# ARE THE REGIONS WITH MORE GENDER EQUALITY THE MORE RESILIENT ONES? AN ANALYSIS OF THE ITALIAN REGIONS

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**Abstract**

The paper aims to investigate the relationship between gender equality and regional resilience. Literature, primarily regional literature, has shown limited interest in gender. Nevertheless, females and males are employed in different industries, so when a shock hits, it can have a different employment impact in terms of gender and, consequently, in terms of resilience. Regions are specialized in some industries. Regional specialization results from historical, cultural, natural endowments, and social elements. Also, the uneven distribution between females and males within industries involves social, cultural, and economic components. As a result, regional specialization determines an employment distribution that can be unequal regarding gender. This employment distribution is captured by the Dissimilarity Index, which measures the sum of the absolute difference in females' and males' distribution over occupations. Therefore, the dissimilarity index emerges as a consequence of regional specialization. This dissimilarity, in turn, could have an impact on resilience. Our results put several significant results forwards. First, there is a relationship between gender segregation and regional specialization. The higher the regional specialization in sectors where the females' share is low, the higher the dissimilarity. Second, there was a positive relationship between resilience and gender equality from 2008 to 2013. The more gender equality regions are also the more resilient ones. Taking a sectoral occupation is not easy, including social values, cultural components, welfare, education, and soft skill. Policies should also address their efforts to enhance the welfare and social dimensions and break gender stereotypes.

**Keywords:** Gender, Regional specialization, Dissimilarity, Resilience, Italy
**JEL classification:** R10, R11, R19, O18

## 1. Introduction

Resilience is a keyword in European economic policy. Nevertheless, resilience is not a new concept: it summarizes the capacity of a territory to be shock-absorber and to trigger a phase of fast recovery after the shock. Starting from the pioneering Holling's contribution (1973), it has received a growing interest in various fields and has become a buzzword after the 2007 economic shock, especially in the Evolutionary Economic Geography (EEG) field. This approach rejects neo-classical inspired notions of adjustment mechanisms towards any notion of equilibrium. Instead, they understand the economic landscape as a complex adaptive system that can never be in equilibrium (Dawley et al., 2010). This rejection of equilibrium in the EEG approach is based on the economy's ability to *self-transform from within* (Witt, as cited in Boschma & Martin, 2010).

Following Martin (2012), regional economic resilience can be defined as "the capacity of a regional economy to reconfigure, that is adapt, its structure (firms, industries, technologies, and institutions) to maintain an acceptable growth path in output, employment, and wealth over time" (Martin 2012 p.14). The adaptive capacity of a region's economy will depend on the region's pre-existing industrial tissue, regional resources, skills, and capabilities. In this context, resilience emerges as a conceptual framework in which the observation unit (community, city, region, and nation) can be represented dynamically and holistically in

which social-ecological and economic components are interrelated. Starting from the Cambridge Journal contributions (2010) and Martin's contribution, a growing body of literature in EEG explores the regional resilience determinants using the Martin resilience index as the dependent variable. Most of the contributions focalized attention on the resilience regional determinants highlighting that sectoral composition and human and social capital are essential for resilience (Cuadrado-Roura and Maroto, 2016; Di Caro, 2015; Di Caro, 2017; Diodato and Weterings, 2015).

Hence, the critical variables in such an approach are sectoral composition and human capital, as they are responsible for knowledge diffusion in the global and local economies. The measurement of industrial composition in literature exploits several approaches, from measures of industrial concentration (as the Hirfendal index used by van Egeraat et al. (2018), Dauth et al. (2018), Neffke et al. (2011)) to more refined measures of composition, like the Local Quotient index (Fan and Scott, 2003; Martini, 2020; Davies and Maré, 2021), and the measures or related and unrelated variety (Frenken et al., 2007, Castaldi et al., 2015; Fritsch and Kublina, 2018). However, a red thread links these contributions: investigating which form of industrial composition fosters knowledge diffusion through externalities effects (from the MAR to the Jacob spillover). The latter remains the engine of a territory's resilience and recovery capacity, and, in this light, the interrelationship between industrial composition and human capital must be seen (Alexiadis, 2020). Firms are not islands, and ideas can not be confined: the local and cognitive proximity of firms and workers in a territory produces a continuous exchange of ideas, organizations, skills, and capabilities.

Moreover, the literature shows that these external effects are stronger when firms and workers share a certain degree of relatedness in production. Nevertheless, the literature treats workers as a homogenous and anonymous body, irrespective of their cultural, social, and economic background and, for our scope, gender. However, the literature shows that gender matters in the cognitive process (Sastre, 2015; Østergaard et al., 2011; Jackson et al., 1995; O'Reilly and Spee, 1997; Xie et al., 2020; Williams and O'Relly, 1988), and workers cannot be treated as an anonymous body. The focus on the gender dimension opens new questions that we want to fill. If the industrial composition matters for knowledge diffusion and if the latter is affected by a gender question, then we have to add these dimensions to the question.

There is extensive literature on the low female participation in the workforce; for several reasons, spanning from a cultural and social context (even inside firms) to female's human capital choice until to the welfare policies helping female workers take care of offspring.

In this paper, we want to investigate these dimensions affecting knowledge transmission, hence the territory's resilience. We focus on Italy for several reasons: in Italy, female workers are confined to a few sectors (gender discrimination), their social and cultural background is particularly binding, and there is a general lack of a welfare system. What is intriguing is that such determinants are not homogenous and are not evenly distributed in the Italian territories: in southern regions, the social, cultural, and productive structure context is particularly discouraging. Moreover, for historical reasons, in northern regions, female workers are more confined to a few industry sectors (textile, wholesale and retail trade, low human capital activities), while female workers are more concentrated in the education sector in the southern regions. Furthermore, the complexity of the gender gap makes an international comparison very hard, as cultural, social, and institutional contexts matter and are very heterogeneous. For example, in Scandinavian countries caring for children, the disabled, and the elderly has been taken over by the public sector, while in some other countries, such as Italy, those activities represent unpaid women's jobs. Those social dimensions can have an impact on the regional resilience process.

Few studies consider gender-related or associated with economic resilience (Renschler et al., 2010; Augustine et al., 2013; Chacon-Hurtado et al. 2020; Wang and Wei, 2021). Despite this, the relationship between gender equality and resilience is still unexplored, particularly with its relationship with industrial composition and knowledge diffusion.

We base our contribution on the conceptual framework of Evolutionary Economic Geography. EEG aims to understand why industries concentrate in space, how networks evolve in space and why some regions grow more than others (Frenken and Boschma, 2015). Proximities play a central role in understanding interactive learning and innovation (Boschma

2005). These proximities influence the diffusion of knowledge and, consequently, innovation and growth.

Gender differences can impact skill-relatedness connectivity, proximities, the diffusion process of knowledge, and consequently, the territory's capacity to be resilient and recover a growth path after a shock. However, these relationships are still neglected in the literature.

As previously discussed, several approaches in the literature measure regional specialization. However, these theories are developed by hypothesizing that social and cultural beliefs are unimportant. Regional specialization is not only the result of productivity and endowments but also depends on regional-specific components such as history, traditions, cultural beliefs, and social values. Following this, the regional sector specialization can be considered the result of several interrelated components influencing each other. Regions with the same productivity and endowments can have different regional specializations. The index summarizing local specialization is the Location Quotient (LQ) -the ratio between the share of regional employment in one sector and the share of employment in that same sector in the reference economy (https://ec.europa.eu/eurostat)-.

The idea that gender matters for growth is not new by itself. The literature dating back to Boserup (1970) has emphasized the positive effects of gender equality on development (Cubers and Teignier, 2014). Nevertheless, a small body of literature finds positive aspects of having a sizeable gender gap (Seguino, 2000). All those studies do not consider the role played by regional specialization. Different industries have different gender compositions. In Italy, gender differences are evident between various industries and regions in the same industry. This uneven distribution can be due to education, cultural components, social values, welfare systems, and beliefs. Substantial reductions in gender segregation will require more extensive measures, including changes in the content and organization of work in traditionally male -and female-dominated areas and changes in young women's and men's choice of education very early in life. Regional sectoral composition emerges from regional productivity, regional endowments, and regional-specific components. We do not explain how these cultural and social dimensions affect regional specialization (it is out of our aim). Considering regional specialization as given and inherited from the past, the relationship between dissimilarity index -ID- (Ducan and Ducan 1955) and regional specialization will be analyzed to investigate if and how the latter impacts on the dissimilarity using several stylized facts emerging from the data investigation.

Our contribution aims to answer the following research question: Does a more gender-equal regional specialization make territories more resilient? Our analysis will focus on Italian regions. Italian regions share the same national roles in terms of welfare but strongly differ in history, cultural beliefs, social values, and regional sectoral composition. Those differences are particularly evident between the Northern and the Southern regions, and a by-product of our analysis is to provide some new clues to the old debate about the North-South divide in Italy.

Concerning results, the analysis of LQ decomposed by gender shows a relationship between gender distribution (segregation) and regional specialization. It leads to an expected result: the higher the regional specialization in sectors where the females' share is low, the higher the gender gap is measured by the dissimilarity index. Therefore, a ri-equilibrium in gender between sectors is desirable to reduce the dissimilarity; we wonder if such rebalancing fosters the resilience of territories. We find that there is a positive relationship between resilience and gender equality. The more gender equality regions are also the more resilient ones. Creating a resilient place means also creating more inclusive sites and vice versa.

We structure our contribution as follows. Section 2 will present the literature review to delimitate our theoretical background and address the research questions. Section 3 shows the stylized facts emerging from the data investigation. Section 3.1 underlines the relationship between the actual regional specialization and the gender distribution among territories and sub-groups (industries), while section 3.2 is the relationship between gender and resilience. Section 4 provides the empirical investigation to section 3; it presents two empirical models; the first is devoted to analyzing if and how regional specialization affects gender segregation (measured by the dissimilarity index ID). The second one uses the fitted value of the previous model (to depurate the ID from the component explained by the regional specialization) as a

covariate of a probit model whose dependence is the probability of being resilient or not. Finally, conclusions, discuss policies and research implications related to our findings.

## 2. Literature review

Following the definition provided by the World Health Organization, gender is used to describe the characteristics of women and men that are socially constructed. At the same time, sex refers to those that are biologically determined. For example, people are born female or male but learn to be girls and boys who grow into women and men. This learned behaviour makes up gender identity and determines gender roles (https://www.euro.who.int/en/health-topics). Following this definition, gender is a cultural category related to the complex social construction of sexual identities, hierarchies, and interactions (Becchio, 2018).

