactions of the owners of capital, whether in the states, bringing to seek remedial measures to crises, the civil society, who feel the greatest need to

organize and spend services that are no longer assumed by the State. However, this context mainly affects society, which suffers such reflexes in different ways, but above all, by the reduction of its capacity of consumption and by the reduction of the services offered by the State.

2.1. Reflections on sustainable development

According to Guzmán (1998), sustainable development arises to face the ecological crisis, making compatible levels of consumption that meet the needs of all humanity, within ecological limits. The ultimate causes of such crisis are clearly linked to the capitalist process of appropriation of nature.

In this context, several international meetings took place, which resulted in an infinity of scientific reports, carried out by diverse researchers and personalities of different nature. The following table summarizes the main events during the 1990s.

Table 1: Theoretical frameworks for the sustainable development of international organizations (until the 1990s)

Event	Discovery	Nature
Stockholm Conference (1972)	Advanced societies discover the existence of a single world	A first warning of environmental deterioration
Works of the Club of Rome (1972-1974)	It is impossible infinite growth with finite resources (Methodology of synergistic and anti-synergistic interrelations)	First official studies on environmental deterioration Reports (1st and 2nd) Empirical rationale.
Global Report Year 2000 (1980) President Carter	Threat of survival of human life on the planet (it is not extendable to everyone the North way of life)	First diagnosis on the environmental deterioration of the biosphere.
Brundtland Report (1987) World Commission on Environment and Development	Official definition of the concept of Sustainable Development	First discussion of the method to face the ecological crisis.
Rio Conference (1992)	Earth Charter (Agenda 21: 27 points)	Code of Behavior to be Followed in the 21st Century
	Climate Charter (Climate Agreement)	Addressing climate change as a consequence of climate change
Conference on Environment and Development (1992)	Convention on Biodiversity	To act in relation to the increasing occupation by the human species of the habitats of other species.

Source: Guzmán (1998)

The United Nations (UN) resumed in the early 1980s the debate on environmental issues raised by environmental social movements. Norway's Prime Minister Gro Harlem Brundtland led the World Commission on Environment and Development. The commission was created in 1983 after an evaluation of the 10 years of the Stockholm Conference, with the aim of promoting worldwide audiences and producing a formal outcome of the discussions. The final document of these studies was called *Our Common Future* or *Brundtland Report*, which was presented in 1987. The document is an explicit proposal for sustainable development.

According to Guzmán (1998), sharing the definition presented by the Eco 92 Conference, the concept of sustainable development essentially consists of potentializing those development schemes that aim to satisfy the needs of the present generation without compromising the capacity of future generations, to satisfy their own needs, and not the indiscriminate economic growth of the region involved, be it a rural area, a municipality, a country or the biosphere as a whole. The concept stipulated by Eco 92 states the following: It is capable of guaranteeing the needs of future generations.

Almeida (1998) emphasizes many are the contradictions perceived in the discussions that involve sustainable development. A great difficulty lies in the lack of even conceptual

consensus and development principles. Because it has a wide area of scope, the idea of sustainable development is demanding the establishment of much more complex parameters, and because it is a very elastic term, allows to harbor different conceptions of economic growth and the use / management of natural resources, generating doubts not only conceptual, but mainly, concerning the practical implications of that term.

Singer (2004) advances with the notion that solidarity development relies on the same advances in knowledge and its application to human endeavors as capitalist development. But solidarity development proposes a very different use of the productive forces thus achieved: these forces should be made available to all producers in the world, so that no country, region or locality is excluded from its use, and therefore the benefits that will provide.

2.2. Solidarity economy: concepts and differentials

In addressing the origin of the Solidarity Economy (ES), Lechat (2002) emphasizes that in England and the United States several cooperative communities or villages were created in the nineteenth century but failed to last for more than a few years, and numerous experiences of workers 'cooperatives led by the British trade union movement, after several successes and democratic advances, were extinguished by the fierce reaction of the bosses' class and by the government's declared hostility. The most famous cooperative of consumption, the cooperative of the Equitable Pioneers of Rochedale, has established a letter of principles that until today inspires the cooperativism and its legislation at world-wide level.

France Filho (2002) stresses the importance of remembering the fact that it was precisely the associative experiences of the first half of the nineteenth century in Europe - in particular the so-called mutual relief societies - that first conceived the idea of social protection. That is, the embryo, in terms of idea, of the modern conception of solidarity via the redistributive function of the State, as expressed by the state social security system, lies precisely in some social economy practices begun in the first half of the nineteenth century in Europe, which were, however, later appropriated by the State.

According to Laville (1994), solidarity economy is characterized as a set of economic activities whose logic is distinct from both the logic of the capitalist market and the logic of the state. Unlike the capitalist economy, centered on the capital to be accumulated and that works from competitive relations having as objective the attainment of individual interests, the solidary economy organizes itself from human factors, favoring the relations where the social tie is valued through reciprocity and adopts community forms of ownership. It is also distinguished from the state economy which presupposes a central authority and forms of institutional property. But the author warns us that the displacement of these manifestations in time and space - the first manifestation was pre-Keynesian and the present one corresponds to the crisis of the Keynesian compromise - points to the limits of a conceptualization of solidarity economy in terms of third sector.

If the spring that moves the capitalist economy is profit and competition, in solidarity economy logic is different. The main drivers of this economic alternative are solidarity and a spirit of cooperation. Solidarity economy has been gradually expanding, and this expansion represents a "light at the end of the tunnel" amid so much chaos, poverty, inequality and exclusion imposed by capitalism and its mechanisms of perpetuating oppression.

3. Employment of the solidar economy of Amapá State: a studies- case

The Northern Region covers almost half of the Brazilian territory, with the largest extension, which is divided among seven states, home to the largest tropical forest in the world, the Amazon, and between the dense forests and the great rivers a cultural and ethnic immensity is celebrated. The State of Amapá stands out in this context, which stands out for its location in the extreme north of Brazil and still being bathed by the largest river in the world, in water level and end, the Amazon.

Although it still has many riverside communities, peculiar to the reality of the Brazilian Amazon, the State of Amapá has shown a significant population growth, in order to integrate more and more the characteristics of large urban centers. According to the latest census, conducted in 2010 by the Brazilian Institute of Geography and Statistics (IBGE), the population increase was 40.18%, well above the national average of 12.33%, and also of the

North Region, 22, 98%, making up the highest rate of population growth in Brazil. Such growth reflects the economic expectations linked to the State, driven by the creation in the 1990s of the Free Trade Area of Macapa and Santana (State Capital and second largest city in population number, respectively), and also of the implantation of large mining multinationals, which generated broad employment prospects.

It has an estimated population (IBGE, 2014) of 750,912 inhabitants, distributed in 16 municipalities, which together amount to an area of 143,453.7 km², representing 3.70% of the North Region and 1.67% of the entire Brazilian territory. The cities with the largest population in the State are Macapa (Capital), with population estimated at 446,757 inhabitants, Santana, with 110,565 and Laranjal do Jari, with 44,777.

Entrepreneurship is progressively strengthened, in line with the rapidly growing population of the state. In addition to the evolution of entrepreneurship, the solidarity characteristics of traditional communities propel a challenging trend, the solidarity economy, which, as seen in the previous chapter, contrasts the characteristics of traditional capitalist enterprises by bringing as a differential the self-management, solidarity between partners and the concern with natural resources.

This article will analyze four enterprises of the economy of solidarity of the State of Amapá, seeking to understand the main advances and challenges to be faced, as well as the public policies developed by the development agencies. It is necessary, for a better understanding of the dynamics of the insertion of the enterprises, a brief analysis on the State. The policy of fostering solidarity economy is officially developed in the State of Amapá through the Secretariat of Labor and Entrepreneurship (SETE) and the Regional Superintendence of Labor and Employment (SRTE / AP), being monitored and systematized by the Amapaense of Solidarity Economy Forum (FAES).

3.1. Promotion of solidarity economy in Amapá

Within the State, the State Secretariat for Labor and Entrepreneurship has the mission of formulating, coordinating and implementing public employment, labor and income policies, aiming at the productive insertion of people of economically active age, prioritizing the demand for greater social vulnerability, seeking to improve the quality of life of the population of the State of Amapá and value the workforce. Among the different focuses of action is the solidarity economy, which is treated and fostered by a specific nucleus for this purpose.

The Nucleus of Associativism and Solidarity Economy (NAES), linked to the Secretariat, has the purpose of disseminating the culture of associativism and cooperativism as an entrepreneurial alternative for the generation of jobs and income, and to stimulate the organization of entities through institutional support. It provides the technical support and enables the training of cooperatives and associations, stimulating the expansion of associative experiences of a productive character.

Another important institution supporting solidarity economy in Amapá is the Regional Superintendence of Labor and Employment (SRTE / AP), which is a federal body linked to the Ministry of Labor and Employment (MTE), whose mission is to ensure compliance with legislation labor, and public policies for employment, work and income, through the following programs: Intermediation and Employee Qualification, First Employment, Employee Labor and Social Security Issuance (CTPS), Unemployment Insurance, and to foster Solidarity Economy, with a view to the development and well-being of the citizen.

It is verified that the solidarity economy has a specific program in the SRTE / AP, counting with own resources for the development of its actions. The policy is coordinated by the Nucleus of Solidarity Economy (NES), which is in the organizational structure of the Superintendency.

The Amapaense Forum of Solidarity Economy (FAES) functions as a representation of the National Forum of Solidary Economy. It has three representatives in Amapá, who are militants of social movements inserted in the solidarity economy and have undergone training of managers in Solidary Economy. According to Santos (2017), in an interview with representatives of the Forum, they point out that the greatest difficulties faced for the development of public policy aimed at strengthening the Solidarity Economy, refers to the

lack of training of managers. They point out that lately the Solidary Economic Developments (EES) have been training constantly in the ES area, are politicized, and the management has difficulty participating in these capacities, vacancies are offered, but there is no interest, this implies the execution of public policies. Sometimes they even have access to resources and can not execute or execute in a wrong way, because they do not know or identify the demands of ES in the state, as has happened in Amapá with the last resources destined for this purpose.

Solidarity economy advanced significantly in Amapá. However, it can be seen that the development of entrepreneurship is still insufficient given the needs and difficulties presented, which could be minimized through various actions by the managers of the solidarity economy policy, some of them with low complexity and also low energy expenditures, such as the feasibility of dialogue and integration among the different bodies / entities that work with the solidarity economy. Next, we will discuss specific cases of amapaenses enterprises, through four case studies focused on different areas and specificities, in order to reach a broader analysis on the reality of the solidarity economy in the State, and its impacts on daily life of entrepreneurs.

3.2. Solidarity ventures: studies-case

This item returns to the central objective of this article, to understand the main advances and challenges experienced by the enterprises of the solidarity economy and the development policies, through multiple case studies. We sought to analyze different economic niches, focusing, then, on the reuse of solid waste, food, extractivism and processing of açaí and handicrafts. Among the selected projects, one of them is located in the city of Macapa, Macapa Solid Waste Collectors Association (ACAM), one has its headquarters in the Maruanum community, the Maruanum Louranas Women Association (ALOMA), and two others are located in the municipality of Laranjal do Jari, the Association of Açaí Extractivists of the States of Amapá and Para (ATEAEPA) and the Association of Agroextractivist Women of Alto Cajari (AMAC). To reach the information, entrepreneurs from the four segments were interviewed, as detailed in table 2, presented below.

Table 2: Demonstration of the research target population

Population	Target Audience	Market niche	Amount
Association of Waste Collectors	President and Associates	Solid wastes	05
Association of Cajari Women	President and Associates	Food	05
Association of Açaí Extractors of Pará and Amapá	President and Associates	Extractivism / Food	05
Association of Maruanum Craftsmen	President and Associates	Craft	05

Source: Prepared by the authors

Table 3 below summarizes the main results of the case studies proposed in this study, with the Economic Research Solidarity Projects (ERS) surveyed, the number of members, time of the project, its main characteristics, incentives received by the State, advances and challenges.

Table 3: Solidarity economic enterprises surveyed.

ERS	Characteristics	Fomentos received from the State	Advances	Challenges
ACAM 70 partners / 20 years	Performance: Solid Waste 36 women and 34 men Age range from 19 to 68 years Average income of R $ 788.00	There was no investment in the association in recent years Follow-up by the Amapaense of Solidarity Economy Forum (FAES) Development Agencies: Environment Secretariat (SEMA) and FAES	FAES has been systematically monitoring the activities of the Documentation update There has been an awareness that the methodology and results of selective collection can be advanced Learn teamwork and increase organization	Not covered by any social security benefits The associates seek help to build a seat outside the landfill so they have more freedom Complain about working conditions and lack of respect for the company that controls the landfill
AMAC 240 partners / 16 years	Performance: Food (processing of Brazil nuts) Age range from 18 to 37 years Average income of R $ 1,200.00	Industrial kitchen and equipment made possible by the State Government Qualification courses were held in business management, customer service and food handling No investment has been made in the Association in the last 24 months	Organization of communal kitchen Documentation update There has been an awareness that the methodology and results of selective collection can be advanced Learn teamwork and increase organization Satisfaction brought to the members by the integration and harmony of the group Have a social benefit, such as licenses and referral to social security	Lack of packaging certification by the Sanitary Surveillance Agency (ANVISA) Need for modernization and acquisition of some machines
ATEAEPA 50 partners / 19 years	Performance: Food (extraction and processing of açaí) Age range of 46-69 years Average income of R $ 1,500.00	Amazon Açaí Project Implanted in 2006 by SETE No investment has been made in the Association in the last 24 months	The Açaí Project of the Amazon brought integration and qualification to the associates	They do not have any social benefits, such as licenses or social security Lack of follow-up and promotion of the State Lack of training for members There is a need to improve the organization of the Association It is necessary to widen the integration between the partners It is important to improve the work environment (the açaí mixers)
ALOMA 12 partners / 30 years	Acting: Handicraft in clay Age range of 40-74 years Average income of R $ 700.00	There was an incentive for the construction of exhibiting tables for the Association, provided by SETE Partnership with Craftsman's House, linked to SETE for the commercialization of ceramics and transport No investment has been made in the Association in the last 24 months	Marketing house of Maruanum Participation of regional, national and international handicraft fairs The integration of the group is something salutary The ceramics achieved visibility and recognition throughout the State of Amapá and in many other states	They do not have any social benefits, such as licenses or social security They present difficulties for the extraction of the caripé (vegetation that is joined to the clay) They present difficulties in getting transportation for the exhibition of ceramics at fairs Association management needs to be more active Decrease of SETE's activities with the venture

Source: Prepared by the authors

The following is a summary analysis of the results of each research project.

