

Are the regions with more gender equality the more resilient one?

An analysis for the Italian regions.

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Abstract

The paper aim is to merge three strands of literature: regards regional specialization, gender segregation, and resilience and exploring the impact of regional specialization on gender segregation and the impact of gender segregation on resilience. Our results put several significant results forwards. First, there is a relationship between gender segregation and regional specialization. The higher is the regional specialization in sectors in which the females' share is low, the higher is the dissimilarity. Second, there is a positive relationship between resilience and gender equality for the period 2008-2013. The more gender equality regions are also the more resilient ones. Tacking sectoral occupation is not an easy task and it includes social values, cultural components, welfare, education, and soft skill. Policies should also address their effort to enhance the welfare component, social dimensions and break down gender stereotypes.

Key words: Gender, Regional specialization, Dissimilarity, Resilience, Italy

Jel Code O18, R11, R19

1. Introduction

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 roles¹. Following this definition, gender is a cultural category related to the complex social construction of sexual identities, hierarchies, and interactions (Becchio 2018).

The first economic contributions that included gender in the analysis (Aigner et al., 1977, Becker, 1985) focused on the different participation rates to the labour market for females and males and the gender pay gap (Abbot and Beach 1994, Altonji and Blank 1999) while the first micro-founded model was developed by Hakim (2000), in which the author uses the preference to explain females' behaviour and choices between employment and family work. Outset from this pioneering

¹ <https://www.euro.who.int/en/health-topics/health-determinants/gender/gender-definitions>

contribution, a growing body of economic literature aims to investigate the different behaviour of females and males in the job market and their consequences on gender segregation². 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. The first is generally pictured as women and men's disparate concentration across industries and occupations. In contrast, the second one refers to gender disparities in positions and roles with different statuses or employment advancement potential. The unequal distribution of females and males between industries means that an increase of females in the labour market will not be equally distributed between industries. As a result, females have a greater probability of falling in some industries than others. Employment segregation has significant consequences for overall 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 labour force participation.

Despite the gender acquired and 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). Our contribution aims to fill this gap by merging three strands of literature. The first one regards regional specialization, the second one concerning gender segregation, and the third one about resilience. To our knowledge, this is the first contribution exploring this topic. The relationship between regional specialization and resilience has been explored 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.

² <https://eige.europa.eu/thesaurus/terms/1210> Eige defines gender segregation as "Differences in patterns of representation of women and men in the labour market, public and political life, unpaid domestic work and caring, and in young women's and men's choice of education".

Nevertheless, 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., (2013) 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 *mancecession*- 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 also to the different share of females and males between industries (Banerjee, 2010). As Boshma (2005) pointed out, 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 the job. The "mancecession" 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 have 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 labour growth and specialization have been explored by Martini (2021), highlighting that increasing females' employment in sectors in which females are already segregated is less effective than increasing females' employment in sectors in which females are less segregated. Furthermore, the results obtained by Mussidda 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 temporarily jobs (Polavieja 2012).

The relationship between regional specialization and gender segregation is still a new topic, and our contribution aims to fill in this gap by exploring it. Therefore, our first research question is:

Q1: Is there a relationship between gender segregation and regional specialization?

Furthermore, females are more concentrated in some industries than others. Therefore, if a sector-specific shock has hit a region, the chances that only one gender will be hit are higher in a more dissimilar region, where one gender is predominant on the other one in some industries than in a more similar region. Hence, our second research question is:

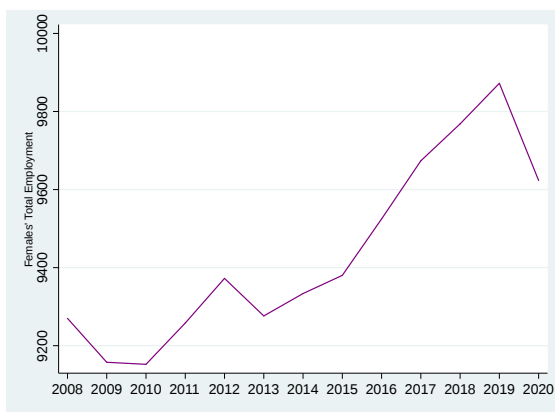
Q2: Are the more gender-equal region the more resilient ones?.

Our empirical analysis puts several significant results forwards. First, there is a relationship between gender segregation and regional specialization. The higher is the regional specialization in sectors in which the females' share is low, the higher is the dissimilarity. Therefore, a re-equilibrium in terms of gender between sectors is desirable to reduce the dissimilarity.