The analysis's first economic contributions included gender (Aigner and Cain, 1977; Becker, 1985) focused on the different participation rates in the labor market for females and males and the gender pay gap (Abbot and Beach 1994; Altonji and Blank 1999). The first micro-founded model was developed by Hakim (2000), in which the author uses the preference to explain females' behavior and choices between employment and family work. At the outset of this pioneering contribution, a growing body of economic literature aims to investigate the different behavior of females and males in the job market and their consequences on gender segregation (Eige (https://eige.europa.eu) defines gender segregation as "Differences in patterns of representation of women and men in the labor market, public and political life, unpaid domestic work and caring, and young women's and men's choice of education"). Gender segregation, actual dominance of one sex in a particular occupation or the higher share of one sex relative to the expected share, can be horizontal such as vertical. However, the first is generally pictured as women and men's disparate concentration across industries and occupations (Duran, 2019, Lyberaki et al., 2017).

In contrast, the second refers to gender disparities in positions and roles with different statuses or potential employment advancement. The unequal distribution of females and males between industries means that an increase of females in the labor market will not be equally distributed between industries. As a result, females are more likely to fall in some industries than others. Employment segregation significantly affects economic growth, household welfare, firm performance, and intergenerational social mobility. Efforts to reduce employment segregation can create a virtuous cycle in which increased female participation in high-return occupations creates more extensive networks of women and changes social norms (Das and Kotikula; 2018). Female participation in the job market is conditioned by national institutions such as welfare regimes, social policies, employment protection legislation (Hall et al., 2019), and cultural norms (Alesina et al., 2011). The evolution of production structure, the de-specialization process taking place in Italy since 1995 (Martini 2020), has increased the service share and, consequently, the females' employment in service sectors (Olivetti and Petrongolo 2016; Petrongolo and Ronchi 2020). Addressing employment segregation is central to reducing the gender wage gap, improving job quality and earnings, and increasing female labor force participation. Policies aim to increase female participation in the labor market, and those aimed at re-skilling the workforce play a central role in responding to crises and contributing to the country's growth process.

### 2.1. From regional specialization to gender segregation

Although gender acquired an increasing interest in economic literature, the theme is still neglected in regional science, and the contributions are limited (Hirschler 2010; Pavlyuk 2011; Noback et al., 2013; Ray et al., 2017; Martini 2021; Correia and Alves, 2017). In particular the role played by regional specialization. As discussed during the introduction, regional specialization is not only the result of productivity and endowments but also depends on regional-specific components such as history, traditions, cultural beliefs, and social values. The stylized fact analysis highlighted that men and women are not employed in the same sub-groups. This uneven distribution is also due to cultural, historical, social, and welfare components. Among them, women receive different education, for instance, they prefer more humanistic topics rather than being involved in STEM fields.

Furthermore, in Italy, especially in the Southern regions, there are still some gender stereotypes and culturally biased regarding which women should be preferably employed in education rather than industry. Moreover, women are still involved in unpaid work, such as caring for children, the disabled, and the elderly. Those social components influence regional specialization. The latter can impact, in turn, gender segregation.

We aim to investigate if and how regional specialization affects gender segregation by merging three strands of literature. The first one regards regional specialization, the second concerning gender segregation, and the third about resilience. To our knowledge, this is the first contribution to exploring this topic. The relationship between regional specialization and resilience has been explored, among the others, by Martini (2020), who highlighted that do not exist a mix of specialization and regional-specific factors able to ensure resilience. The ability to resist the shock or recover after the shock- known in literature with the term resilience- will depend on a mix of regional attributes that vary from shock to shock. The relationship between gender and resilience has been neglected by literature. The few available studies (McKay et al. 2013; Duvvury and Finn 2014) have highlighted that male workers suffered the most significant impact in terms of job losses in the initial phases of the recession in the UK.

Nevertheless, immediately after the initial phase, the situation reversed. This difference finds its roots in how the Government faced the crisis. To reduce the deficit, Governments decided to cut welfare and public services. However, due to the unequal distribution of care between females and males, these cuts have inevitably penalized females (Seguino, 2009). Similar results are found by Ray et al., (2017) for Canada, which analyzed the resilience in terms of gender, highlighting that females and males experienced a different degree of resilience after the 2007 economic shock. This phenomenon, known as *mancession* - unemployment trends in the early stages of the recession seem to affect males more than females- can be due to a gender effect, but it can be imputable to the different shares of females and males between industries (Banerjee, 2010). Boshma (2005) pointed out that regional resilience depends on the sectoral composition. If the shock hits a sector where the females' share is higher than the males', more females will lose their job. The "mancession" incurred during the 2007 economic shock is contrasted by a *shecession* experienced after the Covid-19 shock, during which the hours worked by females' decreased while the males' hours worked remained unchanged (Alon et al., 2021). This phenomenon is also related to sectors, welfare and care. During the Covid-19 shock, many workers accomplished working at home. However, females found more difficulties working at home due to the time spent in care and house duties. Furthermore, schools were closed, and children were at home. As a result, females were less productive than males (Lyttelton et al., 2020).

Scholars do not pay much attention to the relationship between regional specialization and gender. However, the relationship between labor growth and specialization has been explored by Martini (2021), highlighting that increasing females' employment in sectors where females are already segregated is less effective than increasing females' employment in sectors where females are less segregated. Furthermore, the results of Mussida and Pastore (2015) for Italy highlighted that the regional gap in turnover rate is mainly due to differences in the gender of the workforce because females have more temporary jobs (Polavieja 2012).

Literature explored the complex relationship between gender and resilience from several points of view. Le Masson and Lovell (2016) explores the relationship between resilience, natural disaster, and climate change, while Bakas (2015) focuses on the relationship between community resilience and entrepreneurship. The journal Gender and Development 2015 made a special issue titled Gender and Resilience. The conclusion is that the concept of resilience needs to take into consideration also gender. Finally, Papageorgiou and Petousi (2018) empirically investigated the relationship between economic resilience and gender after the 2007 economic shock in Greece.

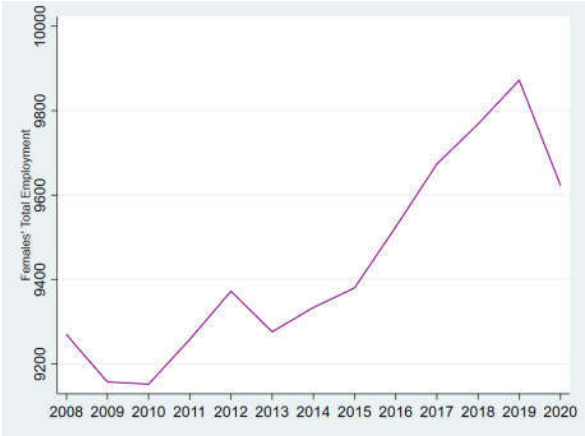
The literature shows a complex relationship between specialization, gender, and resilience that encompasses several cultural and economic dimensions. To address this multi-dimensionality in a single contribution is not feasible. For this reason, we start from the given regional specialization, measured by LQ index decomposed by gender to investigate the effects on the resilience process.

## 3. 3. Stylised facts

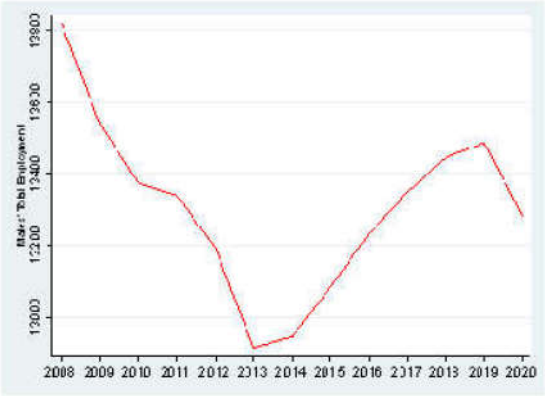
Our analysis focuses on Italian regions for the period 2008-2020 and aims to explore the labor market characteristics in terms of females and males. Data comes from the National Institute for Statistics (Istat); unfortunately, no data are available before 2008. Females and males display differences in employment growth, as depicted in Figure 1.

Figure 1: Employment growth Total, Females, and Males at the national level

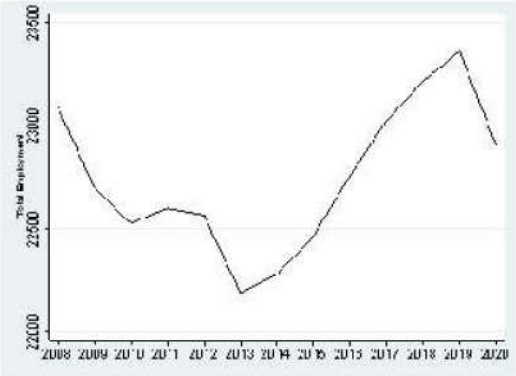
**Females' Total Employment**




**Males' Total Employment**




**Total Employment**

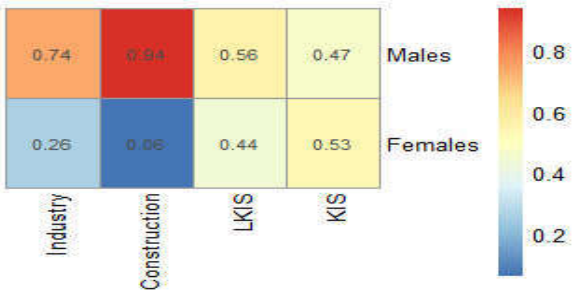



Source: ISTAT

Males' employment decreased during 2008-2013 while females' employment decreased during 2008-2010, followed by recovery during 2010-2012, a new decrease during 2012-2013, and a further recovery starting from 2013. Starting from 2013, females and males display the same employment trend. Consequently, females and males reacted differently to the shock. To investigate the reasons behind this different reaction, we will focus on the distribution of females and males between industries in Italy using data provided by ISTAT for 2008-2020 (the only period available). Due to the data availability, industries will be grouped into four sub-groups: Industry, Construction, Less Knowledge Intensive Services

(LKIS), and Knowledge-Intensive Services (KIS), as shown in Appendix. Figure 2 displays the females/males' share in each sub-group.