3.2.1. Study-Case 1: Association of Waste Collectors

The scarce public and private investment in infrastructure in the State of Amapá results in a series of urban problems. The issue of disposal of solid waste is one of the serious problems. In the last 10 years, the problem has increased with the emergence of a "dump" that has been installed in the northern area of Macapa, with the consent of municipal public service managers in that area, as shown in figure 1.

The Solid Waste Collectors Association of Macapa was founded on May 2, 1997, and has as its president presently a taster who has been working in this function since 1993. The Association's headquarters is a modest masonry construction located inside the space where the landfill is operationalized. The Headquarters has four small compartments, it is not towed, and currently it houses a scavenger that is of the municipality of Tartarugalzinho (far from Macapa about 3h20min) and returns to its house every 15 days, since this worker does not have where to stay in Macapa, to act as taster.

Figure 1: Macapá controlled landfill cell (2014)

Source: FAES Archive

In the operating space of the company, the landfill and the Association there is also a shed built to carry out the sorting of the waste that is brought by the garbage trucks. However, such a shed is not in operation, and the waste is dumped into what the company calls cells. In the system of planned operation, after the discharge of the garbage trucks into the cells, the collectors would collect, and only later, the area would be covered by landfill to be scattered by tractors, but in reality the actions occur simultaneously.

In the interviews the collectors were unanimous in pointing out the difficulties faced for the collection. They claim that they do not have enough time to collect the waste, and after the arrival of the trucks and the disposal of the material, the machine operators do not have time to collect the waste.

Regarding the results of the management, the president emphasized that there is no remuneration or division of resources in the Association because each partner carries out the commercialization of the collected waste, also affirming that the income obtained by the activity, in general, is the main source of income for members. The income obtained from the activity is insufficient even to pay the expenses, this being an affirmation of the president of the association and the response of great part of the collectors interviewed in the research. According to the president, the average monthly income of the Association is R $ 34,000.00 (thirty and forty thousand reais), and the average monthly income declared by the collectors is 1 to 2 minimum wages.

When asked the president of the association about the main achievement achieved by the association, he mentioned that the approach and orientation of the Amapaense Forum of Solidarity Economy (FAES) was the greatest achievement achieved. And when asked about

the main challenges of ACAM, the president emphasized the need for the company responsible for the landfill to respect the space and the role of the collectors, saying that this is a great difficulty to advance the activities. When asked about what solidarity economy has changed in his life, the president emphasized the satisfaction with the possibility of knowledge, the maturation of experience, and the clarification of the concepts and ideals of solidarity economy.

It should be noted that although the scavengers are inserted in a significantly unfavorable social dynamic, which was highlighted by the results of the presented socioeconomic profile, it should be noted that the activity presents financial results for the members, in order to cover the expenses of the majority of the interviewees (expenses incurred for other purposes, not in function or form of investment in the enterprise). This leads to the understanding that the activity has been positive for the partners, since the investment in the venture is minimal, requiring only the acquisition of security equipment by each partner, and payment of the Association's monthly fee, with the small financial return, in some cases, insufficient, but for the great majority, positive. Besides the purely financial analysis, it is also necessary to highlight the satisfaction and the identification of the collectors with the activity, as well as the identification with the group in which they are inserted. The collectors interviewed emphasized the satisfaction with the maturing of the knowledge about the ideals of the solidarity economy, and with the integration of the group.

3.2.2. Study-Case 2: Cajari Women's Association

The Association of Agroextractivist Women of Cajari (AMAC) is being organized on the initiative of women from the reserve and women from nearby localities, who through meetings have integrated and discussed the importance of the union, mainly because they live in an isolated area . The Association is located in the Extractivist Reserve (RESEX Cajari), which was created for the sustainable use of local populations and meant the reaffirmation, construction and development of a set of social, economic and cultural relations that relate to each other and to the environment around them, thus producing a unique way of life. Ribeiro and Filocreão (2013), emphasize that the main economic activity in this region is the Brazil nut tree extractivism, with agriculture and livestock being considered complementary subsistence activities.

The main activity of the associates is the production of cookies, homemade chocolates, pies, sweets, cakes and brazil nut bread. Food products are sold along with some agricultural products made by women such as sweet potatoes, purple, oranges, bananas and brazil nuts, peeled and peeled. There are two types of production of the nut products, first the individual production that is sold at the fair, and the large-scale production carried out in AMAC's kitchen, developed since 2010, with the projects of National Supply Company (CONAB), for through the Food Acquisition Program (PAA), in which CONAB purchases the association's products to make donations feasible for people in situations of food and nutritional insecurity.

The marketing is done individually by each associate, but it is expected to be able to do the marketing collectively, in a way that favors all associates, including for the purpose of improving their living conditions. Sales can be promoted directly in the trade, fairs or schools, as a source of school meals. In the industrial kitchen of the AMAC currently work the 104 women, who develop activities are divided into smaller groups and take turns using the kitchen during the production period. They arrive in the kitchen at seven o'clock in the morning, and leave at five o'clock in the afternoon.

Unlike the other enterprises analyzed by this research, the AMAC guides the associated women in relation to the social benefits, such as maternity leave, and social security, benefits guaranteed by Brazilian Social Security, in a differentiated regime for rural workers. The AMAC grants the associates the necessary declarations for the entry of the application for maternity, retirement and other benefits that a worker can access.

With regard to the challenges surrounding the Association, the president stressed the need to modernize and purchase some machines in order to increase production, such as a drying equipment for the nut, which is still made in a traditional way, as well as extraction of the chestnut oil, which is not yet used by AMAC. The president emphasized that the Association has some activities that have a very outdated methodology, such as the peeling of the chestnut

manually by the associates, which is still carried out individually, demanding a lot of work time.

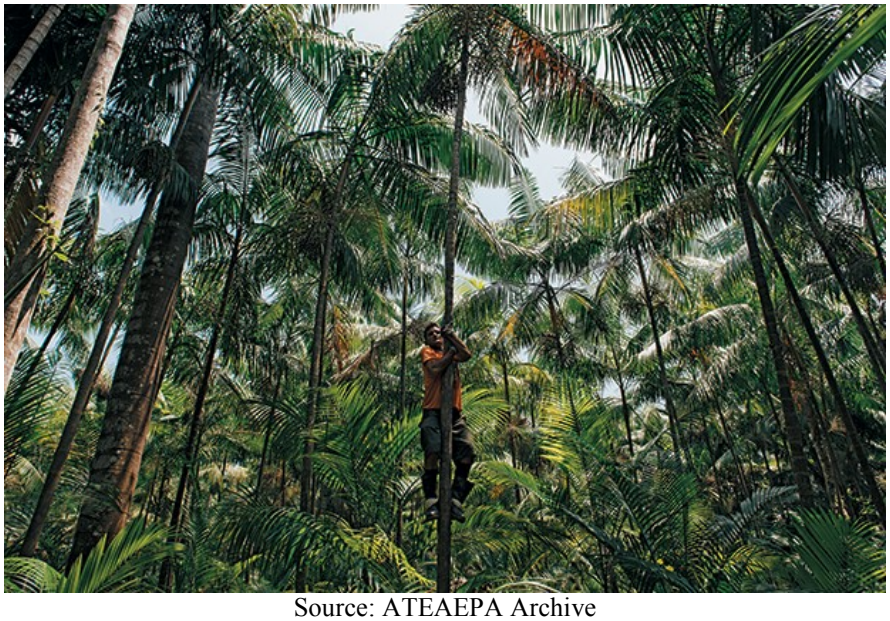
3.2.3. Study-Case 3: Association of Açaí Extractors from Pará and Amapá

The extraction of the açaí stands out due to the high consumption of the fruit by the riverside communities, and especially of the states of Amapá and Pará in the form of pulp, being the main food of the families in a certain period of the year. The commercialization of the fruit is done through the middlemen to the domestic market and to other states.

In addition to the fruit of the açaí palm tree, the palm tree still stands out for the use of the palm heart, which is widely consumed and commercialized in the region. Açaí's derivatives, especially açaí wine, which until recently were typical delicacies of the North Region, due to their different nutritional properties, began to gain space in the national and international market, integrating the role of diets indicated by renowned nutritionists , and the gymnasium menu, as a energizing and pleasant product.

The açaí palm tree derivatives are part of an important Local Productive Arrangement (APL) for the State of Amapá, focused on export and domestic consumption, which requires policies of articulation of production stages in terms of production technology and technical assistance, disposal, storage and industrialization, in the molds required by international certifications, access to markets, marketing promotion, management and marketing. The fruit is withdrawn manually, as shown in figure 2.

Figure 2: Withdrawal of the açaí



Source: ATEAEPA Archive

The Açaí Extractivists Association of Para and Amapá (ATEAEPA) is located in the southernmost part of the State of Amapá, in the municipality of Laranjal do Jari. The Association deals with the extraction and processing of the pulp of the açaí, fruit very appreciated in the diet of the region. ATEAEPA's activities were stimulated by SETE, through the development of the Açaí Project of the Amazon in 2006, which aimed to structure and streamline the production of açaí pulp in the municipality of Laranjal do Jari, in partnership with the Association.

According to the President, the Association had access to professional qualification, political training and self-management, as well as advice for formalization by SETE, actions taken during the implementation period of the Açaí Project of the Amazon. However, in the last two years the Association has not undergone any similar follow-up or action, and also does not undergo any external evaluation.

When asked about what could be improved in relation to the promotion provided by governmental entities, the president stressed that the Association has not received support currently, nor monitoring by the State, and that such support could improve the activities of the entity. When asked about the main achievements of the Association, the president and the partners interviewed emphasized the acquisition of an area for the operation of the entity in an

urban area, as well as the acquisition of vehicles, made possible by the improvements achieved through the Açaí Project of the Amazon.

Given the potential and importance of the production of açaí pulp to the municipality of Laranjal do Jari, as well as the feasibility demonstrated with the actions already undertaken by the State, the closure of the state development ratifies the lack of preparation and concern for local development, which certainly goes against the discourse of equality and emancipation of the less advanced enterprises, besides being a retrocession for the policy of strengthening the solidarity economy, whose municipality of Laranjal do Jari had already been a reference.

3.2.4. Study-Case 4: Maruanum Craftsmen Women's Association

The Maruanum District is part of the city of Macapa, capital of the State of Amapá, and is a community composed of more than ten villages, or communities, spread along the Maruanum River. The population is composed of descendants of indigenous people who lived there in the past, and descendants of blacks in situations of slavery, brought to the State in the 18th century for the construction of the Fortress of San José de Macapá and who fled because of bad treatment, seeking refuge in distant lands (Mafra, 2003).

The ceramics of the women of the Maruanum, as they are popularly known, are not only a beautiful and important form of cultural expression, they represent the viability of the solidarity economy in the State of Amapá, through the valorisation of knowledge, the encouragement of cooperation, concern and respect for the environment, and the possibility of self-management by traditional communities.

The process of making the ceramics obeys a unique ritual, being totally handmade and giving rise to various forms, such as pots, pots, shapes, plates, ovens, pots, stoves, jugs, among others, as seen in figures 3 and 4. It is denominated, it was ritual because of the existence of a complete set of techniques, religious considerations, and offerings dedicated to the legendary institutions in the process of creation (Mafra, 2003).

Figure 3: Craftsman in activity

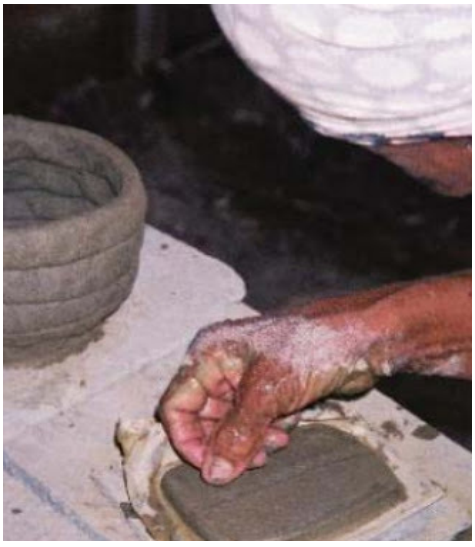


Figure 4: Ceramics

Source: Tamires Kopp

The marketing of the dishes is done individually by each person, each one is responsible for selling their ceramics, so that there is no division of resources by the Association, making it difficult to evaluate the amount collected annually or monthly. Two interviewees emphasized that the Association does not plan or evaluate the activities of the Maruanum Louran Women Association (ALOMA).

When questioned about the results of the activity, the artisans emphasized that the income achieved with the commercialization of handicrafts is the main source of funds of the members, and the four associates, as well as the president of the Association, stated that the income obtained by the activity is sufficient to pay the debts, without, however, leaving any leftovers.

Regarding the achievements of the Association, the artisans interviewed pointed out the marketing house in the Maruanum, made possible by the Municipality of Macapa, as well as

participation in national and international fairs, with the assistance of the State Government. With regard to the challenges to be faced by ALOMA, the insiders emphasize that the current management needs to be more participatory and active, in order to make the activities more dynamic.

4. Conclusions

The solidarity economy has grown in Brazil in different perspectives. From the social point of view, one can see an increase in the number of undertakings that compose the sector, and also the elevation of clarification regarding the theoretical and ideological context in which these are inserted, since many were inserted in the solidarity economy, without knowing exactly the meaning and nuance differences in comparison to the traditional capitalist economy.