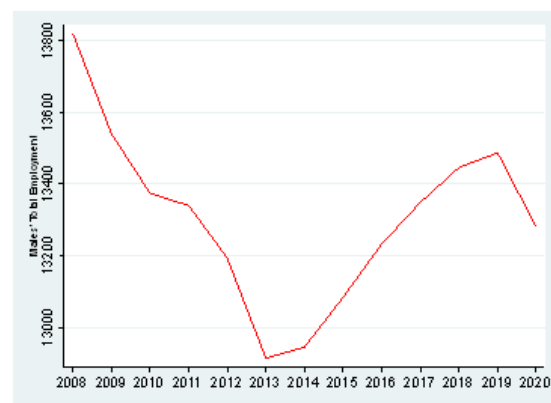
Nevertheless, tackling sectoral occupation is not an easy task. Regional specialization and sectoral occupation emerge from social values, cultural components, education, and soft skill. Policies should also address their effort to enhance the social component and break down gender stereotypes. Furthermore, there is a positive relationship between resilience and gender equality. The more gender equality regions are also the more resilient ones. Gender equality enhances social inclusion, while resilience also includes social components. Creating a resilient place means also creating more inclusive places. To reach these findings, we structure our contribution as follows. The following section will present stylized facts, while the third section will provide the empirical investigation. The final is devoted to discussing policies and research implications related to our findings.

2. Stylized facts

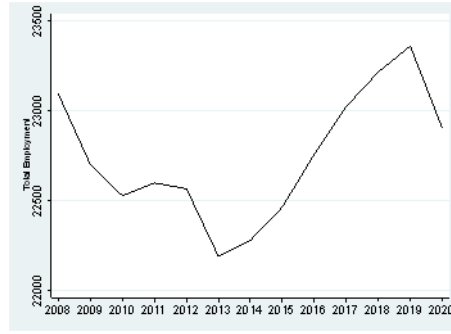
Females and males differ in terms of employment. Figure 1 plots the employment growth in Italy for the period 2008-2020:



Females' Total Employment



Males' Total Employment



Total Employment

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

Males' employment decreases during the period 2008-2013 while females' employment display a decrease during the period 2008-2010, a recovery during the period 2010-2012, a new decrease during the period 2012-2013 and a new 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 1. Figure 2 displays the females/males' share in each sub-group.

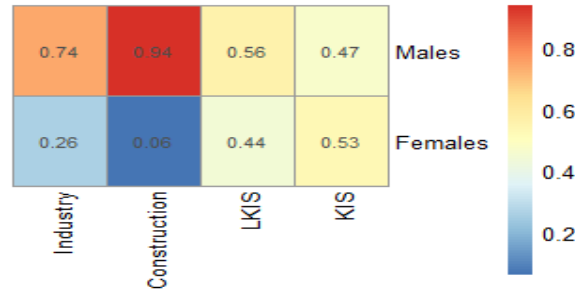


Figure 2: Females and Males' share by sub-groups at national level (average 2008-2020)
Source: our elaboration

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%). This 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 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 ID index at the national level:

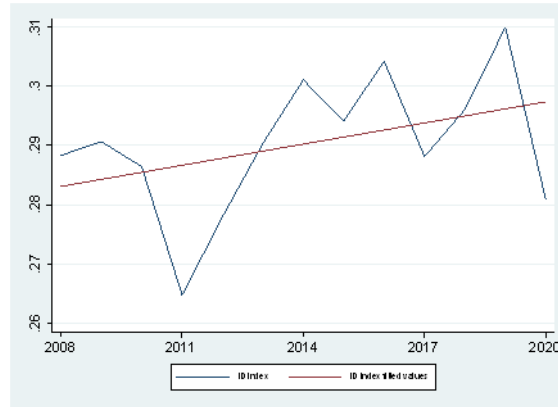


Figure 3: ID index at the national level during the period 2008-2020
Source: our elaboration

The ID index trend is increasing after the 2007 economic shock. Segregation between gender increased, and consequently, females became more segregated. Nevertheless, two turning points are evident in Figure 3 in 2011 and in 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. This trend can be explained by looking at the labour growth rate by sub-groups, as depicted in Figure 4