**Figure 2: Females and Males' share by sub-groups at national level (average 2008-2020)**




Source: our elaboration

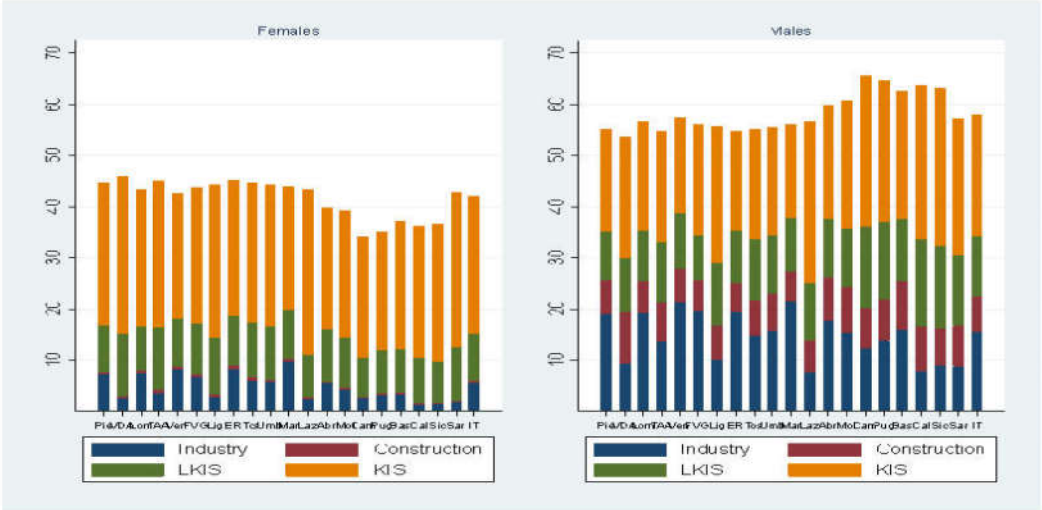
Figure 2 highlights the uneven distribution of females and males between sub-groups. For example, females have the highest share in the KIS sub-group, while the lowest share is construction (6%). It is well known that the 2007 economic shock mainly hit the industry and construction industries where the females' share is low. Consequently, females' employment was less hit by the shock than males' employment.

The uneven distribution between gender is known in the literature as gender segregation. Several indexes capture gender segregation (Emerek et al., 2003). Among them, the index of dissimilarity (ID) proposed by Duncan and Duncan (1955) measures the sum of the absolute difference in females and males' distribution over occupations:

$$ID = \frac{1}{2}\sum_i \left|\frac{M_i}{M} - \frac{F_i}{F}\right| \quad [1]$$

where M represents the total number of males in employment, $M_i$ is the number of males in sub-group *i,* F is the total number of females in employment, $F_i$ is the number of females in sub-group *i*. The ID index is equal to 0 in the case of complete equality (where females' employment is distributed similarly to males across occupations) and is equal to 1 in the case of *complete dissimilarity* (where females and males are in totally different occupational groups). Figure 3 displays the regional share of females/males' employment on the total employment in each sub-group (the regional map is in Appendix, figure A1).

Figure 3: Regional shares by gender. Regional females/males' employment in each sub-groups on the total employment.




Source: our elaboration

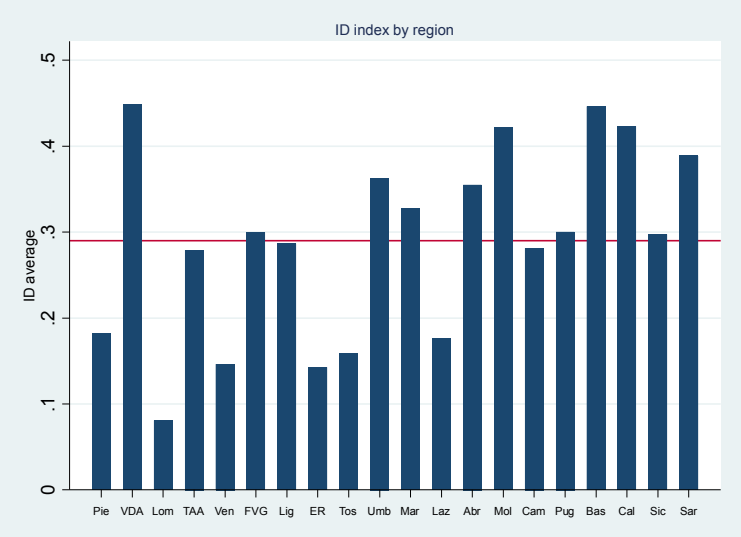
As depicted in Figure 3, females' employment differs between sub-groups and by region. Marche (a well-known district for shoes), for instance, has the highest share of females in the industry (9.73%), while Calabria displays the lowest share (1.32%).

Regional differences are evident, and they cannot be imputable only to the regional structure but also to social and cultural components. The shape of the employment

distribution is the observable part of significant, hidden, and unmeasurable interrelationships among social, historical, and cultural interplay.

Figure 4 displays the ID index as the average of the periods 2008-2020 by region. The red line represents the national ID index obtained as the average of the regional ID index. Figure 4 highlights differences between regions in terms of ID in Italy. Some regions, such as Lombardia, Emilia-Romagna, Veneto, and Toscana, are more gender-equal, while others such as Molise, Basilicata, Calabria, Sardegna, and Valle d'Aosta display greater gender discrimination. Moreover, except for Valle d'Aosta, the unequal regions are localized in the south of Italy (Appendix, figure A1).

**Figure 4: ID index as average of the periods 2008-2020 by region**



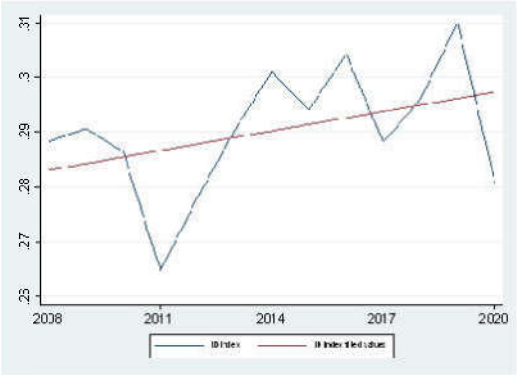

Source: Our elaboration

By comparing Figures 3 and 4, female workers are mainly employed in KIS and LKIS sub-groups but with important regional differences. Once again, southern regions employ a relatively lower share of women in these sectors than the northern ones. Hence, not only the gender gap is a matter of regional specialization but also a geographical one (Cutrini and Valentini, 2017). The well-known North-South divide regards not only the regional GDP, but it is evident also in terms of gender segregation.

Social and historical components drive the results. From the historical point of view, females have been employed in textile, starting from Middle Ages. Furthermore, they were educated in art and literature since Renaissance. Consequently, females are more concentrated in service sectors than industry sector. Moreover, due to the unpaid job (childcare, housecare), typically done by women, they preferred to be involved in work with more flexible hours (such as teaching). Finally, following the patriarchal roles firmly rooted in the southern regions, females typically do not work in the industry and, in general, are characterized by lower labor market participation.

If we look at the time series of the national ID index (Figure 5), we see that it is increasing after the 2007 economic shock. As a result, segregation between gender increased, and consequently, females became more segregated. Nevertheless, two turning points are evident in Figure 5 in 2011 and 2014. From 2008 to 2011, the ID index decreased, while from 2011 to 2014, it increased. From 2014 onwards, the ID index highlights a fluctuating trend.

**Figure 5: ID index at the national level during the period 2008-2020**




Source: our elaboration

This trend can be explained by looking at the labor growth rate by sub-groups, as depicted in Figure 6, which highlights that females' and males' labor growth during 2008-2013 have different growth rates but the same trend while, after 2013, by contrast, they have different growth rates and trends because females' labor growth rate is countercyclical to males' employment growth rate. Therefore, those other trends reflect in the ID index.

**Figure 6: Labour growth by gender and sub-groups**


Source: Our elaboration

### 3.1. From regional specialization to gender segregation

As discussed during the introduction, regional specialization is the result of productivity and endowments and depends on regional-specific components such as history, traditions, cultural beliefs, and social values. The stylized fact analysis highlighted that females and males are not employed in the same sub-groups. Moreover, this uneven distribution differs by region. Therefore, our first aim is to explore the relationship between regional specialization and gender segregation.

To measure regional specialization, we will use the Location Quotient (LQ):

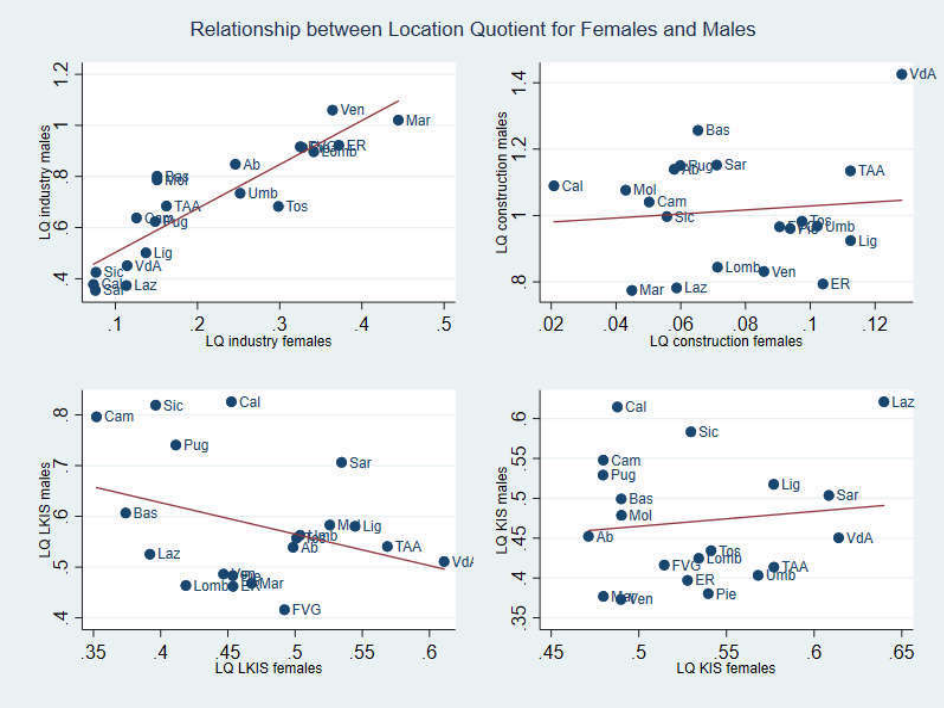
$$LQ_i = \frac{e_{ij}}{E_J} \Big/ \frac{E_i}{E} \qquad [2]$$

where $i$ is the sub-group and $j$ the region, $e_{ij}$ represents the employment in sub-group $i$ in region $j$, $E_j$ is the total employment in region $j$, $E_i$ is the employment at the national level in sub-group $i$, and E is the employment at the national level. LQ>1 means that the region is specialized in each sub-group. The Location Quotient does not consider gender. A region can be more specialized than the nation in a given sub-group due to a high number of employees, but those employees can belong all to the same gender. The total LQ in Eq.2 will be decomposed in:

$$LQ_{ij} = \frac{\left(\frac{e_{Fij}}{E_j} + \frac{e_{Mij}}{E_j}\right)}{\frac{E_i}{E}} = \underbrace{\frac{\frac{e_{Fij}}{E_j}}{\frac{E_i}{E}}}_{LQ_{Fij}} + \underbrace{\frac{\frac{e_{Mij}}{E_j}}{\frac{E_i}{E}}}_{LQ_{Mij}} \quad [3]$$

to consider regional specialization and gender in the same index. $e_{Fij}$ is the females' employment in sub-group $i$ in region $j$, $E_i$ is the national employment in sub-group $i$, $E_j$ is the regional employment, and E is the national employment. The sum of $LQ_{Fij}$ and $LQ_{Mij}$ is equal to the regional LQ. This decomposition allows us to consider the regional and regional specialization by gender. The LQ values, by regions and gender, are displayed in Appendix (figure A2). As expected LQ differs not only by region but also between gender in the same region. Figure 7 depicts the relationship between LQ for females and males by sub-groups and gender.