Policies to foster the solidarity economy run counter to a common problem with other public policies, the lack of articulation and integration among them, often driven by communication problems and political unpreparedness of public leaders. It was clear in this research that the organs of promotion to the solidarity economy sometimes work in a disjointed way, and the policies are linked to each management mandate. It was observed that, in many development agencies, the exchange of the governors represents a hindrance to the continuity of actions, whether due to the exchange of personnel peculiar to the exchange of government or lack of interest in the use of previous plans, as if each manager had an interest in "making his mark" and breaking with the work prior to his inauguration. Such behavior and reality result in great social losses, since it makes stagnation feasible, and in some cases, a reversal in the course and evolution of politics.

Studies of entrepreneurship have shown that solidarity economy is a viable and emancipatory alternative, but needs to be better understood and fostered by the state. Their differentials and values, need to be strengthened every day, because in them they emphasize the otherness, that seeks the respect for the other, favoring the tolerance to the differences; hope, which enables persistence, even in the midst of the most obscure difficulties imposed by life; the solidarity that allows the loosening of the knot tied by the spirit of competition, and the awakening of many other symbolically remarkable values.

Acknowledgments

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BDI's CORRELATION WITH LEADING ECONOMIC INDICATORS

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Abstract
The aim of this paper is to investigate the correlation between the Baltic Dry Index (BDI) and certain leading economic indicators. We follow a different path than the existing literature follows. In particular, using a multi-linear regression method and defining the BDI index as a dependent variable, we seek to determine the multiple relations of the independent variables regarding the BDI value. We are looking at whether the BDI is a representative indicator not only for the shipping industry itself, but also for the whole economic and financial environment in which the shipping industry operates.
Keywords: Transportation Economics, General Financial Markets, Financial Securities
JEL classification: R4, R42, G1

1. Introduction

The Baltic Dry Index (BDI) receives daily prices from the Baltic Stock Exchange in London, providing valuation of maritime freight rates regarding the major raw materials. For the purpose of this calculation, 26 sea routes are counted, measured with timetables and distances. It covers Dry Bulk Handymax, Panamax and Capesize, which transport major bulk commodities. BDI indirectly measures global supply and demand for goods that are imported/exported to international markets with bulk carriers being, at the same time, negotiated between ship-owners and charterers. The index, regardless of whether it is accurately representative for specific routes, cargoes and ship types, contributes decisively to a widely accepted 'benchmark' freight rate in the shipping market.

There have been efforts in the literature to connect the higher / lower demand for raw materials with a systematic fluctuation of various economic and/or production indices. Evidently, one expects to see some positive correlation between an increase in global demand for commodities and higher freight rates in case that globalization increases. However, time and accuracy is of the essence. Haralambides (2015) observes the high correlation between the Goldman Sachs Commodity Index (GSCI) and the BDI, arguing that the latter seems to be a leading indicator of economic activity. Putting it differently, he proposes that not only freight rates are good leading indicators of oncoming recessions but also commodity markets may shape the view of shipping developments and expectations.

In this context, a positive relation between commodities seaborne trade, raw material production and pace of economic growth has been confirmed by Radelet and Sachs (1998), Stopford (2009), Klovland (2004), Ruan et al. (2016) and Kilian (2009). A positive correlation between economic growth and stock market performance has been also confirmed by Levine and Zervos (1996), Liu et al. (2010) and Antonios (2010). Alizadeh and Muradoglu (2010) and Bakshi, Panayotov and Skoulakis (2011), look at the positive relation between freight rates and stock market performance. Bildiricu et al (2015) offer evidence that BDI can be used for an indicator of a crisis in GDP growth for the US in particular, while Bashi et al (2011) confirm that BDI exhibits a positive and statistically significant relation to subsequent global stock returns, commodity returns and industrial production growth.

On another note, Fernando (2009) argues that shipping rates are lousy for predicting the economy and the direction of the stock market in particular. Pelagidis and Pantazis (2017) investigate the importance of certain financial indicators to stock performance of specific companies. Rothfeder (2016) also notes that economists have had difficulty recalibrating the

BDI to reflect the vessel imbalance provoked by China shipyards' tremendous increase in productivity during 2010-13 and, so, their confidence in the index's predictive abilities waned. Chen (2014) notes the illusory connection between the Baltic Dry Index and stock prices, while FRBD (2010) stretches the importance of a careful and holistic evaluation of all evidence when offering analysis or predicting future trends especially on producers' price index, based on BDI fluctuations.

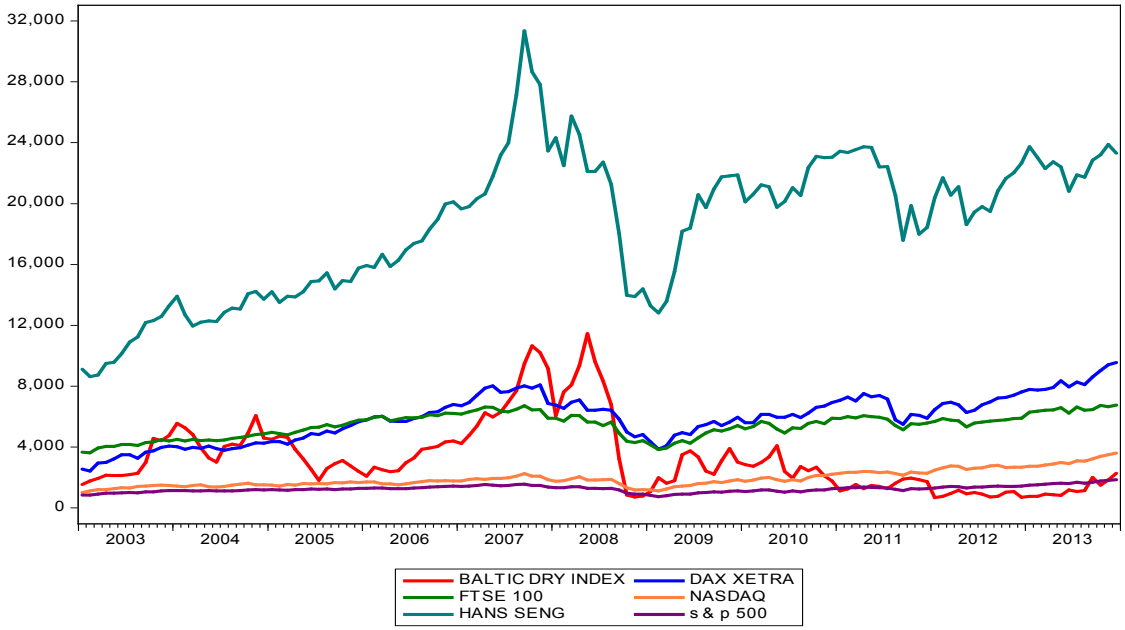
In this paper, we follow a slightly different path looking at the correlation of BDI with various economic indices. In particular, we, inversely, attempt to examine the main economic factors having an impact on the freight rate as freight rates are affected by many factors. In particular, using a multi-linear regression method and defining the BDI index as a dependent variable, we seek to determine the multiple relations of the independent variables regarding the BDI value. We take as independent variables various economic and maritime indices. Taking monthly values for the period 2003-2013, we construct four linear equations and using the OLS method we determine the variables' estimators. We finally compare actual prices for the critical period 1/2011 to 12/2013 –critical as it involves the boom 2003-2007, the bust 2007-08 and the immediate after bust 2010-13 periods - with the forecast prices of our model, using data derived by Bloomberg, Yahoo Finance and Clarkson.

2. BDI'S correlation with financial indicators

In the first model we examine the relationship between the BDI and the main stock market indices such as Nasdaq, S&P500, XetraxDax, HangSeng and FTSE100. The data that used cover the period between January 2003 to December 2013.

Below is a graphical representation of all variables.

Graph (1)



All variables follow the same trend, excluding the period 2004-2007, in which case BDI has a downward trend, while the indices rise. We also note that during the crisis period 2008-2009 all indicators have downward trend.

Using the OLS method for linear regression, the following equation is derived:

BDI = -568,55+-0,85*DAXXETRA - 3.68*FTSE100 + 0.74*HANSSENG - 6.57 *NASDAQ + 22.19*SP500

The BDI is affected either positively or negatively by the above stock markets indices. The HangSeng and S&P500 indices are the ones that have a positive relationship with our dependent variable, representing China and the US respectively, the two largest economies in the global economy.

An assumed 1% increase in the Nasdaq, Daxxetra and FTSE100 indices causes the BDI to fall by 6.57%, 0.85% and 3.68% respectively, while a corresponding increase in the Hangseng and S&P500 indices increases the index by 0.74% and 22.19% respectively.

Below are linear regression in detail.

Dependent Variable: BDI
Method: Least Squares
Sample: 2003M01 2013M12
Included observations: 132
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DAXXETRA	-0.858299	0.287513	-2.985255	0.0034
FTSE100	-3.684542	0.519429	-7.093453	0.0000
HANSSENG	0.741065	0.063755	11.62360	0.0000
NASDAQ	-6.575465	0.492765	-13.34401	0.0000
SP500	22.19539	1.641540	13.52108	0.0000
C	-568.5484	965.5706	-0.588821	0.5570

R-squared	0.777207	Mean dependent var	3274.492
Adjusted R-squared	0.768366	S.D. dependent var	2368.643
S.E. of regression	1139.990	Akaike info criterion	16.95982
Sum squared resid	1.64E+08	Schwarz criterion	17.09085
Log likelihood	-1113.348	Hannan-Quinn criter.	17.01306
F-statistic	87.90935		
Prob(F-statistic)	0.000000	Wald F-statistic	66.26242
Prob(Wald F-statistic)	0.000000		

We observe that all probabilities from t-statistic are less than 0.05 level of significance indicating that all variables, independently, are related to the dependent variable.

The probability from F-statistic is less than 5%, which indicates that all the independent variables together affect the dependent variable. Adjusted R2 is very close to the unit as its value is 0.768, indicating that the BDI variability is interpreted by 76.8% of the model.

However, in order for our model to be valid, we must ensure the absence of heteroskedasticity and autocorrelation and that residuals follow a normal distribution.

HETEROSKEDASTICITY TEST

Below, our model is tested for heteroskedasticity by applying the White test.

Heteroskedasticity Test: White

F-statistic	1.572252	Prob. F(20,111)	0.0723
Obs*R-squared	29.13927	Prob. Chi-Square(20)	0.0851

The probability value is greater than the probability value for significance level $\alpha = 0.05$, therefore our model is controlled for heteroskedasticity.

AUTOCORRELATION OR SERIAL CORRELATION TEST

We test our model for autocorrelation by applying the Breusch-Godfrey Serial Correlation LM Test.

Breusch-Godfrey Serial Correlation LM Test:

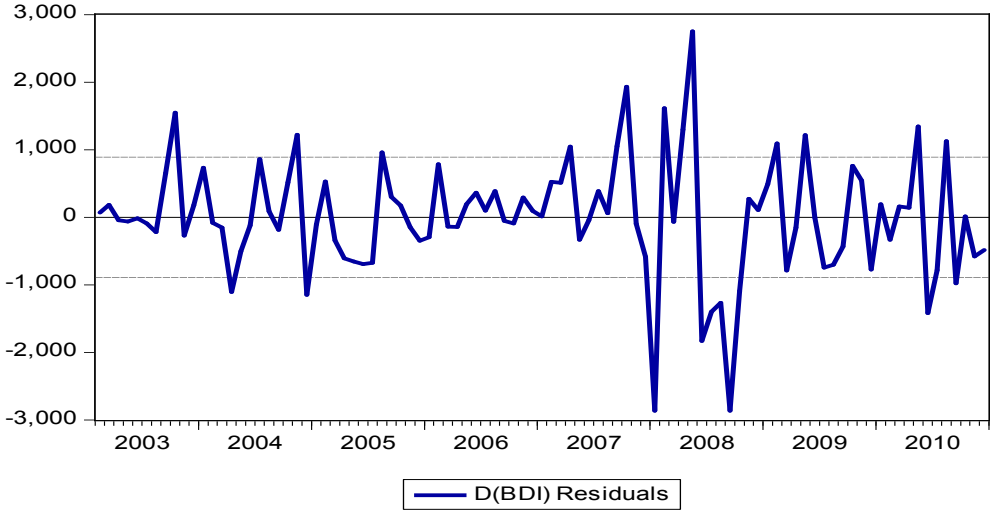
F-statistic	2.185962	Prob. F(2,123)	0.1167
Obs*R-squared	4.496454	Prob. Chi-Square(2)	0.1056

We take into consideration the Obs * R-squared value with probability 10.5%, therefore our model is also controlled for autocorrelation as p-value is greater than 5%.

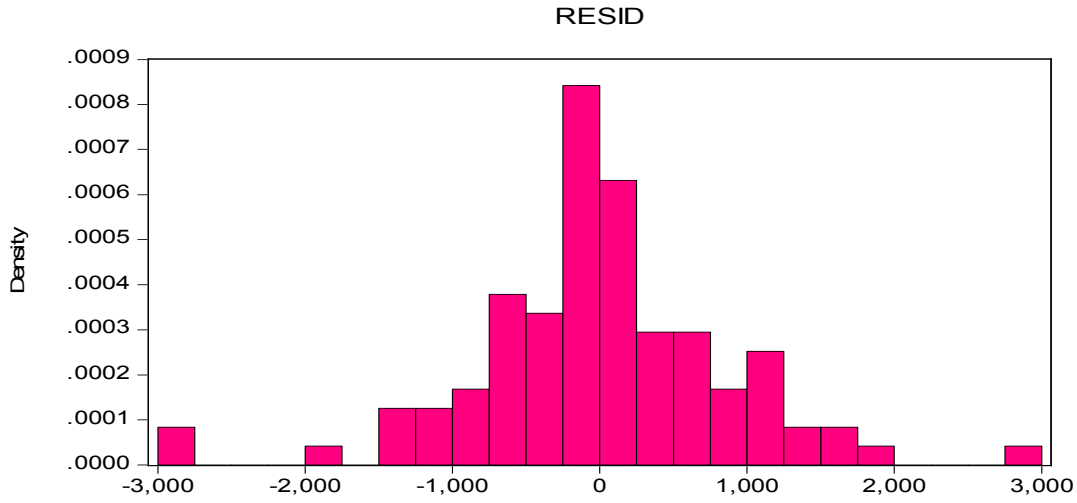
NORMAL DISTRIBUTION OF RESIDUALS

Below is a graph of the residuals of our model. As seen from the graphs (3) and (4) residuals follow a normal distribution, meaning that our model is valid.