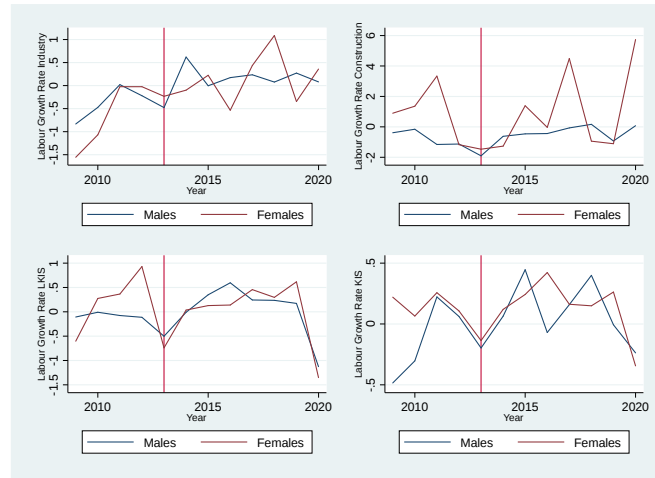


Figure 4: Labour growth by gender and sub-groups
Source: Our elaboration

Figure 4 highlights that females' and males' labour growth during 2008-2013 have different growth rates but the same trend. After 2013, by contrast, they have different growth rates and trends. Those different trends reflect in the ID index.

Gender segregation can be imputable to social and economic components. We aim to focus on regional specialization. To capture it, we will use the Location Quotient (LQ):

$$LQ_i = \frac{\frac{e_{ij}}{E_j}}{\frac{e_i}{E}} \quad [2]$$

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:

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

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. As expected LQ differs not only by region but also between gender in the same region. Figure 5 displays the relationship between ID index and Location Quotient by gender and by sub-groups:

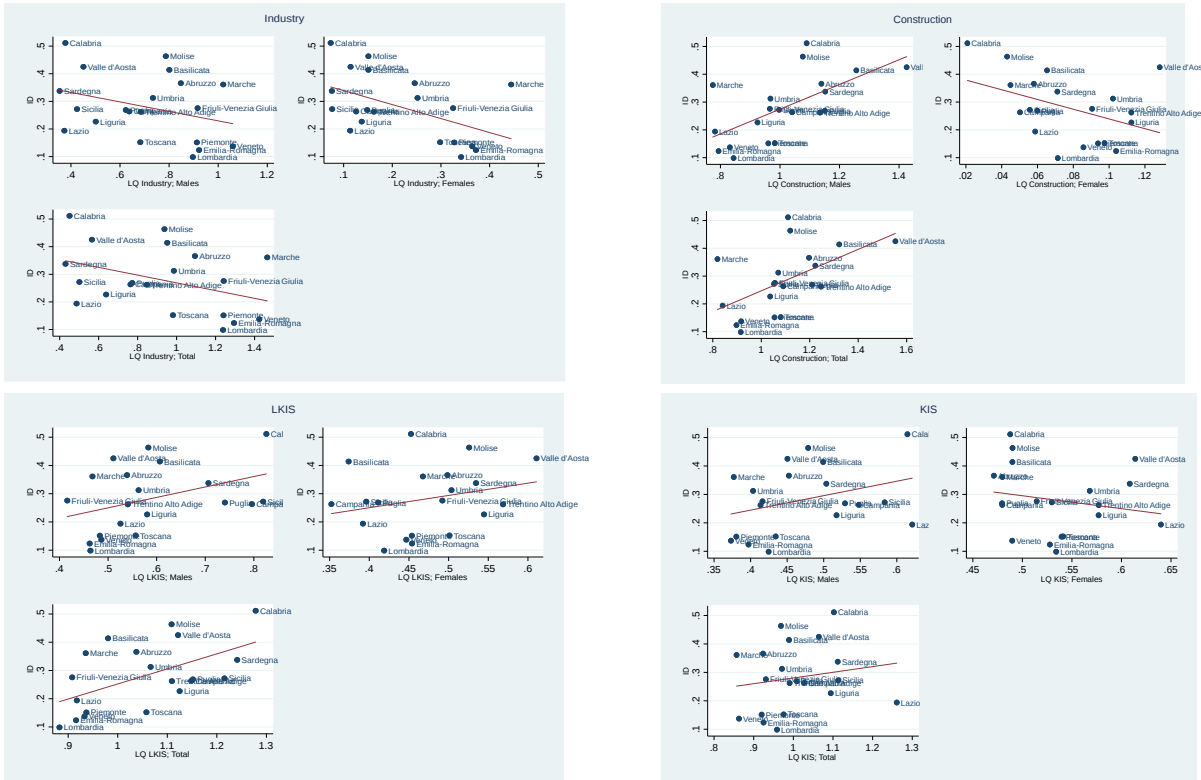


Figure 5: Relationship between ID index and LQ; LQ total and by gender

Source: our elaboration

As depicted in Figure 5, the relationship between Location Quotient in Industry and ID index is negative. Regions more specialized in the industry are the more equal ones. By contrast, the relationship between LQ in the LKIS sub-group and the ID index is positive. The higher is the regional specialization in this sub-group, the higher is the regional dissimilarity. Constructions and KIS sub-groups display a mixed path. The relationship is positive when the total LQ and the male

LQ are considered, while the relationship is negative when females are considered. This result highlights that dissimilarity and LQ are related and that the relationship will vary by gender.