**Figure 7: LQ relationship between LQ for females and males by sub-groups (*)**




(*): R2 industry 0.835, R2 construction 0.006, R2 LKIS 0.126, R2 KIS 0.034)

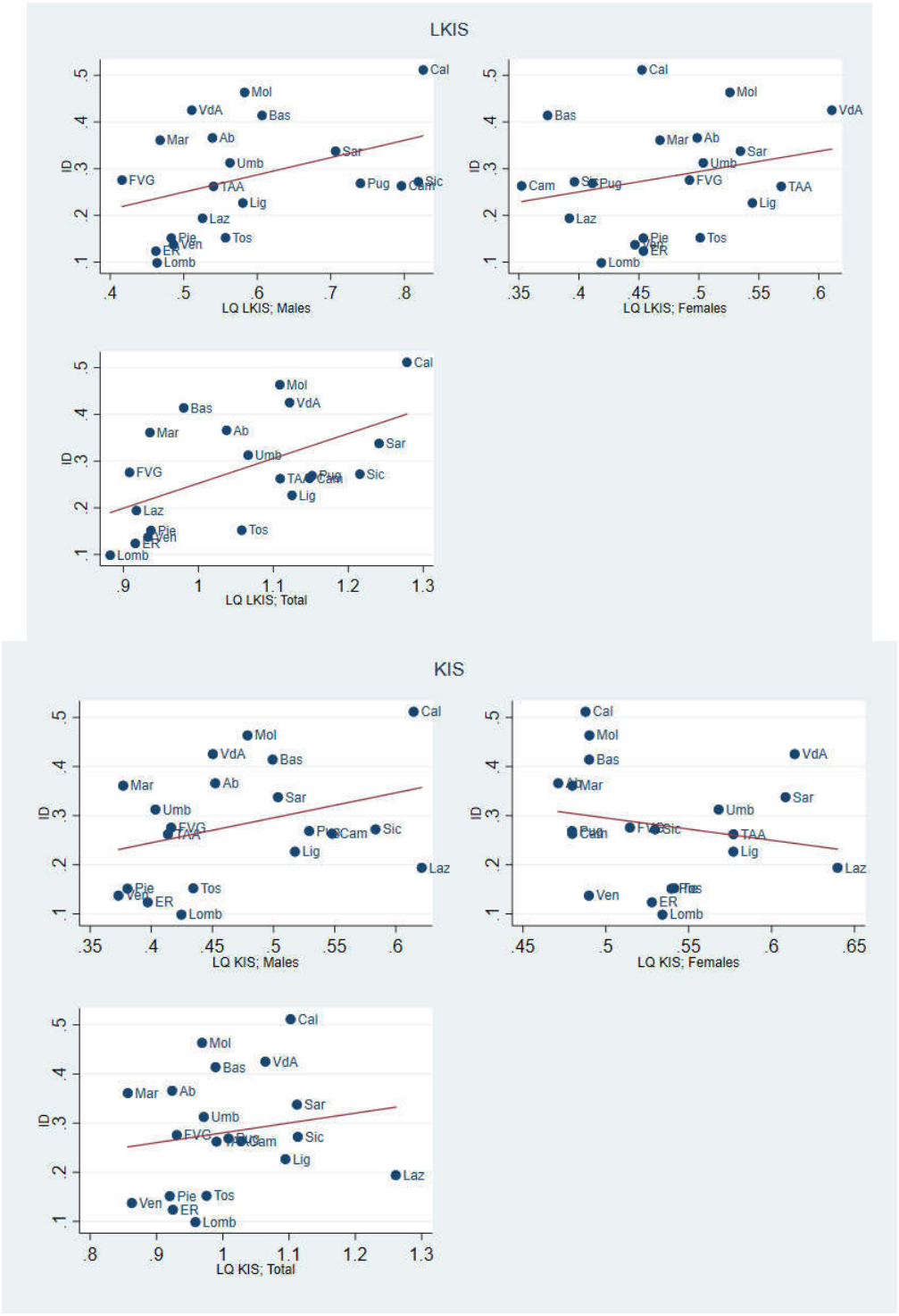
Figure 7 highlights a positive relationship between LQ for females and males in the industry sub-group (LQ in a region is the sum of LQf and LQm. If the sum is above one, the region is more specialized than the national average). Specialization in the industry (Carbonara and Giannoccaro, 2016) is an advantage for females and males. Regions more specialized in industry, such as Veneto, Emilia Romagna, and Lombardia, also display a higher share of females in this sub-sector (as pointed out in Figure 3). If regional specialization in industry increases in these regions, females are more likely to fall in this industry than in the other regions. Consequently, LQ in industry, for females and males, is positively related. Regions specialized in services are mainly localized in the South of Italy.

Furthermore, services sub-groups display an equal distribution between females and males within subgroups (as displayed in Figure 2). Nevertheless, these sub-groups have different behavior. In the LKIS sub-group, the males' share in the southern regions is higher than that of the females. For instance, in Campania, the males' share in LKIS is 15.8%, with 7.33% of the females' share (in Sicily, the females' share is 7.99%, and the males' share is 16.21%). In

Lombardia, by contrast, the females' share is 8.44%, while the males' share is 9.9% (in Piemonte, the females' share 9.55%, and the males' share is 10.82%). Even if southern regions are more specialized in LKIS (due to the higher value of LQ), a sub-group in which the females' share is considerable, in these regions' females have a lower probability of falling into this sub-group than in the other regions. KIS, by contrast, is a sub-group in which females and males are equally distributed, and there are no differences between regions. This sub-group displays the same behavior as the industry sub-group.

The previous analysis highlighted that some regions perform better than others in balancing male and female workers. We want to analyze how the result affects the segregation index. Figure 8 displays the relationship between ID index and Location Quotient by gender and by sub-groups.

**Figure 8: Relationship between ID index and LQ; LQ total and by gender (*)**




(*): R2 industry Total 0.175 R2 industry Female 0.238 R2 industry Males 0.134,
R2 construction Total 0.134, R2 construction Female 0.163 R2 construction Males 0.477
R2 LKIS Total 0.18 R2 LKIS Females 0.025 R2 LKIS Males 0.10
R2 KIS Total 0.04 R2 KIS Females 0.02 R2 KIS Males 0.09
Source: our elaboration

As depicted in Figure 8, the relationship between Location Quotient ad ID varies within sub-groups. For example, the industry and ID index displays a negative relationship. Regions more specialized in industry foster an equal distribution of workers. The result was largely expected because Figure 7 shows that females and males are, in some sense, complements. By contrast, the relationship between LQ and ID index in the LKIS sub-group is positive: the higher the regional specialization, the higher the regional dissimilarity.

### 3.2. Gender segregation and Resilience index

So far, we have explored the relationship between regional specialization and dissimilarity. Our second research question aims to explore the relationship between dissimilarity and resilience.

There are several ways to measure resilience. The mainstream EEG uses the Martin approach (Martin et al., 2016). Resilience is composed of two different components: resistance and recoverability. Resistance represents the region's ability to resist after the shock, while recovery represents the ability to recover after the shock. In Martin et al., (2016) approach, followed in our contribution, the resistance/recovery periods are calculated pick to pick with respect to the national economy. In this approach, the national economy is used as the expected growth path of the regional ones, with the idea that the latter adjusts to the national path. The Martin index is hence built by looking at the difference between the actual and the expected regional growth rate (measured by the national one) to measure the regional performance. In this sense, regions can lead or lag the national path, depending on if they are growing more or less than the national economy. In other approaches, as Han and Goetz (2015), the regional expected growth rate is measured locally by smoothing the time series over a window of ± 2 years.

Consequently, using Figure 1 in our contribution, we consider as resistance period of the recessionary downturn 2008-2010 for females, followed by a recovery period 2010-2012, a new resistance period 2012-2013, a recovery period between 2013-2019 and a new resistance period between 2019-2020. For males, the resistance period is 2008-2013, followed by a recovery period between 2013-2019 and a new resistance period between 2019-2020. Unfortunately, data by gender and sectors are not available before 2008. Consequently, it is impossible to explore and understand if the negative trend between 2008-2010 in women's total employment in Figure 1 of our contribution were already in progress before 2008. Martin et al., (2016) calculates the resilience index by comparing the movement of national employment (in contraction and expansion phases) concerning expected falls and increases in the region concerned. The expectation is that each region's employment would contract (in recession) and expand (in recovery) at the same rate as nationally. The expected change in employment in region *r* during recession or recovery of duration *k* periods would be given as:

$$\left(\Delta E_r^{t+k}\right)^e = \sum_i g_N^{t+k} E_{ir}^t \quad [4]$$

where $g_N^{t+k}$ is the rate of contraction (in recession) or expansion (in recovery) of national employment; and $E_{ir}^t$ is the employment in the industry *i* in region *r* in starting time *t*. The starting time *t* represents the turning point into recession or recovery. The measure of regional resistance can be expressed as:

$$Resistance_r = \frac{\left(\Delta E_r^{Contraction}\right) - \left(\Delta E_r^{Contraction}\right)^{expected}}{\left|\left(\Delta E_r^{Contraction}\right)^{expected}\right|} \quad [5]$$