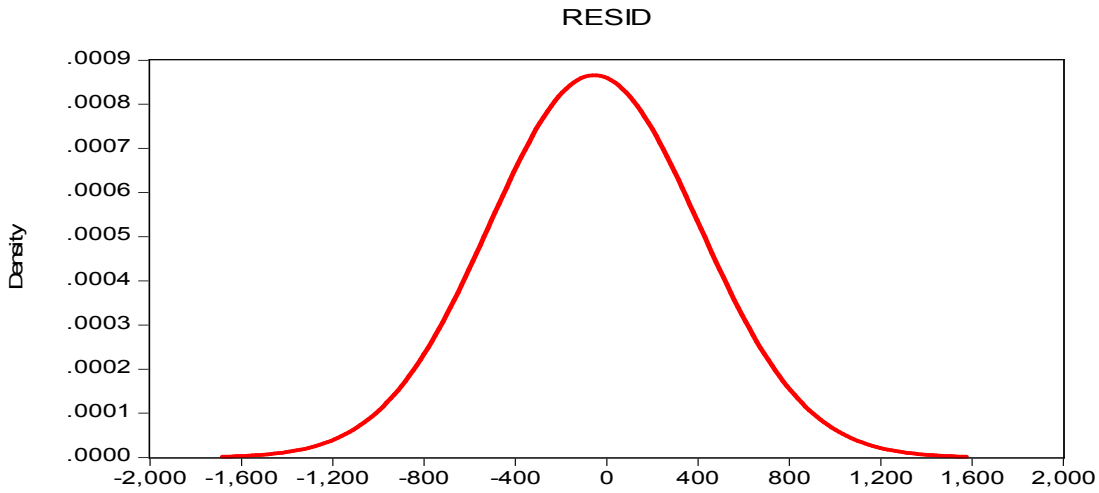
Graph (2)



Graph (3)



Graph (4)



UNIT ROOT TESTING

We also perform a stationarity check. The following table shows the results of a unit root control with the Augmented Dickey-Fuller (ADF) method for our variables.

VARIABLES	t-statistic*	Probability**	Test Result
Daxxetra	**-1.014239**	**0.7470**	Unit Root
Hansseng	**-2.073623**	**0.2557**	Unit Root
Ftse100	**-1.862637**	**0.3490**	Unit Root
Nasdaq	**0.657438**	**0.9908**	Unit Root
Sp500	**-0.485882**	**0.8892**	Unit Root

*t-statistic: Critical Value=-3.45 at 5% significance level

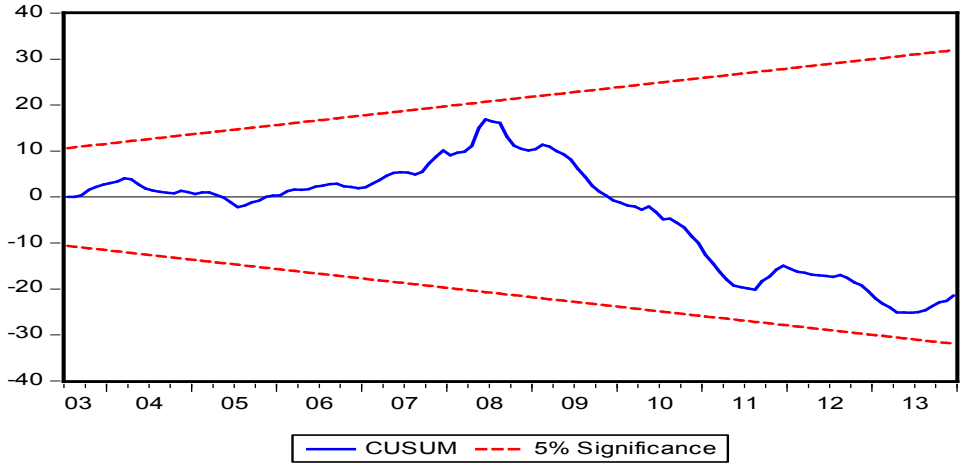
**MacKinnon(1996) one-sided p-values

In all variables, the probability level is more than 5%, so our model is stationary.

STABILITY TEST

Below we check whether our model has stability or otherwise if our dependent variable has stability. With the help of COSUM test we produce the following graph. We notice that our dependent variable is within the significance level of 0.05. So our model is stable.

Graph (5)

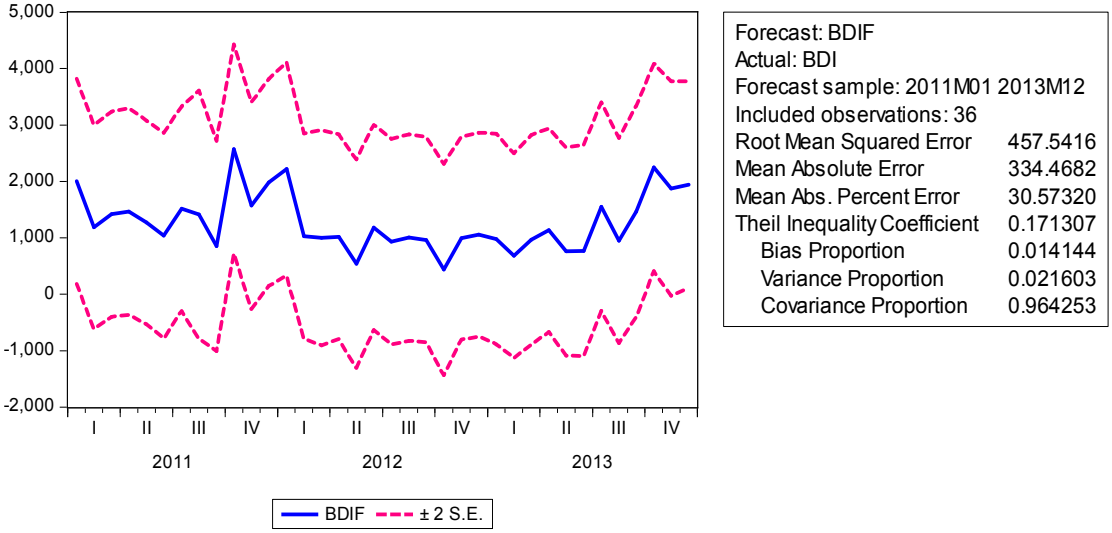


STATIC FORECASTING

In order for a model to be valid, it should be able to forecast. As soon as we have completed the stability test, using our data from 1/2003 to 12th / 2010, we attempt to make a forecast for the period 1/2011 to 12/2013.

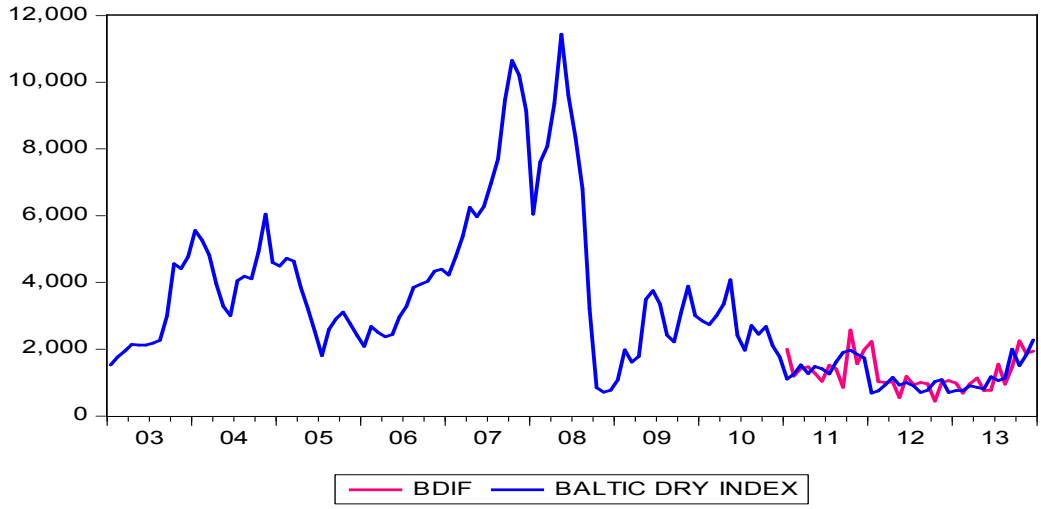
In the chart below, we notice that BDI values for the period 1/2011 to 12/2013 ranges within the 95% confidence interval.

Graph (6)



The following chart shows the actual values of our dependent Baltic Dry Index and the values we predicted for the period 1/2011 to 12th / 2013 (BDIF). As we observe, the predicted values are very close to the actual values of our dependent variable. Therefore, the predictability of our model is quite satisfactory.

Graph (7)



2.1. DISCUSSION OF THE RESULTS

Our model demonstrates that the BDI is affected by the main stock market indices, which reflect to an extent the world market economy. The index is positively influenced by the HangSeng and S&P500 indices, representing the two largest economies in the world, China and the US respectively, while negatively affected by the Nasdaq, Daxxetra and FTSE100 indices. The S&P500 represents the world's 500 heaviest industries, which also justifies the greater positive effect it has on the BDI.

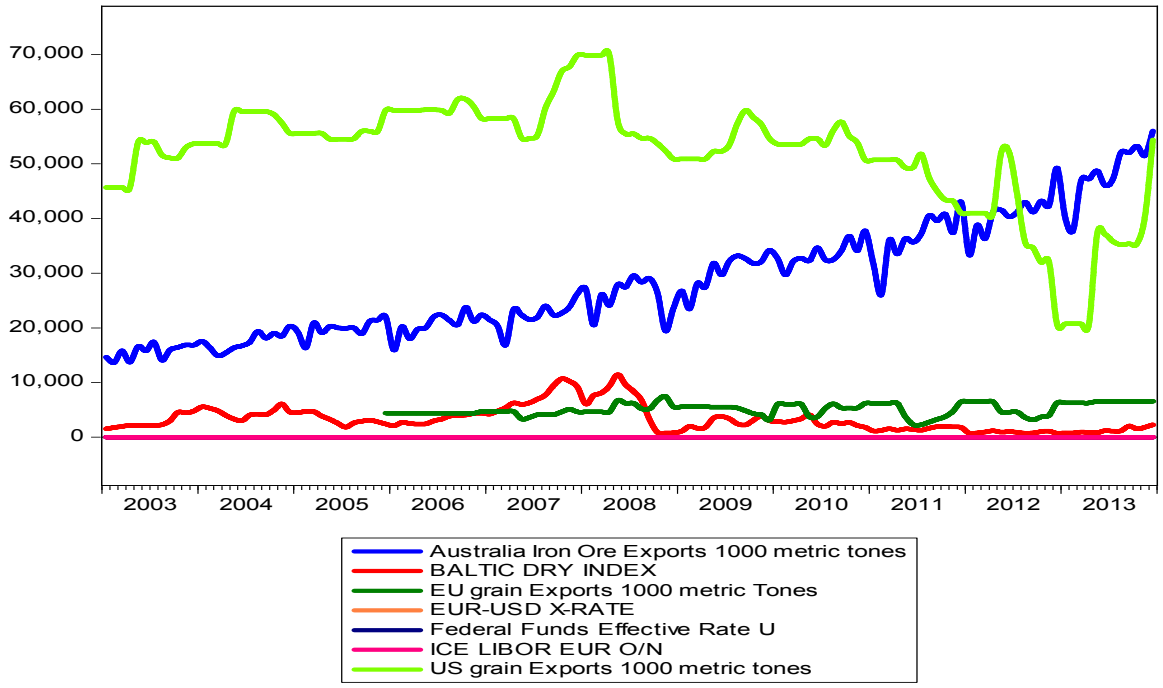
During the period 2003-2008 there was a rapid growth in global maritime transport, which led to a large increase in orders for the construction of, any type, new ships. During the

financial crisis of 2008-2009, the enormous order book at the time as well as the existing over supply of tonnage had led to a steep fall in freight rates. As a result, due to the difficulty of businesses to meet their financial obligations, and the need for a huge deleverage in sipping, many ships were driven to scrap as the market were going, at the same time, into a deep and prolonged recession.

3. BDI'S correlation with exports, the Euro-Dollar exchange rate and macroeconomic policy

We will look now at the relationship between the BDI and total exports of wheat from Europe and America, exports of Australian iron ore, America's interest rates, and LIBOR, which is the basis for shipping borrowing We use monthly data for the period 1/2003 to 12/2013. Below is a graph depicting our variables following the same trend.

Graph (8)



Using the least squares method, the following linear regression is produced:

BDI= 0.04*AUSTRALIA IRON ORE EXPORTES + 0.14*EU GRAIN EXPORTS+ 13669*EUR/USD XRATE + 508.22*FEDERAL FUNDS EFFECTIVE + 494.84*ICE LIBOR/EUR+ 0.05*US GRAIN EXPORTS- 21625.9

All variables have a positive relationship with our dependent variable. Increasing exports of cereals and iron ore lead to an increase in demand for maritime transport and, eventually, an increase in the BDI index. Surprising is the positive relationship of the index with the US borrowing rate, as an increase in the borrowing rate implies an increase in borrowing costs and an increase in the cost of transporting the goods. All of the above should lead to a reduction in demand and ultimately a reduction in the BDI index.

Below are the full regression data.