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. In measuring resilience, we will adopt the approach developed by Martin et., (2016) that calculates it 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:

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

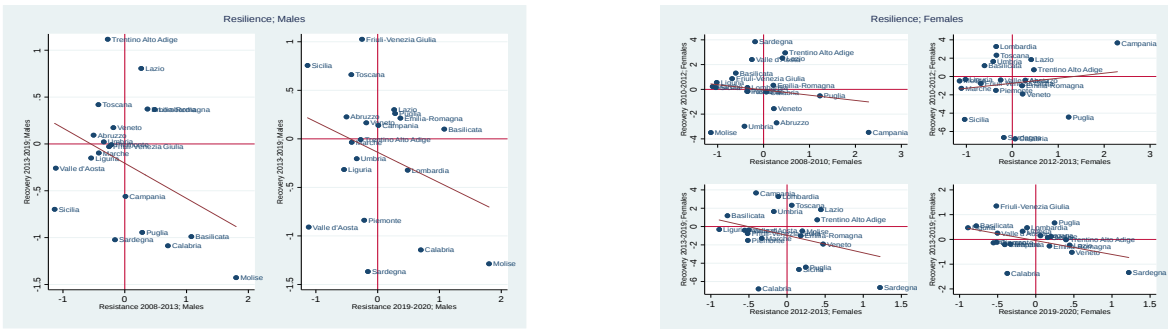
where g_N^{t+k} is the rate of contraction (in recession) or expansion (in recovery) of national employment; and E_{ir}^t is the employment in the industry i in region r in starting time t . The starting time t represents the turning point into recession or recovery. The measure of regional resistance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

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

And the recoverability is given by:

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

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. According to Figure 1, the resistance period for males and the entire economy is during 2008-2013, followed by a recovery period between 2013-2019 and a new resistance period between 2019-2020. Regarding the females' employment, the first resistance period is 2008-2010, 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. 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 6:



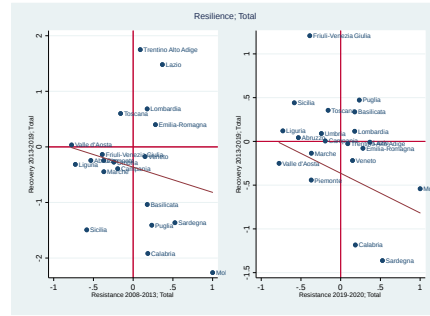


Figure 6 Regional resistance and recoverability for Males, Females and the whole economy

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 7:

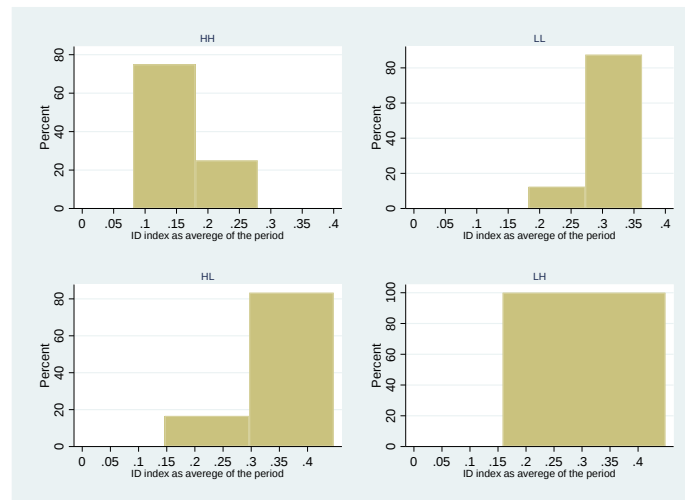


Figure 7: Relationship between resistance/recoverability and dissimilarity index (ID)