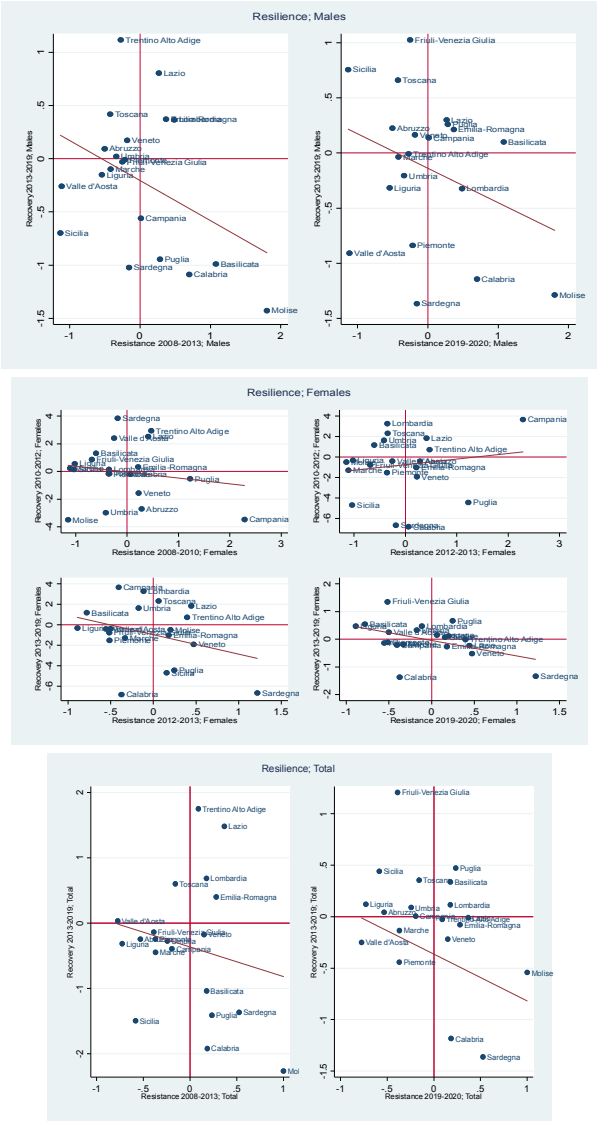
And the recoverability is given by:

$$Recovery_r = \frac{\left(\Delta E_r^{Recovery}\right) - \left(\Delta E_r^{Recovery}\right)^{expected}}{\left|\left(\Delta E_r^{Recovery}\right)^{expected}\right|} \quad [6]$$

The two measures of resistance and recovery are concentrated around zero. Thus, an R greater than zero indicates that a region is more resistant to recession or abler to recover more than the national economy.

Females' employment differs from males' employment during 2008-2013, attesting those females react differently to males to the 2007 economic shock. The relationship between resistance index and recovery index is depicted in Figure 9.

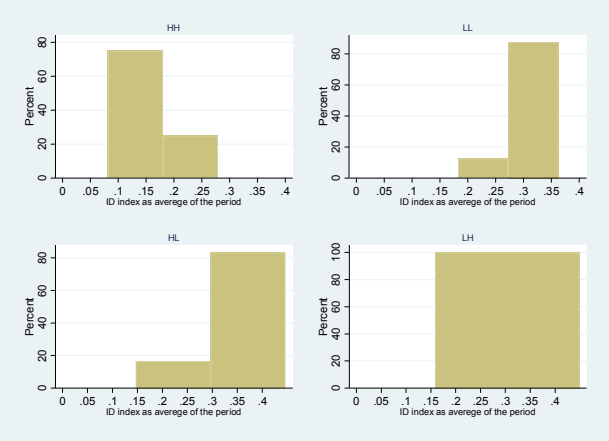
**Figure 9: Regional resistance and recoverability for Males, Females and the whole economy**




Source: our elaboration

The resilience index varies from shock to shock. Moreover, if gender is considered, resistance and recovery will be different. The resilience during the resistance and recovery period for males is similar to the whole economy, while resilience differs for females. According to the resilience index calculated on the whole economy, Regions can be divided into four different groups. The first group experienced a high resistance and recoverability (H;H). The second group experienced a high level of resistance and a low level of recoverability (H;L). A third one experienced a low level of resistance and high level of recoverability (L;H), and a fourth was composed of regions with low resistance and low recoverability (L;L). The relation between recovery, resistance and ID index is depicted in Figure 10. As shown in Figure, regions with high resistance and recoverability also exhibit a low dissimilarity index. Conversely, a higher dissimilarity index is associated with low resistance and recovery regions.

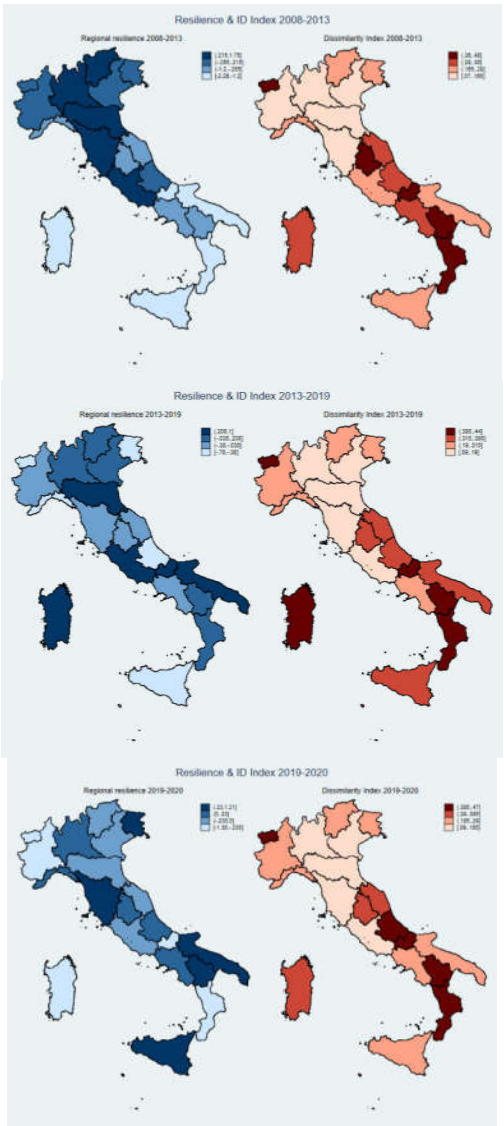
**Figure 10: Relationship between resistance/recoverability and dissimilarity index (ID)**




Source: our elaboration

The stylized facts highlighted that females and males are employed in different sub-groups. An index, the segregation index, captures this uneven distribution. Furthermore, regional specialization can differ by gender. Finally, the resilience index is different when gender is taken into account. Figure 11 maps the regional resilience and the ID index as period average.

**Figure 11: Relationship between resistance/recoverability and dissimilarity index (ID) at the regional level**



The maps highlight a negative relationship between regional resilience and ID index during the 2008-2013 i.e. the higher the resilience, the lower the dissimilarity. However, the relationship no longer holds during the recovery period 2013-2019 and the following resistance period (2019-2020). The following section of the paper aims to develop an empirical investigation to explore the relationship between regional specialization, dissimilarity index, and resilience.

## 4. Methodology and empirical investigation

The paper investigates a relationship between gender segregation and regional specialization and whether the more gender-equal are also more resilient. Our analysis will be developed in two steps. The first will consider the impact of specialization, captured by LQ by gender on the index of dissimilarity ID. The second one will explore the relationship between ID and resilience.

To explore the relationship between dissimilarity index and regional specialization, we will use the Location Quotient dived by gender obtained in equation [3]. Due to the collinearity, the LQ impact on ID will be estimated considering regional specialization in industry (*I*) and construction (*C*) for females and males. In this case, the Variance Inflation Factor (VIF) is less than 5, ensuring the absence of collinearity among covariates. The equation to be estimated is the following:

$$ID_{it} = \alpha_i + \beta_1 LQ_{FI} + \beta_2 LQ_{FC} + \beta_3 LQ_{MI} + \beta_4 LQ_{MC} + \varepsilon_{it} \quad [7]$$

To estimate equation [7] we will use a panel model with fixed effects. The results are depicted in Table 1.

**Table 1: estimation results**

| Location Quotient | Coefficient |
|---|---|
| $LQ_{FI}$ | -0.193** |
| | (0.0706) |
| $LQ_{FC}$ | -2.016*** |
| | (0.0940) |
| $LQ_{MI}$ | 0.0571 |
| | (0.0446) |
| $LQ_{MC}$ | 0.0683*** |
| | (0.0190) |
| Cons | 0.350*** |
| | (0.0405) |
| *N* | 260 |

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: our elaboration

ID is equal to 0 in the case of complete equality (where females' employment is distributed similarly to males across occupations). The results highlight that increases in females' regional specialization in sub-groups industry and construction, in which the females' share is low, decrease the dissimilarity index, while an increase in males' regional specialization in sub-group construction will cause an increase in the ID index. Furthermore, increasing employment in sub-groups where females' share is lower than males will decrease the ID index. Therefore, regions become more egalitarian in terms of gender.

To answer our research question: Does a more gender-equal regional specialization make territories more resilient? We will use the following estimation strategy. Indicating the fitted values of equation [7] as $\widehat{ID}_{it}$, a probit model will be used to explore the relationship between the resilience index at the regional level and the dissimilarity index. We use the fitted values $\widehat{ID}_{it}$ calculated as the regional average.

Our resilience index will be measured by a binary variable which will take a value of 1 if regions are resilient and 0 if they are not. Our regressions will be the following:

$$Pr(res_{08-13} = 1|\widehat{ID}_{i2008-2013}) = \phi(\beta_0 + \beta_1 \widehat{ID}_{i2008-2013}) \quad [8.1]$$

$$Pr(rec_{13-19} = 1|\widehat{ID}_{i2013-2019}) = \phi(\beta_0 + \beta_1 \widehat{ID}_{i2013-2019}) \quad [8.2]$$

$$Pr(rec_{19-20} = 1|\widehat{ID}_{i2019-2020}) = \phi(\beta_0 + \beta_1 \widehat{ID}_{i2019-2020}) \quad [8.3]$$

The results are depicted in Tables 2, 3, and 4. The results obtained using a probit model can be interpreted as how much the (conditional) probability of the outcome variable changes when the value of a covariate changes.

The results highlight that a more gender-equal region has more chance of being resistant than a less gender-equal one. However, this result holds only for the first resistance period (2008-2013), not for the remaining one. As previously highlighted, 2013 represents, in Italy, a turning point. Since 2013, the segregation index does not impact resilience. Therefore, regarding our second research question Q2, the results do not allow us to give an unambiguous answer.