Dependent Variable: BALTIC_DRY_INDEX
Method: Least Squares
Sample (adjusted): 2005M12 2013M12
Included observations: 97 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

AUSTRALIA_IRON_ORE_EXPOR	0.044766	0.022576	1.982905	0.0504
EU_GRAIN_EXPORTS_1000_ME	0.142019	0.152872	0.929010	0.3554
EUR_USD_X_RATE	13669.32	2601.021	5.255370	0.0000
FEDERAL_FUNDS_EFFECTIVE_	508.2180	180.8620	2.809976	0.0061
ICE_LIBOR_EUR_O_N	494.8447	242.9012	2.037226	0.0446
US_GRAIN_EXPORTS_1000_ME	0.049009	0.017321	2.829416	0.0057
C	-21625.95	3620.720	-5.972830	0.0000

R-squared	0.777906	Mean dependent var	3185.649
Adjusted R-squared	0.763100	S.D. dependent var	2661.393
S.E. of regression	1295.363	Akaike info criterion	17.24040
Sum squared resid	1.51E+08	Schwarz criterion	17.42620
Log likelihood	-829.1593	Hannan-Quinn criter.	17.31553
F-statistic	52.53902	Durbin-Watson stat	0.615295
Prob(F-statistic)	0.000000	Wald F-statistic	47.54430
Prob(Wald F-statistic)	0.000000		

As we observe, all variables of our model influence positively our dependent variable, though in one of them the probability of t-statistic is greater than 0.05.

The probability from F-statistic is less than 5%, indicating that all the independent variables together affect the dependent variable.

The adjusted R2 adj is very close to the unit as its value is 0.763, indicating that the BDI index variability is interpreted by 76.3% from the model.

HETEROSKEDASTICITY TEST

Below we check our model for heteroskedasticity. Using the White Test, it turns out that our model has homoskedasticity as the Obs * R-squared probability is more than 5%.

Heteroskedasticity Test: White

F-statistic	1.633296	Prob. F(6,89)	0.1472
Obs*R-squared	9.522069	Prob. Chi-Square(6)	0.1463

AUTOCORRELATION OR SERIAL CORRELATION TEST

The autocorrelation test follows with the Breusch-Godfrey Serial Correlation LM Test, where we observe that the Obs * R-squared probability is greater than 5%, so our model is not auto correlated.

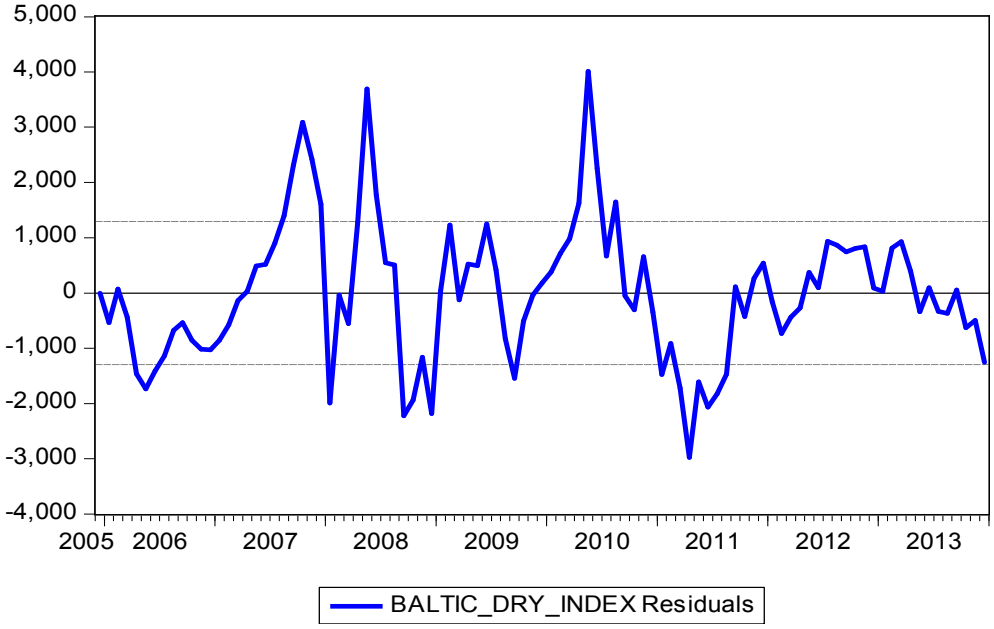
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.470524	Prob. F(2,87)	0.0905
Obs*R-squared	5.159183	Prob. Chi-Square(2)	0.0758

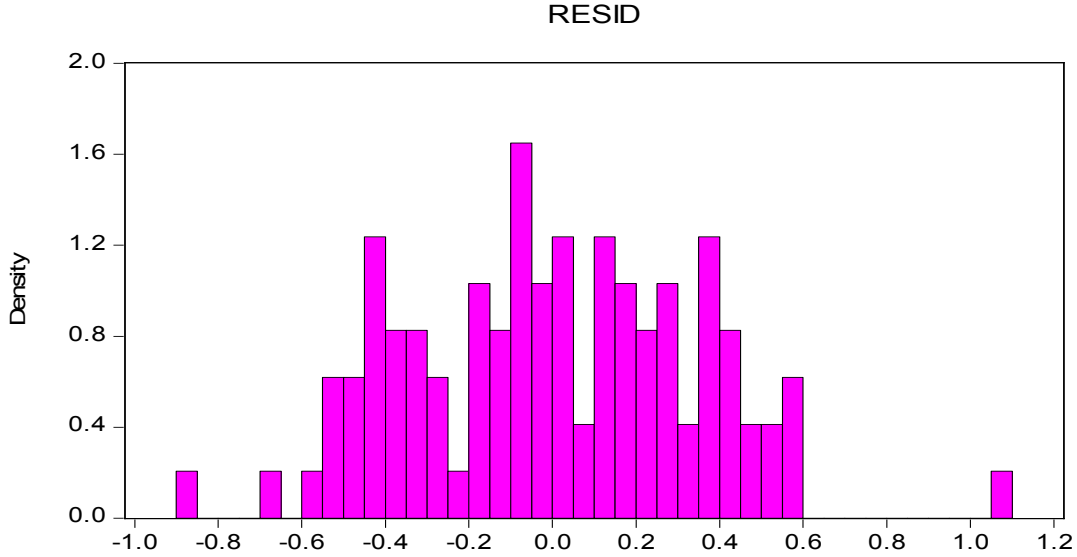
NORMAL DISTRIBUTION OF RESIDUALS

As we can see from charts (10) and (11), residuals follow the normal distribution.

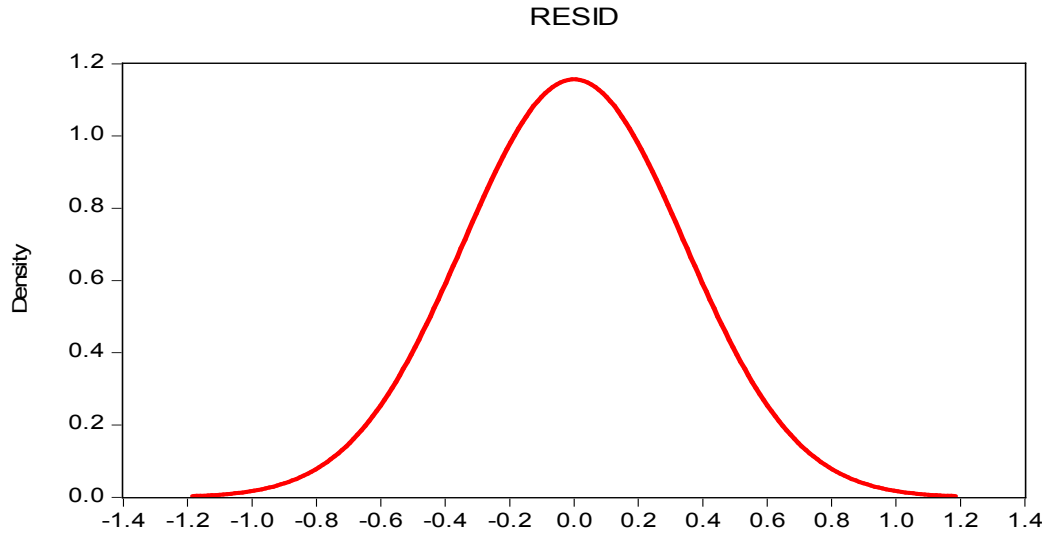
Graph (9)



Graph 10



Graph (11)



UNIT ROOT TESTING

Using the Augmented Dickey-Fuller (ADF) method, we perform a unit root test for stationarity in our model.

Variables	t-statistic*	Probability**	Test Result
Funds	**-1.057761**	**0.7309**	Unit Root
Lneugrain	**-4.051766**	**0.0018**	No Unit Root
Lniron	**1.087515**	**0.9973**	Unit Root
Lnlibor	**-1.689282**	**0.4343**	Unit Root
Lnusd	**-2.838403**	**0.0557**	Unit Root
Lnusgrain	**-2.348257**	**0.1587**	Unit Root

*t-statistic: Critical Value=-3.45 at 5% significance level

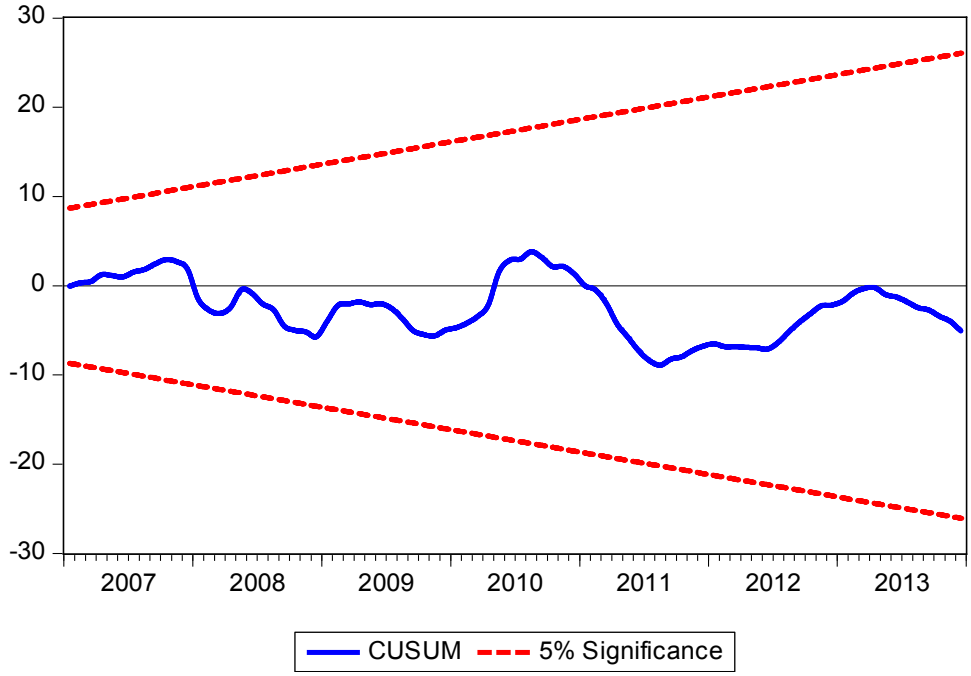
**MacKinnon (1996) one-sided p-values

In all variables, with the exception of the variable representing European wheat exports, the probability levels are greater than 5%, so our model is stationary.

STABILITY TEST

With the help of Cosum Test, we find that our model is stable as our dependent variable is within the 5% significance level.

Graph (12)

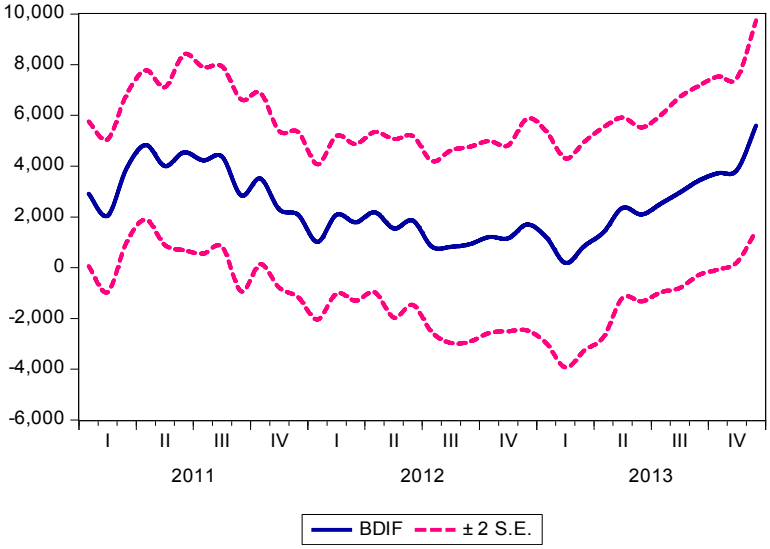


STATIC FORECASTING

Using data for the period 1/2003 to 12th / 2010, we will attempt to predict the values of our dependent variable for the period 1/2011 to 12/2013.

In the graph below, we see that the BDI values for the forecast period range within 95% confidence interval.

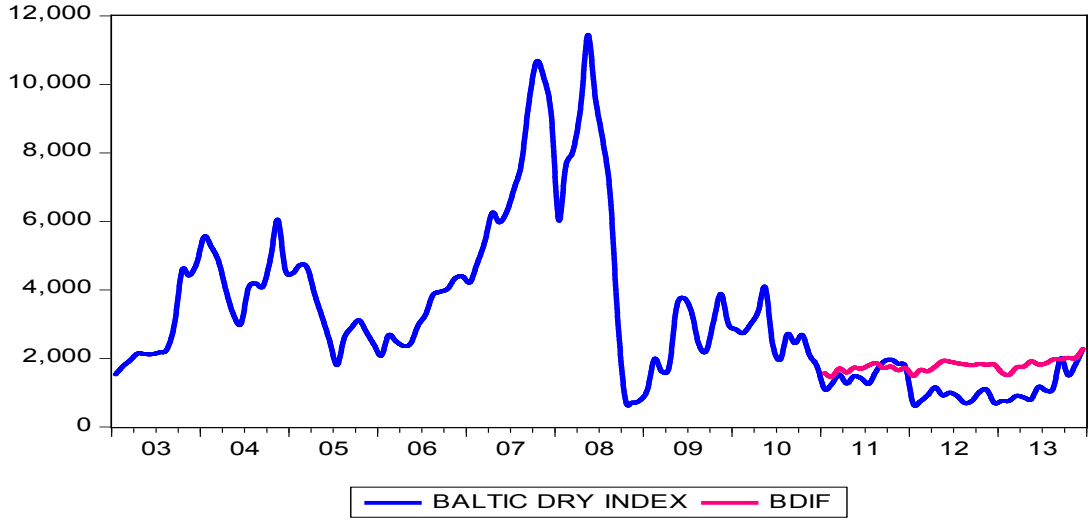
Graph (13)



Forecast: BDIF	
Actual: BDI	
Forecast sample: 2011M01 2013M12	
Included observations: 36	
Root Mean Squared Error	1634.614
Mean Absolute Error	1285.468
Mean Abs. Percent Error	101.6523
Theil Inequality Coefficient	0.398206
Bias Proportion	0.581516
Variance Proportion	0.302854
Covariance Proportion	0.115630

As we can see from the chart below, the values we predicted for our dependent variable for the period 1 / 2011-1 / 2012 as well as for September, November and December 2013 are quite close to real prices but for the rest of the period prices we predicted are far from the real ones.