Source: our elaboration

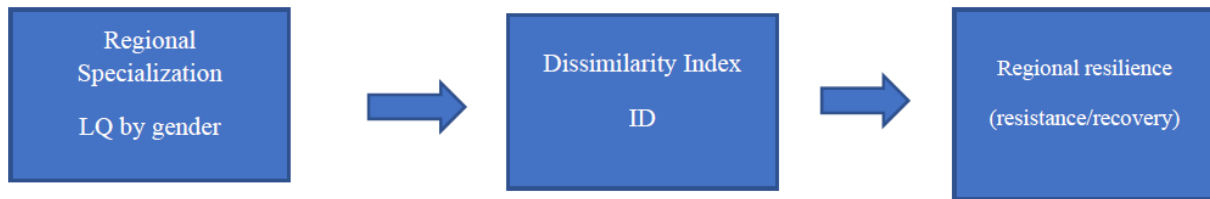
As shown in Figure 6, regions with high resistance and recoverability also exhibit a low dissimilarity index. Conversely, a higher dissimilarity index is associated with low resistance and recovery regions.

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. The descriptive analysis highlighted that regional specialization, gender segregation and resilience

can be related. The following section of the paper aims to develop an empirical investigation to explore the relationship between regional specialization, dissimilarity index, and resilience.

3. Methodology and empirical investigation

The paper aims to investigate 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 divided by gender obtained in equation [3]. Due to the collinearity, the LQ impact on ID will be estimated considering regional specialization in industry and construction 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:

	Location Quotient
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)
<i>N</i>	260
Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$	
Table 1: estimation results	

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 of females' regional specialization in sub-groups industry and construction, in which the females' share is low, decrease the dissimilarity index while an increase of males' regional specialization in sub-group construction will cause an increase in the ID index. Therefore, regarding our first research question: **"Is there a**

relationship between gender segregation and regional specialization?" the results highlight a relationship between gender segregation index and regional specialization. Furthermore, increasing employment in sub-groups in which females' share is lower than males will decrease the ID index. Therefore, regions become more egalitarian in terms of gender.

So far, we have investigated the relationship between the ID index and regional specialization. Nevertheless, our second research question is: **"are the more gender-equal region, the more resilient ones?"** To answer this question, 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. Our resilience index will be proxied by a dummy variable which will take value 1 if regions are resilient and 0 if they are not. Furthermore, the ID fitted value will be the regional average for the resistance/recovery period. 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 Table 2.1-2.3:

Resistance 2008-2013			
	Total Economy	Males	Females
$\widehat{ID}_{i2008-2013}$	-24.31* (12.09)	-19.69* (9.014)	-0.621 (6.212)
cons	6.315 (3.312)	5.419* (2.571)	-0.202 (1.851)
<i>N</i>	20	20	20
Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$			
Table 2.1: Estimation result; period 2008-2013			

Recovery 2013-2019			
	Total Economy	Males	Females
$\widehat{ID}_{i2013-2019}$	2.664 (6.218)	7.058 (6.277)	-0.571 (6.178)
cons	-0.770 (1.817)	-2.303 (1.846)	0.0395 (1.809)
<i>N</i>	20	20	20
Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$			
Table 2.2: Estimation result; period 2013-2019			

Resistance 2019-2020			
	Total Economy	Males	Females

$\widehat{ID}_{i2019-2020}$	1.897 (5.072)	1.831 (5.041)	-2.170 (5.064)
cons	-0.531 (1.447)	-0.512 (1.437)	0.607 (1.444)
N	20	20	20
Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$			
Table 2.3: Estimation result; period 2019-2020			

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 to be resistant than a less gender-equal one. However, this result holds only for the first resistance period (2008-2013), but not for the remaining one. As previously highlighted, 2013 represents, in Italy, a turning point. Starting from 2013, the segregation index does not impact resilience. Therefore, regarding our second research question: **Are the more gender-equal region, the more resilient ones?** The results do not allow to give an unambiguous answer.

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. To our knowledge, this is the first contribution in literature exploring this topic. Our empirical analysis puts several significant results forwards. First, the empirical results highlighted a relationship between regional specialization and gender. This result enhances the idea that females and males are not equal in the job market, and considering gender in the analysis is essential in terms of policies implications. Increasing employment is always a desirable aim. Nevertheless, some policies can be effective only on one gender. Borrowman and Kasen (2017) 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 focuses on digitizations and innovation, ecological transition. To reach these aims, human capital is essential. Females need to 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-specialization process switching from industry to services sector. The latter represents an advantage for females. Nevertheless, as Kusci and MacManus (2017) 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"³. Consequently, the relationship between resilience and dissimilarity did not hold any more. 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 are 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 can be not ignored by policies makers

Appendix 1

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

Table 1. Sectoral definition NACE2_Rev

³ Kusci and MacManus (2017) pg 18



Figure A.1: LQ by gender
Source: our elaboration