**Table 2: Estimation result; period 2008-2013**

| **Resistance 2008-2013** | | | |
|---|---|---|---|
| | Total Economy | Males | Females |
| $\widehat{ID}_{i2008-2013}$ | -24.31* | -19.69* | -0.621 |
| | (12.09) | (9.014) | (6.212) |
| cons | 6.315 | 5.419* | -0.202 |
| | (3.312) | (2.571) | (1.851) |
| *N* | 20 | 20 | 20 |
| Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ | | | |
| McFadden's $R^2$: 0.530 | | | |
| Maximum Likelihood $R^2$: 0.476 | | | |

Source: our elaboration

**Table 3: Estimation result; period 2013-2019**

| **Recovery 2013-2019** | | | |
|---|---|---|---|
| | Total Economy | Males | Females |
| $\widehat{ID}_{i2013-2019}$ | 2.664 | 7.058 | -0.571 |
| | (6.218) | (6.277) | (6.178) |
| cons | -0.770 | -2.303 | 0.0395 |
| | (1.817) | (1.846) | (1.809) |
| *N* | 20 | 20 | 20 |
| Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ | | | |
| McFadden's $R^2$: 0.32 | | | |
| Maximum Likelihood $R^2$: 0.26 | | | |

Source: our elaboration

**Table 4: Estimation result; period 2019-2020**

| **Resistance 2019-2020** | | | |
|---|---|---|---|
| | Total Economy | Males | Females |
| $\widehat{ID}_{i2019-2020}$ | 1.897 | 1.831 | -2.170 |
| | (5.072) | (5.041) | (5.064) |
| cons | -0.531 | -0.512 | 0.607 |
| | (1.447) | (1.437) | (1.444) |
| *N* | 20 | 20 | 20 |
| Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ | | | |
| McFadden's $R^2$: 0.31 | | | |
| Maximum Likelihood $R^2$: 0.21 | | | |

Source: our elaboration

## 5. Discussion and conclusion

The paper aimed to merge three strands of literature, regional specialization, gender segregation, and resilience, to investigate the relationship between regional specialization and segregation index and between segregation index and resilience. Our contribution underlines the importance of including gender in the analysis. Females and males are not equally distributed between industries. Moreover, this uneven distribution varies from region to region. The empirical investigation confirms this result and enhances the idea that considering gender in the analysis is essential in terms of policy implications. Increasing employment is always a desirable aim.

Nevertheless, some policies can be effective only for some regions and sub-groups. Consequently, policies should consider the national dimension and the regional ones. Borrowman and Klasen (2020) have pointed out that tackling sectoral occupation is not easy. It requires the analysis of constraints that prevent females from moving from one sub-group to another, including social and welfare elements such as childcare and home duties. Furthermore, formal and informal barriers to accessing specific jobs need a deeper investigation.

Moreover, the social and mental barriers which induce females to choose some education fields instead of STEM fields need a deeper analysis. The National Recovery and Resilience Plan (PNRR) focuses on digitization, innovation, and ecological transition. Human capital is essential to operationalize the PNRR. Therefore, females must acquire technological competencies to compete in the job market. However, performing those policies is complex, and gender segregation remains pervasive.

Second, the analysis highlighted that the ID index could play a role in enhancing regional resistance. Creating more gender-equal regions can protect them from external shocks. This result holds only during the period 2008-2013. From 2013 onwards, there is no relationship between resilience and dissimilarity. This result can be imputable to the structural change that interested Italy starting from 1993 and exacerbated by the 2007 economic shock (Martini 2020). From 1993 Italy experienced a de-specialisation process switching from industry to the services sector. The latter represents an advantage for females. Nevertheless, as Kushi and MacManus (2021: 381) pointed out, whereas "labor market segregation in the early years of the crisis effectively sheltered women's employment and wages, long-term economic decline and fiscal consolidation, particularly cuts to public sector employment and social spending, have exposed women to greater labor market instability". Consequently, the relationship between resilience and dissimilarity did not hold anymore. Resilience literature highlighted that resilience is a process and it depends on several interrelated dimensions. To develop resilient regions decreasing gender segregation should remain an aim. Less segregated regions it is more protected by shock under the social dimension. Our analysis does not take into consideration temporary jobs, for instance.

Nevertheless, it is well known that the temporary position is mainly available in service sectors and is mainly filled in by females. This situation makes one gender more exposed to the external shock with economic and social consequences. In conclusion, gender is an important topic involving social and economic components. This topic cannot be ignored by policymakers.

Finally, a word on the North-South divide. Our analysis shows that regions behave in different ways: while some have a minor role in driving the gender composition, others show a remarkable negative impact on the ID. This is particularly true for Southern regions, even in sub-groups where we should expect higher female participation. As we argue, the reasons are mainly cultural, social, and historical and this makes the North-South divide in Italy still on the policymaker's agenda, not only as a question of "growth gap" but also of gender one.

## 6. References


Abbott, Michael G., and Charles M. Beach. 1994. "Wage changes and job changes of Canadian women: evidence from the 1986-87 labour market activity survey." *Journal of Human Resources*: 429-460.

Aigner, Dennis J., and Glen George Cain. 1977. "Statistical Theory of Discrimination in Labor Market". *ILR Review 30*, no. 2: 175-187.

Alesina, Alberto, Paola Giuliano, and Nathan Nunn. 2011 "Fertility and the Plough." *American Economic Review 101*, no. 3: 499-503.

Alexiadis, Stilianos. 2020. "Regional Convergence: Theory and Empirics." *Regional Science Inquiry 12*, no 1: 245-252.

Alon, Titan, Coskun, Sena, Doepke, Matthias, Koll, David, and Tertilt Michèle. 2021. From Mancession to Shecession: Women's employment in regular and pandemic recessions. National Bureau of Economic Research, no. w28632

Altonji, Joseph G., and Rebecca M. Blank. 1999. "Race and gender in the labor market." Handbook of labor economics 3: 3143-3259.

Augustine, Nancy, Wolman, Hal, Wial, Howard, and McMillen Mara. 2013. "Regional economic capacity, economic shocks, and economic resilience. Building resilient regions" (Working Paper). Berkeley Institute of Urban and Regional Development, University of California.

Bakas, Fiona. 2015. "The importance of investigating the role of gender in tourism's resilience to an economic crisis." *Revista Turismo & Desenvolvimento*, 23: 21-35.

Banerjee, Preet. 2010. "Feeling our way out of the mancession." Globe and Mail, 8 December.

Becchio, Giandomenica. 2018. "Gender, Feminist and Heterodox Economics: Interconnections and Differences in a Historical Perspective". *Economic Alternatives 1*: 5–24

Becker, Gary S. 1985. "Human capital, effort, and the sexual division of labor." *Journal of labor economics 3*, no.1: S33-S58.

Borrowman, Mary, and Stephan Klasen. 2020. "Drivers of gendered sectoral and occupational segregation in developing countries." *Feminist Economics 26*, no. 2: 62-94.

Boschma, Ron. 2005. "Rethinking regional innovation policy." Rethinking regional innovation and change. Springer, New York, NY: 249-271.

Boschma, Ron, and Ron Martin. 2010. "The aims and scope of evolutionary economic geography." The handbook of evolutionary economic geography. Edward Elgar Publishing.

Boserup, Ester. 1970. "Woman's Role in Economic Development", George Allen and Unwin, London

Carbonara, Nunzia, and Ilaria Giannoccaro. 2016. "Competitive success of industrial districts: An explorative study in Italy." *Regional Science Inquiry 8*, no.1: 99-115.

Castaldi, Carolina, Koen, Frenken, and Bart Los. 2015. "Related variety, unrelated variety and technological breakthroughs: an analysis of US state-level patenting." *Regional studies 49*, no. 5: 767-781.

Chacon-Hurtado, Davis, Kumar, Indraneel, Gkritza, Konstantina, Fricker, Jon D., and Beaulieu Lionel J. 2020. The role of transportation accessibility in regional economic resilience. *Journal of transport geography 84*: 102695.

Correia, Leonida, and Marina Alves. 2017. "Regional employment in Portugal: differences and cyclical synchronisation." *Regional Science Inquiry 9*, no.2: 159-175.

Cuadrado-Roura, Juan R., and Andrés Maroto. 2016. "Unbalanced regional resilience to the economic crisis in Spain: a tale of specialisation and productivity." *Cambridge Journal of Regions, Economy and Society 9*, no.1: 153-178.

Cuberes, David, and Marc Teignier. 2014. "Gender inequality and economic growth: A critical review." *Journal of International Development 26*, no. 2: 260-276.

Cutrini, Eleonora, and Enzo Valentini. 2017. "Regional strategies for dealing with structural change." *Regional Science Inquiry 9*, no.1: 107-118.

Das, Smita, and Aphichoke Kotikula. 2018. Gender Based Employment Segregation: Understanding Causes and Policy Interventions. Washington: World Bank.

Dauth, Wolfgang, Michaela Fuchs, and Anne Otto. 2018. "Long-run processes of geographical concentration and dispersion: Evidence from Germany." *Papers in Regional Science 97*, no. 3: 569-593.

Davies, Benjamin, and David C. Maré. 2021. "Relatedness, complexity and local growth." *Regional Studies 55*, no. 3: 479-494.

Dawley, Stuart, Andy Pike, and John Tomaney. 2010. "Towards the resilient region?." *Local Economy 25*, no.8: 650-667.

Di Caro, Paolo. 2015. "Recessions, recoveries and regional resilience: evidence on Italy." *Cambridge Journal of Regions, Economy and Society 8*, no.2: 273-291.

Di Caro, Paolo. 2017. "Testing and explaining economic resilience with an application to I talian regions." *Papers in Regional Science 96*, no.1: 93-113.

Diodato, Dario, and Anet BR Weterings. 2015. "The resilience of regional labour markets to economic shocks: Exploring the role of interactions among firms and workers." *Journal of Economic Geography 15,* no. 4: 723-742.

Duncan, Otis Dudley, and Beverly Duncan. 1955. "A methodological analysis of segregation indexes." *American sociological review 20*, no.2: 210-217.

Duran, Hasan Engin. 2019. "Regional unemployment dynamics in Turkey." *Regional Science Inquiry 11*, no. 1: 9-23.

Duvvury, Nata, and Caroline Finn. 2014. "'Man-covery': recession, labour market, and gender relations in Ireland." *Gender, Sexuality, and Feminism 1*, no.2

Emerek, Ruth, Figueiredo, Hugo, González, Pilar, Gonäs, Lena, and Rubery Jill. 2003. "Indicators on gender segregation.". Rapport, CETE, Faculdade de Economia, Universidade do Porto.