Graph (14)



3.1. DISCUSSION OF THE RESULTS

Our model demonstrates that our dependent BDI variable is affected and relates to major export products (wheat and iron ore), US interest rates, LIBOR and the dollar exchange rate. The positive relationship between the index and exports is interpreted by the fact that the increase in exports leads to an increase in the demand for transport service and consequently to an increase in freight rates and, eventually, to an increase of the index.

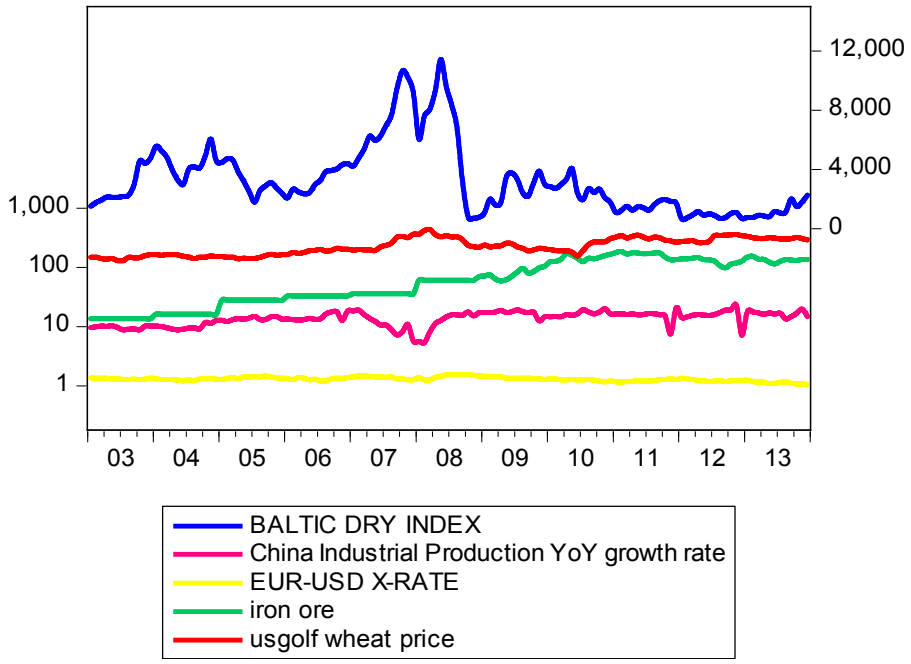
Finally, it is striking that the index has a positive relationship with both American interest rates and Libor. It would be expected that their relationship would be negative as interest rates rise, leading to increased borrowing costs and consequently increased transport costs.

The results from the statistical tests performed for the interpretation of the above model are generally satisfactory, but our model cannot be considered as significantly successful, as we have seen the prices we predicted at the end are far from the real ones. In conclusion, the BDI is correlated to all the independent variables used for this model, but further research will be required to arrive at safer conclusions.

4. BDI'S relationship with prices of raw materials and industrial production

In the third model, we will look at the relationship between the BDI and the prices of wheat, iron ore, China's index of production and the euro-dollar exchange rates. The data used for the period from January 2003 to December 2013. A graph of the above data is presented below.

Graph (15)



China's industrial output index and the BDI show the largest decline during the 2008-2009 crisis. Industrial production represents the demand for maritime transport. The decline in China's industrial output reflects a decline in demand for raw materials such as grain and iron ore. Using the least squares method, the following linear regression is produced:

BDI= -195.22*CHINA INDUSTRIAL PRODUCT + 5531.32*EUR/USD X RATE – 21.22*IRON ORE + 15.99*USGOLFWHEATPRICE -3402.57

The basic currency for trading in shipping is the dollar. This explains the positive effect of the euro / dollar exchange rate variable on our dependent variable. Increasing the euro / dollar exchange rate means a decline in the dollar. This reduction leads to lower product prices, increased demand and demand for transport and eventually an increase in the BDI index.

The increase of wheat in its price is due to either an increase in demand or a decrease in production. Its correlation to the BDI is positive, so increasing the price of wheat causes an increase in its index value too. Iron ore's correlation with our dependent variable is negative. An increase in its price will lead to a decline in demand, a reduction in transport and, ultimately, a fall in the price of the BDI. Finally surprising is that the increase in the industrial production index in China leads to a price reduction of BDI index. China belongs to one of the emerging economies, which has consistently high growth rates, mainly due to exports of industrial materials to the US. Despite the financial crisis of 2008, China has consistently maintained a relatively high annual pace of growth.

Below are the full regression data:

Dependent Variable: BALTIC_DRY_INDEX
Method: Least Squares
Sample: 2003M01 2013M12
Included observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-3402.569	2348.710	-1.448697	0.1499
CHINA_INDUSTRIAL_PRODUCT	-195.2257	51.78792	-3.769716	0.0002
EUR_USD_X_RATE	5531.327	1726.476	3.203826	0.0017
IRON_ORE	-21.22821	4.685126	-4.530980	0.0000
USGOLF_WHEAT_PRICE	15.99127	2.514947	6.358494	0.0000

R-squared	0.505482	Mean dependent var	3274.492
Adjusted R-squared	0.489906	S.D. dependent var	2368.643
S.E. of regression	1691.704	Akaike info criterion	17.74200
Sum squared resid	3.63E+08	Schwarz criterion	17.85120
Log likelihood	-1165.972	Hannan-Quinn criter.	17.78638
F-statistic	32.45391	Durbin-Watson stat	0.382315
Prob(F-statistic)	0.000000		

As we can see, all variables independently affect our dependent variables as in all the probability of t-statistic is less than 5%. The probability from F-statistic is less than 5%, which indicates that all the independent variables together affect the dependent variable.

On the other hand, the adjusted R2 adj is 0.49, indicating that the variability of the BDI is interpreted to only 49% of the model, and therefore, to increase the interpretive capacity of our model, one should add more variables.

HETEROSKEDASTICITY TEST

Below we check our model for the presence of heteroskedasticity. Using the Harvey Test, it turns out that our model has homoskedasticity as the Obs * R-squared probability is more than 5%.

Heteroskedasticity Test: Harvey

F-statistic	1.980080	Prob. F(4,127)	0.1015
Obs*R-squared	7.748888	Prob. Chi-Square(4)	0.1012

AUTOCORRELATION OR SERIAL CORRELATION TEST

The autocorrelation test follows with the Breusch-Godfrey Serial Correlation LM Test, where we observe that the Obs * R-squared probability is greater than 5%, so our model is not autocorrelated.

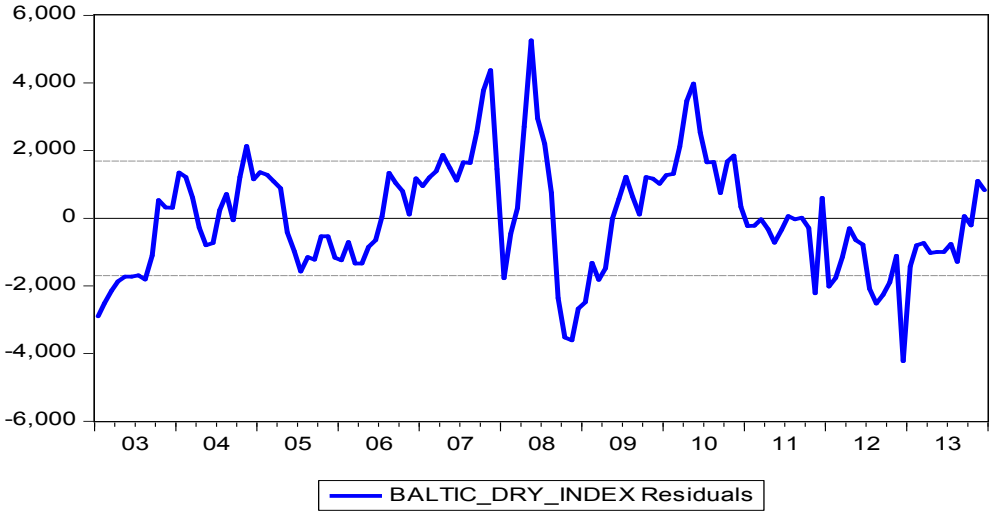
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.440447	Prob. F(28,97)	0.0982
Obs*R-squared	38.47275	Prob. Chi-Square(28)	0.0898

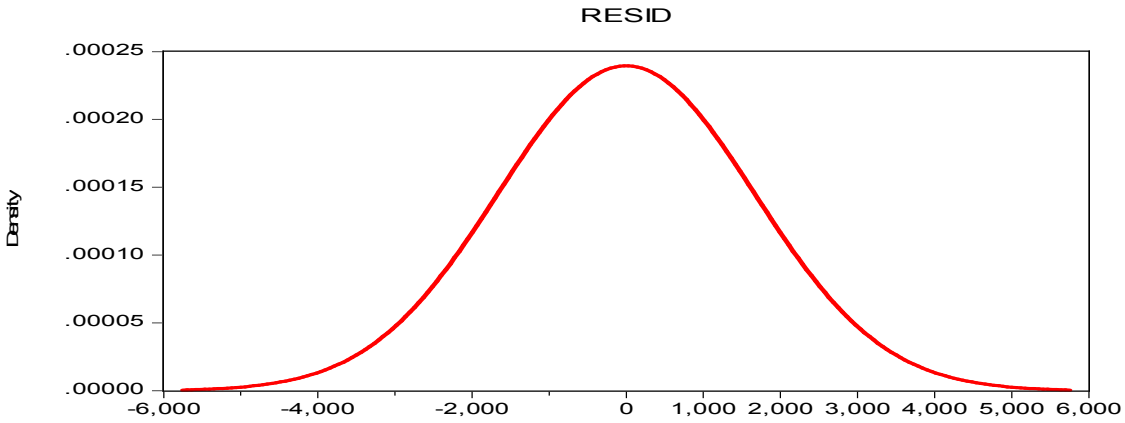
NORMAL DISTRIBUTION OF RESIDUALS

As we can see from charts (17) and (18), the residuals of our model follow the normal distribution**.**

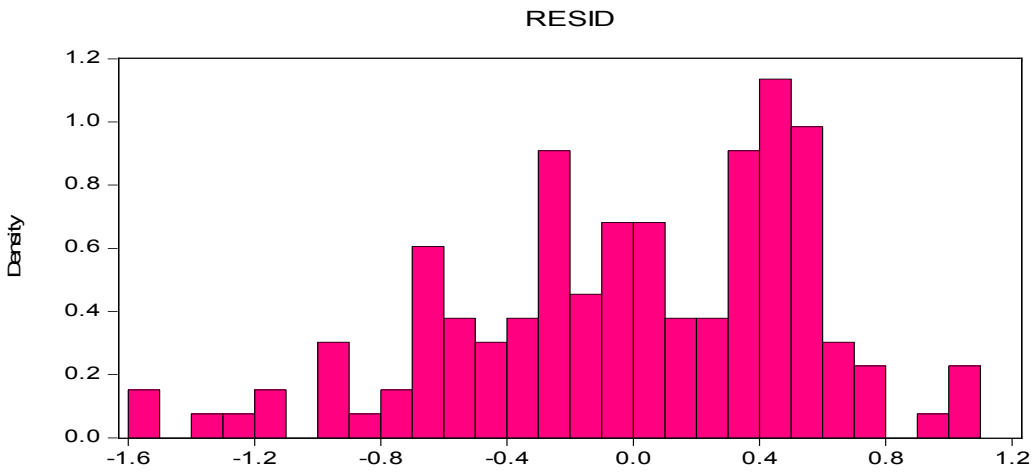
Graph (16)



Graph (17)



Graph (18)



UNIT ROOT TESTING

Using the Augmented Dickey-Fuller (ADF) method, we perform a unit root test for stationarity in our model.

Variables	t-statistic*	Probability**	Test Result
China Industrial Production	**-2.949010**	**0.0426**	No Unit Root
Eur Usd x rate	**-1.722570**	**0.4176**	Unit Root

Iron ore	**-0892051**	**0.7882**	Unit Root
Usgolf wheat price	**-1.927596**	**0.3188**	Unit Root

*t-statistic: Critical Value=-3.45 at 5% significance level

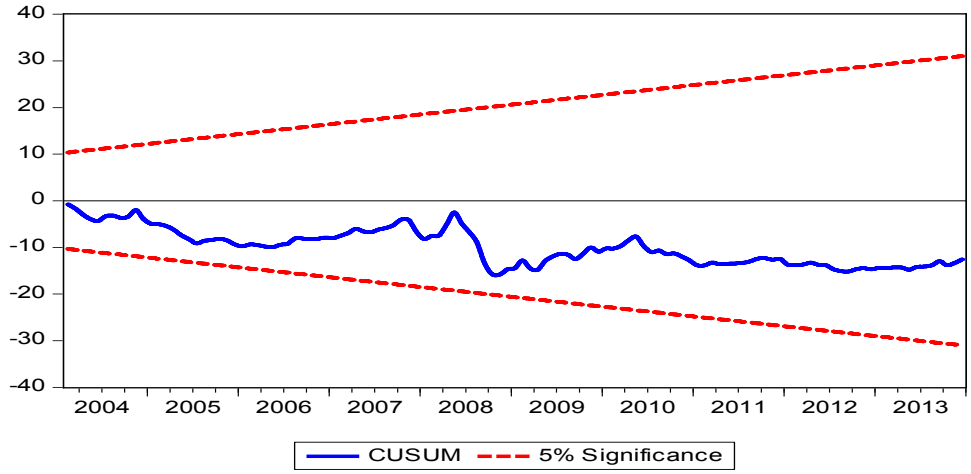
**MacKinnon(1996) one-sided p-values

In all variables, excluding the variable representing China's industrial production, the probability levels are greater than 5%, so our model is stationary.