Fan, C. Cindy, and Allen J. Scott. 2003. "Industrial agglomeration and development: a survey of spatial economic issues in East Asia and a statistical analysis of Chinese regions." *Economic geography 79*, no.3: 295-319.

Frenken, Koen, and Ron Boschma. 2015. "Geographic clustering in evolutionary economic geography." Handbook of Research Methods and Applications in Economic Geography. Edward Elgar Publishing: 291-302.

Frenken, Koen, Frank Van Oort, and Thijs Verburg. 2007. "Related variety, unrelated variety and regional economic growth." *Regional studies 41*, no.5: 685-697.

Fritsch, Michael, and Sandra Kublina. 2018."Related variety, unrelated variety and regional growth: the role of absorptive capacity and entrepreneurship." *Regional Studies 52*, no.10: 1360-1371.

Hakim, Catherine. 2000. "Work-Lifestyle Choices in the 21st Century." Oxford: Oxford University Press.

Hall, Donna, Gains, Francesca, Lupton, Ruth, Sanders, Anna, Howcroft, Debra, Rubery, Jill, Norman, Helen, Fagan, Colette, Teasdale, Nina, White, Cath, Majeed-Aris, Rabiya, Gadd, David, and Price Debora. 2019. "On Gender: Analysis and Ideas on taking Gender Lens to Policy." Mancester: Mancester Universtity.

Han, Yicheol, and Stephan J. Goetz. 2015. "The economic resilience of US counties during the great recession." *Review of Regional Studies 45*, no.2: 131-149.

Hirschler, Petra. 2010. "Gender and Regional Studies." *Regional Insights 1*, no.1: 3-3.

Holling, Crawford S. 1973. "Resilience and stability of ecological systems." *Annual review of ecology and systematics:* 1-23..

Jackson, Edgar L., and Karla A. Henderson. 1995. "Gender-based analysis of leisure constraints." *Leisure sciences 17,* no.1: 31-51.

Kushi, Sidita, and Ian P. McManus. 2021. "Gender, austerity and the welfare state." Handbook on Austerity, Populism and the Welfare State. Edward Elgar Publishing: 375-394.

le Masson, Virginie, and Emma Lovell. 2016. "Equity and Inclusion in Disaster Risk Reduction: Building Resilience for all," *eSocialSciences*, Working Papers id:11362,

Lyberaki, Antigonea, Tinios, Platonb, Papadoudis, Georgea, and Georgiadis Thomasa. 2017. "Do People With A Different Employment Background Age Differently? European Evidence from the Share Survey". *Regional Science Inquiry Journal 9*, no. 2: 197-209.

Lyttelton, Thomas, Emma, Zang, and Kelly Musick. 2020. "Gender differences in telecommuting and implications for inequality at home and work." Yale University, New Haven, CT.

Martin, Ron. 2012. "Regional economic resilience, hysteresis and recessionary shocks." *Journal of economic geography 12,* no.1: 1-32.

Martin, Ron, Sunley, Peter, Gardiner, Ben, and Tyler Peter. 2016. "How regions react to recessions: Resilience and the role of economic structure". *Regional Studies 50,* no.4: 561-585.

Martini, Barbara. 2020. "Resilience and Economic Structure. Are they related?" *Structural Change and Economic Dynamics 54*: 62-91.

Martini, Barbara. 2021. "Genere e specializzazione produttiva. Esiste una relazione? Una analisi spazio-temporale per le province italiane." *ANNALI MEMOTEF*.

McKay, Ailsa, Campbell, Jim, Thomson, Emily, and Ross Susanne. 2013. "Economic recession and recovery in the UK: what's gender got to do with it?" *Feminist Economics 19*, no.3: 108-123.

Mussida, Chiara, and Francesco Pastore. 2015. "Worker turnover across Italian regions." Geographical Labor Market Imbalances. Springer, Berlin, Heidelberg: 17-35.

Neffke, Frank, Henning, Martin, Boschma, Ron, Lundquist, Karl-Johan, and Olander Lars-Olof. 2011. The dynamics of agglomeration externalities along the life cycle of industries. *Regional studies 45*, no.1: 49-65.

Noback, Inge, Lourens Broersma, and Jouke Van Dijk. 2013. "Gender-specific spatial interactions on Dutch regional labour markets and the gender employment gap." *Regional Studies 47*, no.8: 1299-1312.

O'Reilly, Jacqueline, and Claudia Spee. 1977. "Regulation work and welfare of the future: towards a new social contract or a new gender contract?." *European Journal of Industrial Relations 4*, no.3: 259-81

Olivetti, Claudia, and Barbara Petrongolo. 2016. The evolution of gender gaps in industrialized countries. *Annual Review of Economics 8:* 405-434.

Østergaard, Christian R., Bram, Timmermans, and Kari Kristinsson. 2011. "Does a different view create something new? The effect of employee diversity on innovation." *Research policy* 40, no.3: 500-509.

Papageorgiou, Yota, and Vasiliki Petousi. 2018. "Gender resilience in times of economic crisis: Findings from Greece." *Partecipazione e Conflitto 11,* no.1: 145-174.

Pavlyuk, Dmitry. 2011. "Spatial analysis of regional employment rates in Latvia." *Sustainable spatial development* 2: 56-62.

Petrongolo, Barbara, and Maddalena Ronchi. 2020. "Gender gaps and the structure of local labor markets." *Labour Economics 64*.

Polavieja, Javier G. 2012. "Socially embedded investments: explaining gender differences in job-specific skills." *American Journal of Sociology 118*, no.3: 592-634.

Ray, Michael D., MacLachlan, Ian, Lamarche, Rodolphe, and Srinath K. P. 2017. "Economic shock and regional resilience: Continuity and change in Canada's regional employment structure, 1987–2012." *Environment and Planning A 49*, no. 4: 952-973.

Renschler, Chris S., Frazier, Amy E., Arendt, Lucy A., Cimellaro, Gian-Paolo, Reinhorn, Andrei M., and Bruneau Michel. 2010. "A framework for defining and measuring resilience at the community scale: The PEOPLES resilience framework." NIST GCR 10-930. Gaithersburg, Maryland: U.S. Department of Commerce, National Institute of Standards and Technology, Office of Applied Economics Engineering Laboratory.

Sastre, Juan Fernández. 2015. "The impact of R&D teams' gender diversity on innovation outputs." *International Journal of Entrepreneurship and Small Business 24*, no.1: 142-162.

Seguino, Stephanie. 2000. "Gender inequality and economic growth: A cross-country analysis." *World development 28,* no.7: 1211-1230.

Seguino, Stephanie. 2009. "The global economic crisis, its gender implications, and policy responses." Paper prepared for gender perspectives on the financial crisis panel at the fifty-third session of the commission on the status of women, United Nations.

van Egeraat, Chris, Morgenroth, Edgar, Kroes, Rutger, Curran, Declan, and Gleeson Justin. 2018. A measure for identifying substantial geographic concentrations. *Papers in Regional Science 97*, no. 2: 281-300.

Wang, Zanxin, and Wei Wei. 2021. "Regional economic resilience in China: Measurement and determinants." *Regional Studies 55,* no.7: 1228-1239.

Williams, Katherine Y., and O'Reilly III Charles A. 1998. "Demography and Diversity in Organizations: A Review of 40 Years of Research." *Research in organizational behavior 20*, 77-140.

Xie, Luqun, Zhou, Jieyu, Zong, Qingqing, and Lu Qian. 2020. "Gender diversity in R&D teams and innovation efficiency: Role of the innovation context." *Research Policy, 49*, no.1: 103885.

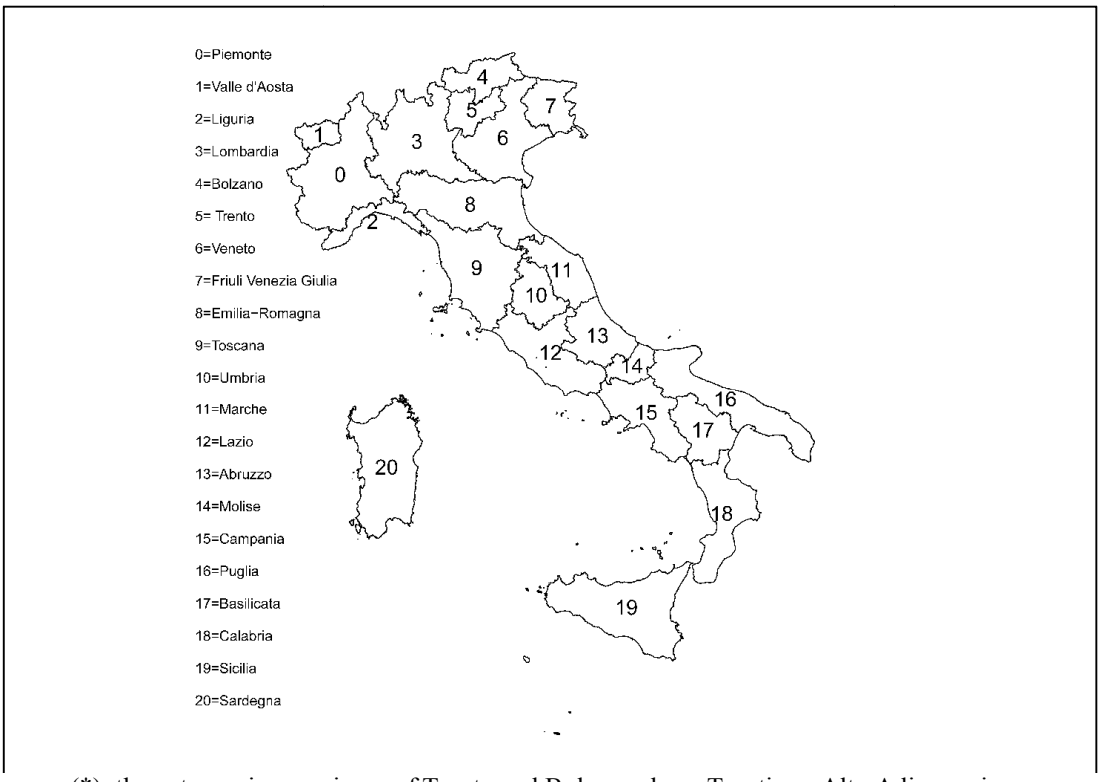
## 7. Appendix

**Table A. Sectoral definition NACE2_Rev**

| **Group 1: Industry (I)** | **B** | **Mining and quarrying** |
|---|---|---|
| Group 1: Industry (I) | C | Manufacturing |
| Group 1: Industry (I) | D | Electricity, gas, steam and air conditioning supply |
| Group 1: Industry (I) | E | Water supply; sewerage, waste management and remediation activities |
| Group 2: Construction (C) | F | Construction |
| Group3: Less Knowledge Intensive Services (LKIS) | G | Wholesale and retail trade; repair of motor vehicles and motorcycles |
| Group3: Less Knowledge Intensive Services (LKIS) | H | Transportation and storage |
| Group3: Less Knowledge Intensive Services (LKIS) | I | Accommodation and food service activities |
| Group4: Knowledge Intensive Services (KIS) | J | Information and communication |
| Group4: Knowledge | K | Financial and insurance activities |