STABILITY TEST

Using the Cosum Test, we find that our model is stable as our dependent variable is within the 5% significance level.

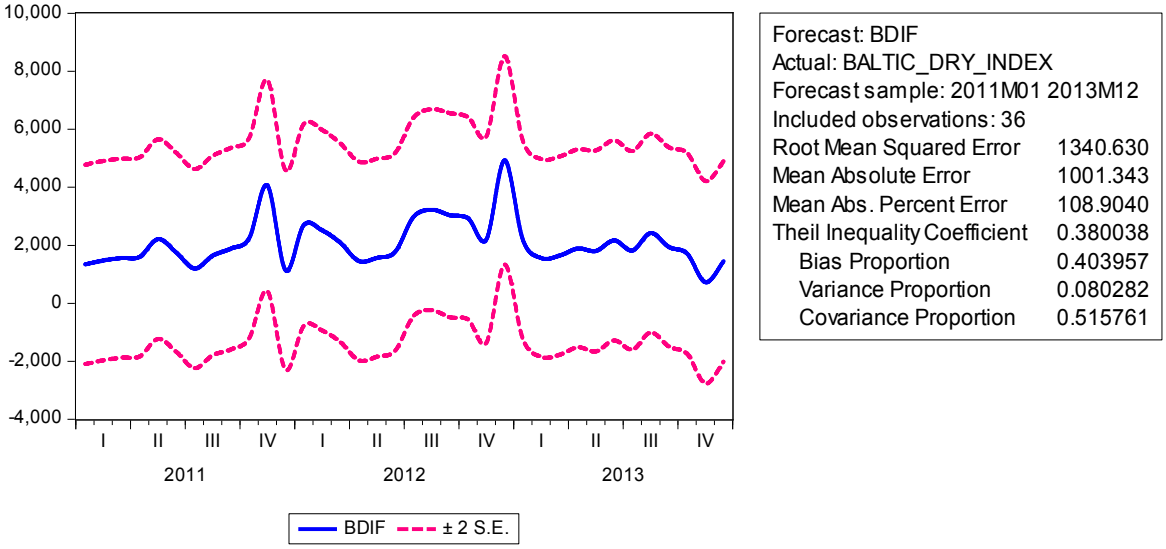
Graph (19)



STATIC FORECASTING

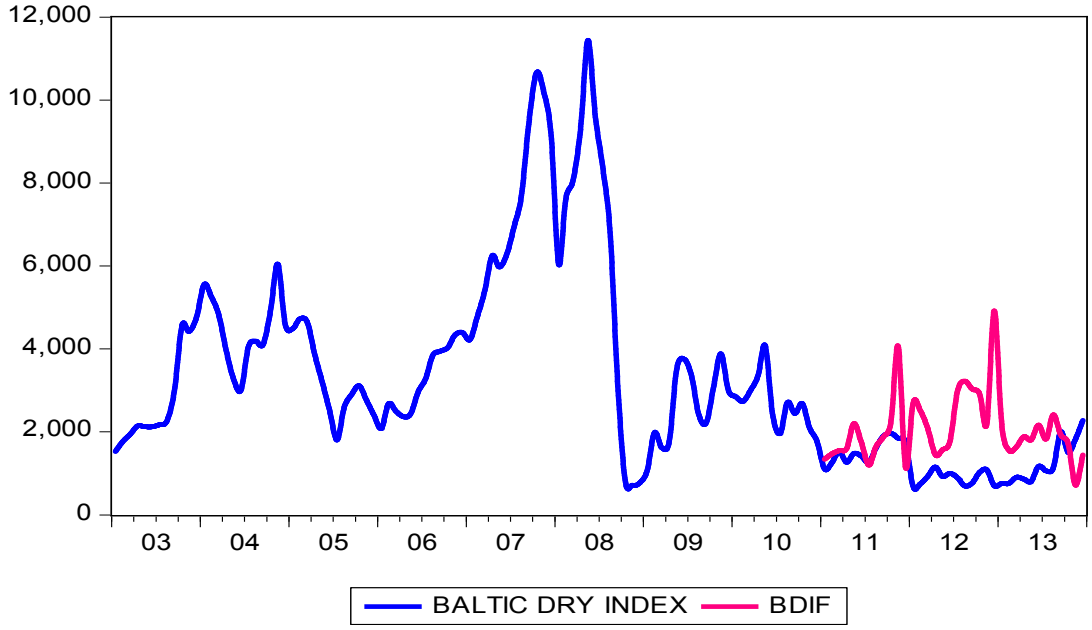
Using data for the period 1/2003 to 12th / 2010, we attempt to predict the values of our dependent variable for the period 1/2011 to 12/2013. In the graph below, we notice that the BDI index values for the forecast period range within 95% confidence interval.

Graph (20)



As we can see from the chart below, the prices we predicted for our dependent variable for 2011 and September and October 2013 are close enough to real prices, but for the rest of the period the prices we predicted are far from the actual. We, therefore, conclude generally that the predictability of our model is not satisfactory enough in this case.

Graph (21)



4.1. DISCUSSION OF THE RESULTS

Concluding our analysis, we summarize the following.

The biggest influence on our dependent variable is the euro / dollar exchange rate as the dollar is the basic currency used in shipping-related transactions.

China's industrial production has, surprisingly, a negative impact on the BDI. China is one of the main exporting countries. The volume of Chinese imports was not able to bring back a balance to the freight market, especially during the period when the BDI fell to the lowest prices in the last 25 years. Although China's imports continued to remain satisfactory despite a slowdown in its economy (due to a decline in demand for exports mainly in Europe but also to a fall in investment), oversupply of ships/tonnage not only offset imports but also generated a negative balance between supply and demand, particularly on large tonnage vessels.

On the other hand, iron ore, given that it is exported throughout the year, affects negatively the index, as the price of the commodity decreases demand and eventually the index value.

On the contrary, wheat is a basic commodity, moving in specific periods of time, depending on many unpredictable factors such as weather phenomena. As a result, their impact on the index is positive, meaning that there is price increases with the BDI.

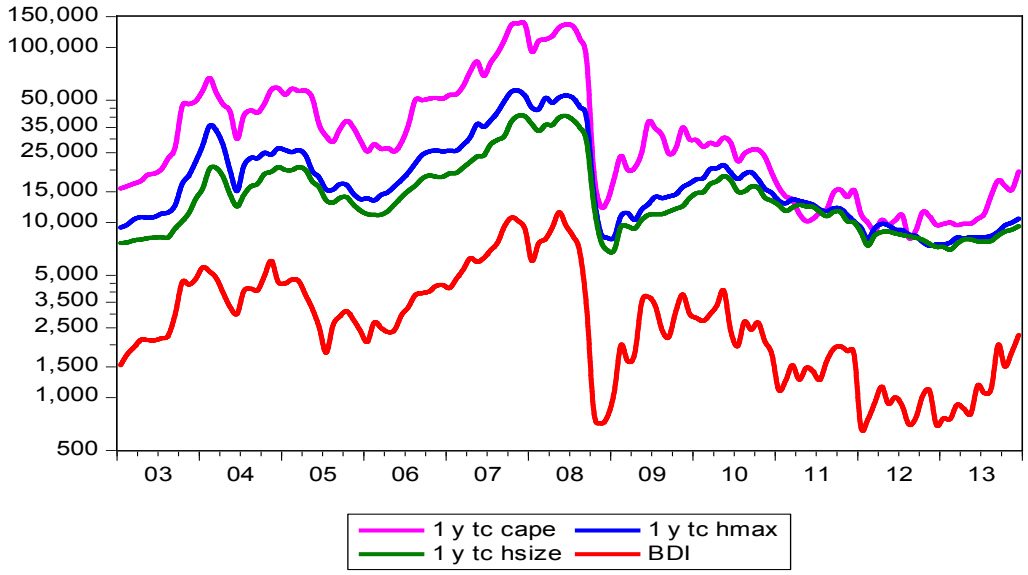
Our model shows that both industrial production and raw materials are directly correlated to the BDI. For the year 2011 prices are predicted successfully albeit not for 2012 and 2013. However, our model manages to predict successfully the general price trend.

5. BDI'S relationship with TC freight rates

In our fourth and last model, we will look at the relationship between BDI and TC freight rates for different types of ships. The data we used for the survey is for the period January 2003 to December 2013.

First we provide a graph of our data

Graph (22)



As we can see, both the BDI and the time-charter values follow the same trend. All variables show a strong downward trend in 2008-2009, a period when the crisis occurred. The largest fall is in the larger size, Capesize vessels.

Using the least squares method, we take the following linear regression:

BDI = 685.43 - 0.12*1Y TC HSIZE + 0.11*1Y TC HMAX + 0.06*1Y TC CAPE

The relationship between BDI and large-size Capesize and Handymax ships is positive, as demand for trucks increases and freight increases. But the index ratio is negative with Handysize-sized small-sized ships. This is partly due to a number of reasons. Small-sized ships represent the smallest share of the world fleet, make specific and short-haul routes and deliver a reduced profit to shipowners. Therefore, these types of vessels are not chartered by the shipowners to a one-year charter but to the spot market and for a short period of time.

Below we provide the full regression data

Dependent Variable: BDI
Method: Least Squares
Date: 07/05/15 Time: 13:45
Sample: 2003M01 2013M12
Included observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.
1Y TC HSIZE	-0.121950	0.035258	-3.458786	0.0007
1Y TC HMAX	0.107025	0.031077	3.443880	0.0008
1Y TC CAPE	0.061111	0.007984	7.654398	0.0000
C	685.4287	155.9943	4.393933	0.0000

R-squared	0.937288	Mean dependent var	3274.492
Adjusted R-squared	0.935818	S.D. dependent var	2368.643
S.E. of regression	600.0768	Akaike info criterion	15.66183
Sum squared resid	46091793	Schwarz criterion	15.74918
Log likelihood	-1029.681	Hannan-Quinn criter.	15.69732
F-statistic	637.6884	Durbin-Watson stat	0.908429
Prob(F-statistic)	0.000000		

As we can see above, all variables independently affect our dependency as in all the probability of t-statistic is less than 5%. The probability from F-statistic is less than 5%, which indicates that all the independent variables together affect the dependent variable.

The adjusted R2 is very close to the unit as its value is 0.936, indicating that the BDI variability is interpreted by 93.6% from the model.

HETEROSKEDASTICITY TEST

Below we check our model for the presence of heteroskedasticity. Using the White Test, it turns out that our model has homoskedasticity as the Obs * R-squared probability is more than 5%.

Heteroskedasticity Test: White

F-statistic	1.836509	Prob. F(9,122)	0.0682
Obs*R-squared	15.74962	Prob. Chi-Square(9)	0.0723

AUTOCORRELATION OR SERIAL CORRELATION TEST

The autocorrelation test follows with the Breusch-Godfrey Serial Correlation LM Test, where we observe that the Obs * R-squared probability is greater than 5%, so our model is not autocorrelated.

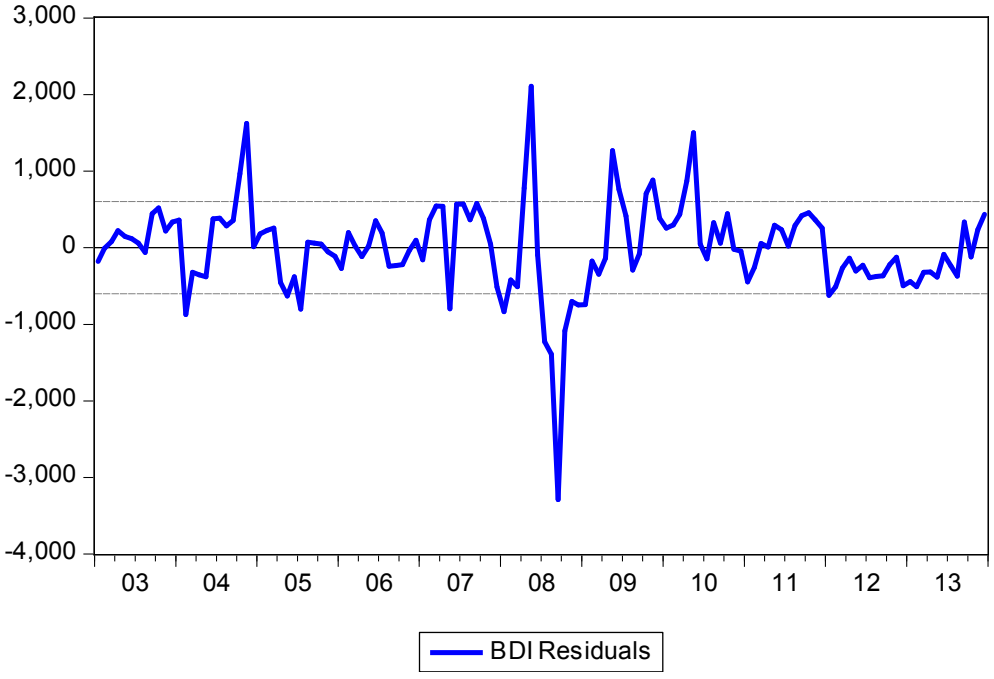
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.884161	Prob. F(2,125)	0.0596
Obs*R-squared	5.778541	Prob. Chi-Square(2)	0.0556

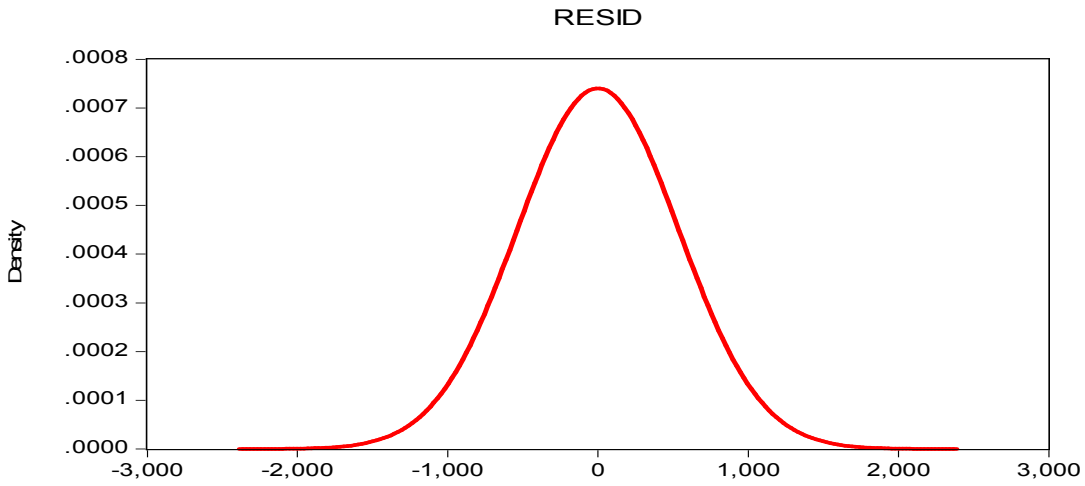
NORMAL DISTRIBUTION OF RESIDUALS

As we can see from charts (24) and (25), the residuals of our model follow the normal distribution.

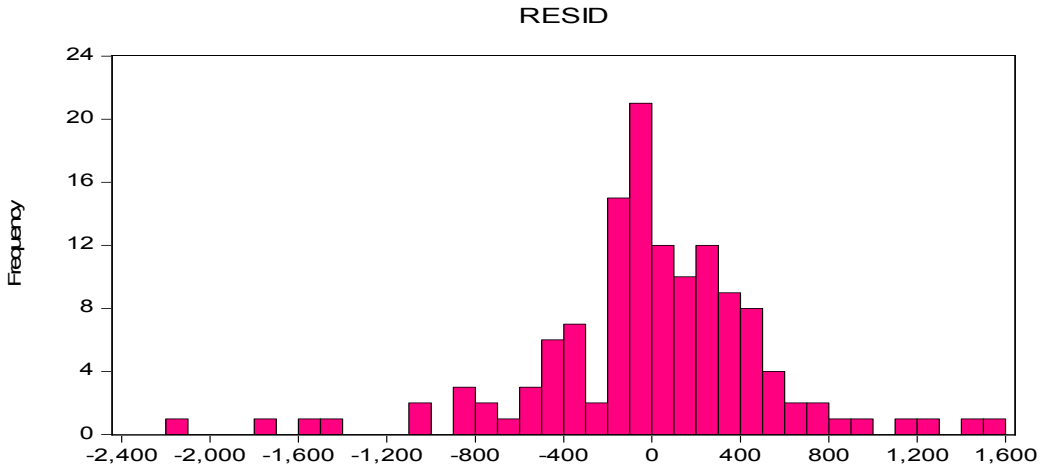
Graph (23)



Graph (24)



Graph (25)



UNIT ROOT TESTING

Using the Augmented Dickey-Fuller (ADF) method, we perform a unit root test for stationarity in our model.

Variables	t-statistic*	Probability**	Test Result
1Y TC CAPE	**-2.417443**	**0.1389**	Unit Root
1Y TC HMAX	**-2.558311**	**0.1044**	Unit Root
1Y TC HSIZE	**-2.778648**	**0.0641**	Unit Root

*t-statistic: Critical Value=-3.45 at 5% significance level

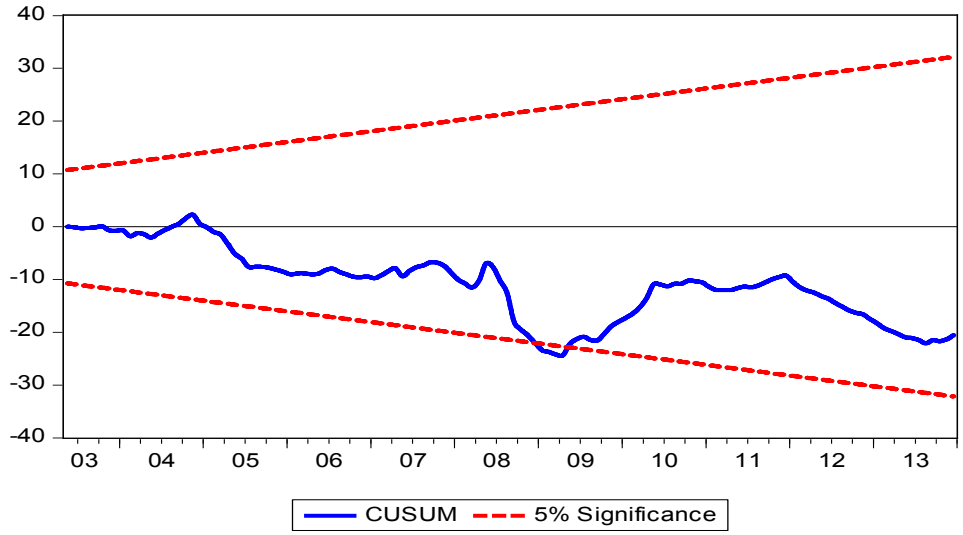
**MacKinnon (1996) one-sided p-values

In all variables the probability levels are greater than 5%, so our model is stationary.

STABILITY TEST

With the help of Cosum Test, we find that our model is stable as our dependent variable is within the 5% significance level.

Graph (26)

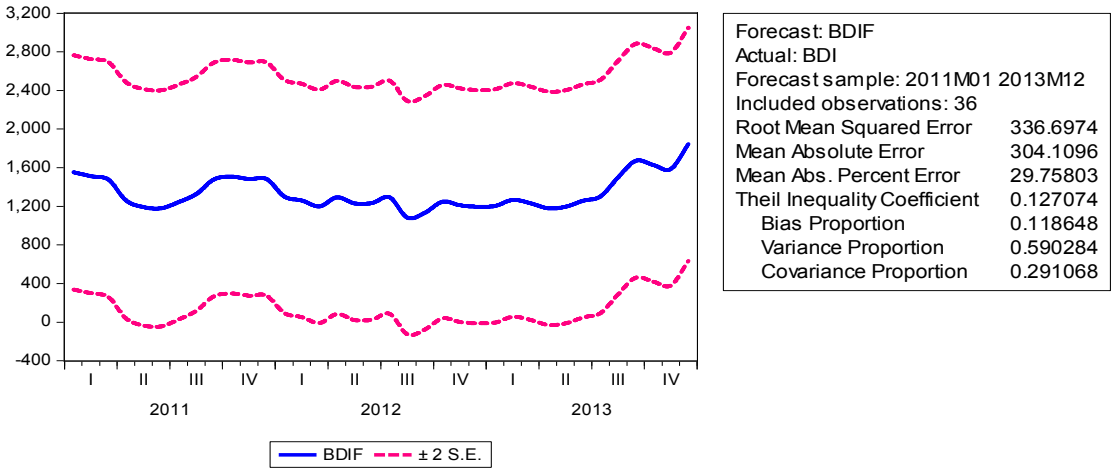


STATIC FORECASTING

Using data for the period 1/2003 to 12th / 2010, we will attempt to predict the values of our dependent variable for the period 1/2011 to 12/2013.

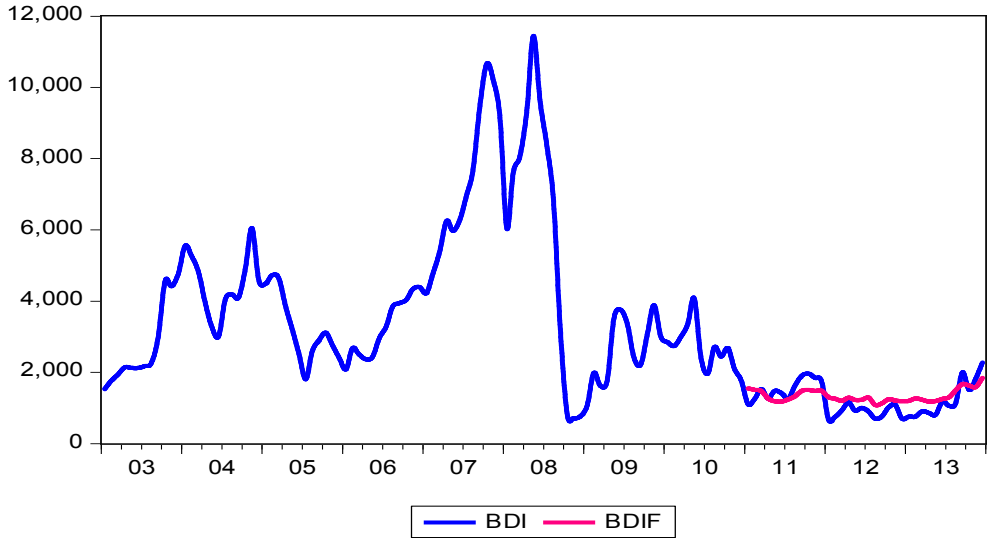
In the graph below, we see that the BDI values for the forecast period range within 95% confidence interval.

Graph (27)



As we can see in the chart below, the values we predicted for the 2011-2013 are close enough to real values. Therefore, the ability of our model to predict is quite satisfactory.

Graph (28)



5.1. DISCUSSION OF THE RESULTS

From our analysis we first notice that the greatest correlation with the indicator is the one-year time charter of the Capesize type ships. These ships react more strongly to the changes in the index. This is to be expected as in times of crisis the first decommissioned ships are those that are large in capacity and old in age. Smaller ships are less affected due to their size as there is usually enough quantity of goods to cover their tonnage.

Also from the variables examined, only values for Handysize ships are negatively related to the index. These ships are of small size and are used on specific short journeys. The profit margins they can offer are very small and are usually chartered in the spot market.

The results of all the statistical checks we performed are particularly satisfactory and our model has a fairly satisfactory forecasting capability as the prices we predicted for the period 2011-2013 are close enough to the real values of our index.

6. Evaluation and comparison of the models

The last part of our research includes comparison and evaluation of the four models we analyzed above based on the results of the ACAIKE, SWARTZH and R2 values.

EVALUATION OF MODELS

		R^2	AIC	SIC
MODEL 1	**BDI VS Stock Markets**	76.8%	16.96	17.09
MODEL 2	**BDI VS Exports, EURO/Dollar Macroeconomic Policy**	76.3%	17.24	17.43
MODEL 3	**BDI VS Commodity prices China Industrial Production**	48.9%	17.74	17.85
MODEL 4	**BDI VS Time charter Rates**	93.5%	15.66	15.75

As we see the best model is the fourth "BDI vs Time charter rates" (higher R2 and lower AIC and SIC). But taking into account the ability to predict, of each model, the first "BDI vs Stock Markets" model also gives very good results.

From the statistical tests we performed, all four models we analyzed give good results both in terms of homoskedasticity and non-autocorrelation, as well as in terms of stability, stationarity and predictability. In models 2 and 3, the predicted values do not converge much with the real ones, but we observe that they follow the trend of the real index values, thus demonstrating that all the variables we used for our research are actually correlated to our dependent variable.

7. General Conclusions

In this paper we investigated the correlation of some key global economic indicators with the BDI.

The first model proved to be positively influenced by the stock indices HangSeng and S&P500, representing the two largest economies in the world, China and the US respectively, while negatively affected by the Nasdaq, Daxxetra and FTSE100 indices. The S&P500 represents the world's 500 heaviest industries, which also justifies the greater positive effect it has on the BDI.

In the second model, our dependent BDI variable has been positively affected and correlated to major export products (wheat and iron ore), US interest rates, LIBOR and the dollar exchange rate. Notable -and unexpected- was the positive relationship of the index with interest rates, as rising interest rates mean an increase in borrowing costs and thus transport costs, so we should have normally expected a fall in demand and ultimately a decrease in our dependent variable.

The third model has shown that the BDI is positively influenced by the dollar / euro exchange rate and grain, so that their price increases accordingly with the index value. Its relation to the iron ore is negative, because as a non-basic commodity, its price is decreasing, its demand is decreasing and, finally, the price of the index is reduced similarly to the industrial production of China at the time.

In the fourth model, Handysize time charters have been negatively related to the index, since given their small size, they offer small profit margins and are therefore chartered in the spot market. Capesize's time charters have the greatest effect on the index, as they are more likely to react to the changes in the index due to their size.

Summarizing, it has been shown that the BDI is a representative indicator not only for the shipping industry. As it is influenced by various macroeconomic and financial indices, inversely it may also be a nice indicator for them.

The models we analyzed are not intended to predict the future, which is rather impossible in such a volatile market. However, it may help the parties involved in the shipping industry to act rationally judging by the past.

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GUIDELINES

for the Writers & a format model for the articles submitted to be reviewed & published in the journal

Regional Science Inquiry Journal

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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
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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.**

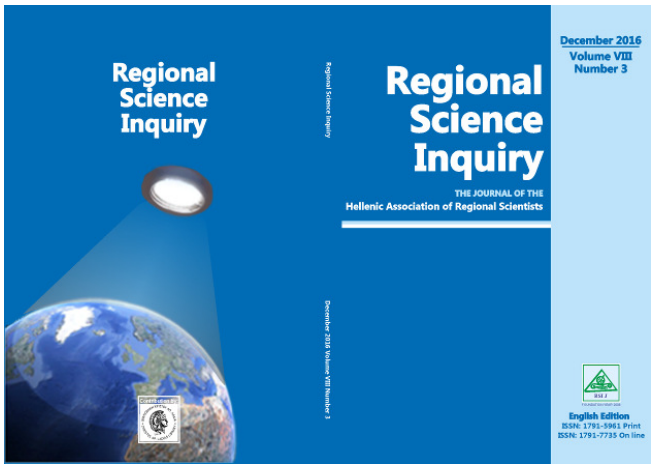
5.1.1. Reference inside the text

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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