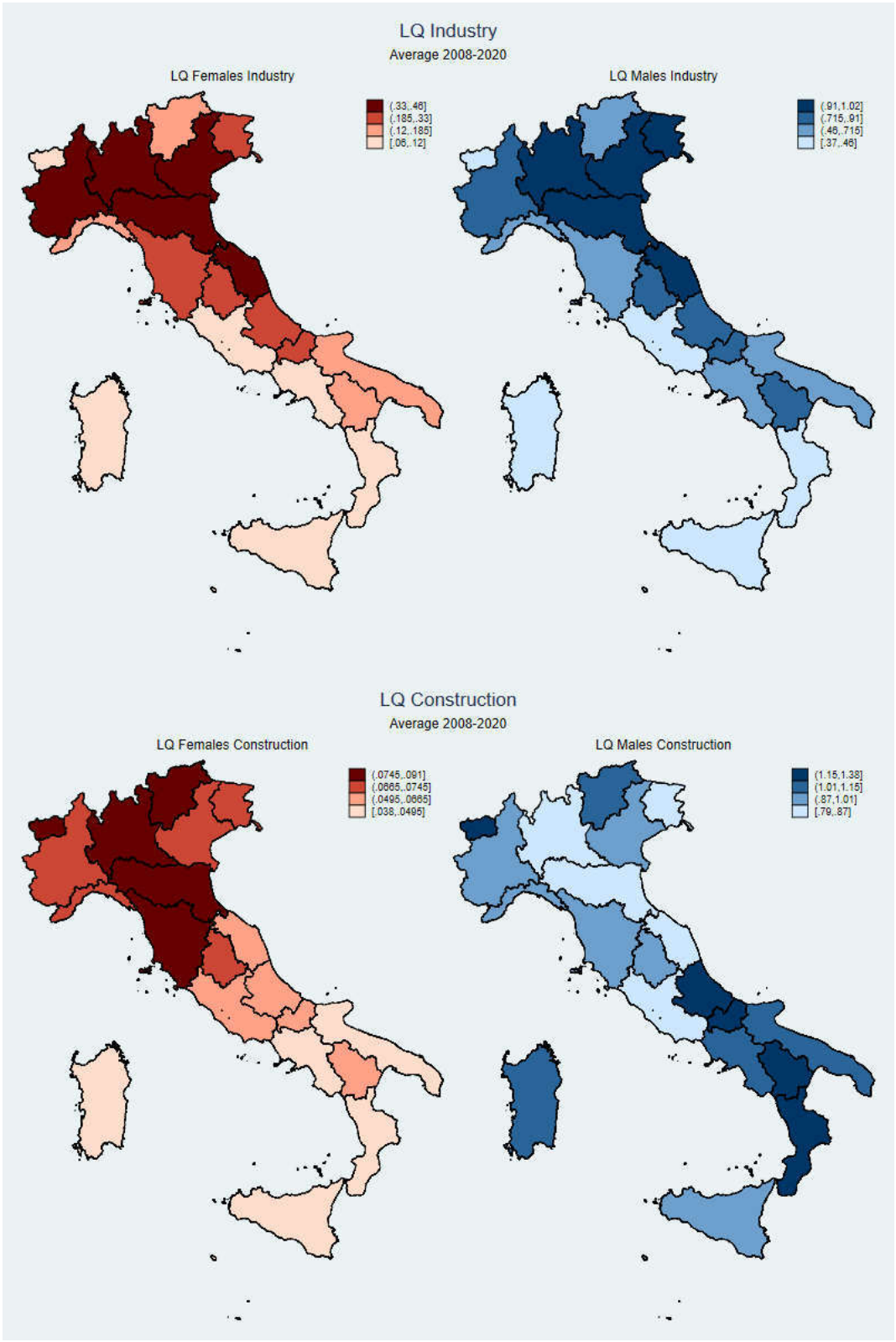
| | | | |
|---|---|---|---|
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | L | Real estate activities |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | M | Professional, scientific, and technical activities |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | N | Administrative and support service activities |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | P | Education |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | Q | Human health and social work activities |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | R | Arts, entertainment, and recreation |
| Intensive Services (KIS) | | | |
| Group4: | Knowledge | S | Other service activities |
| Intensive Services (KIS) | | | |

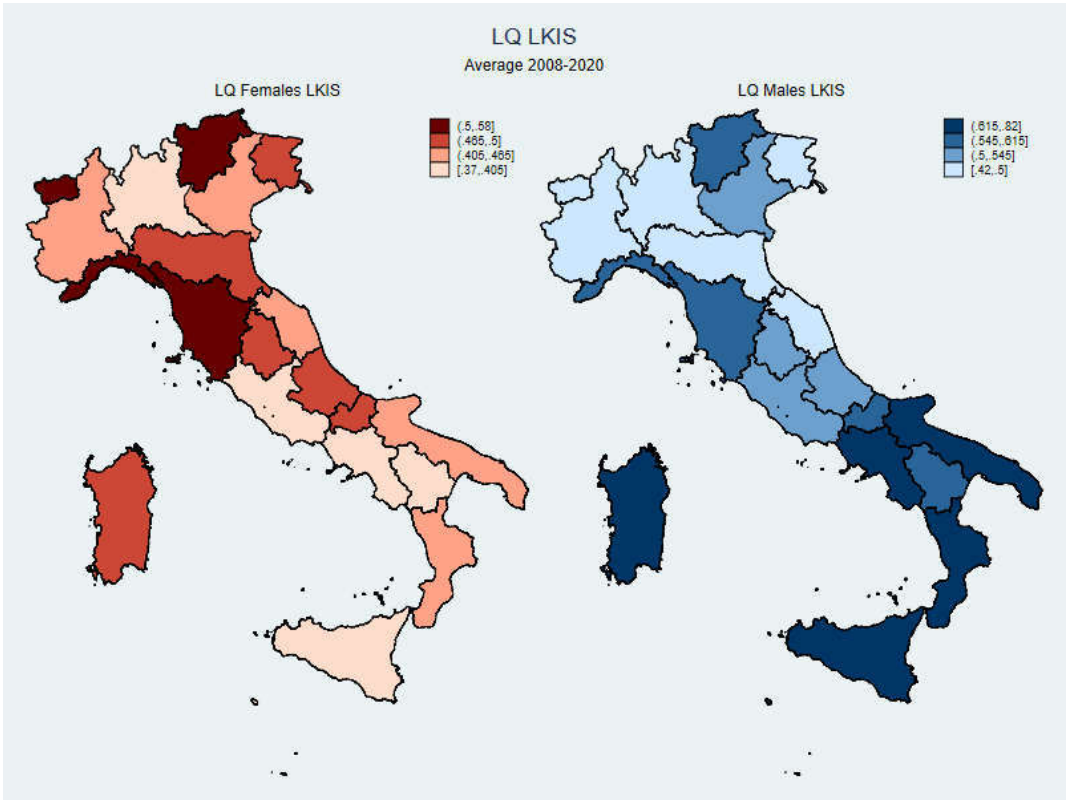
**Figure A1: Regional map of Italy (*)**

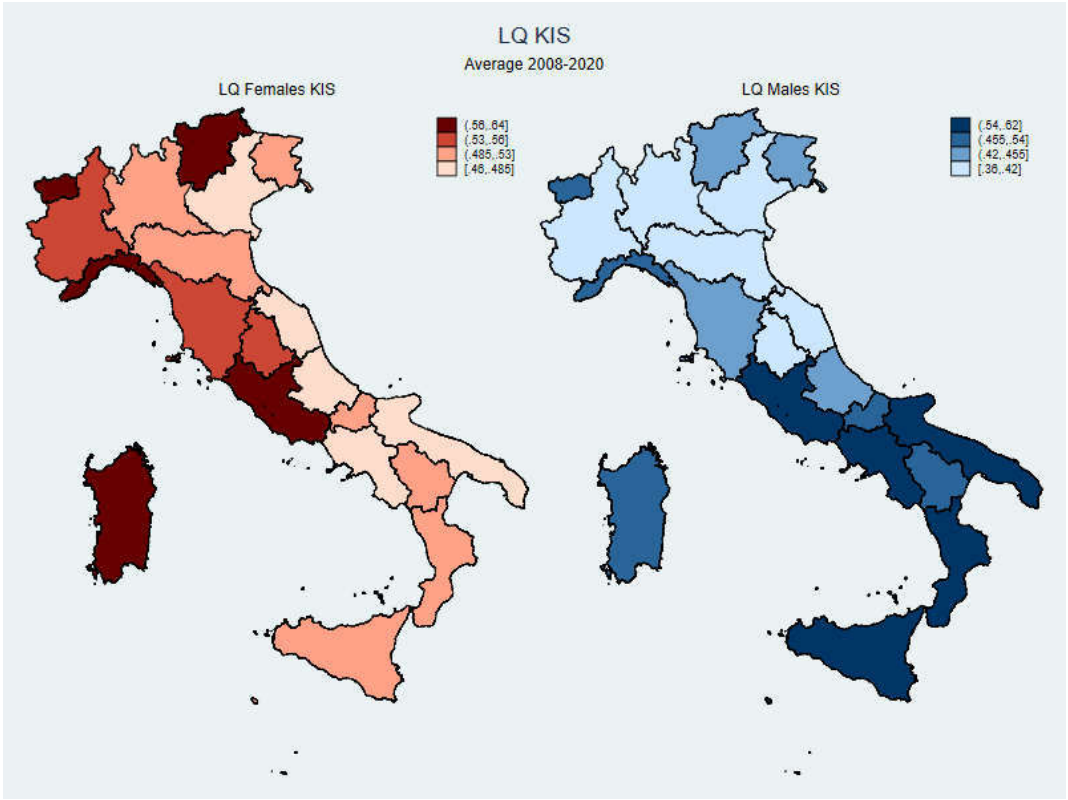



(*): the autonomies provinces of Trento and Bolzano shape Trentino - Alto Adige region

**Figure A2: LQ by gender**






Source: our elaboration