

VOLUME LXXVI – N. 3

LUGLIO-SETTEMBRE 2022

# RIVISTA ITALIANA DI ECONOMIA DEMOGRAFIA E STATISTICA



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## **WHY DO WOMEN CHOOSE STEM EDUCATIONAL PATH?**

Giovanna Di Castro, Valentina Ferri, Salvatore Marsiglia

### **1. Introduction**

In recent decades, women's participation in higher education has definitely increased but not in every field of study. As has happened, for example, in the STEM (science, technology, engineering and mathematics) paths where female presence remains very low.

The gender segregation in STEM education contributes to explain the persistence of gender inequalities in the labor market, and the relatively poor occupational chances compared to male ones (Barone, 2020). The study is based on longitudinal data on a cohort of Italian high schools and shows how academic strength plays an important role in determining this gap.

Taking into account 67 countries, Mostafa (2019) finds that girls are stronger in reading and boys in science and mathematics. Also in Italy we show the same pattern (Di Castro e Ferri, 2021). These differences could explain why boys are more likely than girls to choose STEM fields, even if the overall performance are similar between them. The authors conclude that students choose their field of studies basing on their comparative strengths rather than considering their absolute strengths (Mostafa, 2019).

The gender gap in the choice of scientific subjects could have many consequences, although studies have been conducted by many authors that attribute partly the gender pay gap to the choice of fields of study, Ferri et al. (2022) find that the gender pay-gap remains high excluding from the estimations the fields of studies in which female graduates are underrepresented.

The present study aims to investigate the probability that girls choose STEM fields at university compared to boys. The research focuses on the existence of a gender gap after high school degree, and analyses the variables that mostly affect this gap. In order to investigate the gender gap we use a probit model and Oaxaca blinder decomposition.

The paper is structured as follows: the second paragraph is a literature review, the third paragraph describes data and methodology, the fourth paragraph regards the results and the fifth paragraph concludes.

### **2. Literature**

Over the past decade, women's participation in higher education has overtaken men's. Despite this achievement, women are systematically over-represented in the

humanities and social sciences fields of study, which offer relatively poor employment prospects. At the same time, women continue to be underrepresented in more competitive and rewarding sectors than the average, such as science, mathematics, engineering, and ICT (Romito et al. 2020; OECD, 2020; 2021).

According to some authors, gender segregation in higher education is recognized as a significant factor explaining the persistence of gender inequalities in the labor market, despite the reversal of the gender gap in education and higher female rates.

Barone (2020), using a set of longitudinal data on a recent cohort of Italian upper secondary school graduates, demonstrated how the motivations linked to preferences for school subjects and specific professional careers can significantly reduce gender segregation in higher education. Furthermore, a key role is played by the choice of upper secondary level school which determines the gender difference in female access to the humanities and social sciences (2/3 of the total) instead of access to engineering and ICT (only 1/3 of the total).

Some researchers who have analyzed the role of the comparative advantage of men in mathematical fields, argue that this advantage cannot be considered a sufficient explanation to understand the genesis of such models. Indeed, comparing through the Oaxaca-Blinder method the behaviors of males and females with similar mathematical results, the dominance of males in STEM fields does not change significantly (Justman & Méndez 2016). The authors also find that family socio-economic disadvantage negatively affects the choice of STEM pathways for male students, more than it does for female students.

However, other authors, who have also used the Oaxaca-blinder decomposition method, show that women expect to earn less than men and also have lower expectations about wages of average graduates across different fields.

In any case, according to the study, it does not contribute to explaining the gender gap in the choice of STEM (Osikominu & Pfeifer 2018). The students make their college decisions also due to the future earnings streams associated with the different university paths (Arcidiacono, 2012). Such evaluation certainly affects their choices but in different way between girls and boys.

Among the authors who take into account factors related to socio-economic disadvantage, Kumar e Sahoo (2021) analyze the role of social identity and find that especially females and individuals belonging to historically disadvantaged social groups are significantly less likely to study science. In the end, no single factor can explain the persistence of this model related to the differences for choosing the university path between males and females. And it is evident that various factors contribute to stimulating and strengthening this horizontal segregation. However, focusing on the elements that play a role in this dynamic can be useful in the still distant goal of reversing this trend that risks perpetuating a waste in terms of female human capital potentially linked to the STEM sectors.

### **3. Data, methodology and descriptive statistics**

The research is based on the survey “Educational and Professional paths of upper secondary school graduates” (ISTAT, 2015). This sample survey is carried out

interviewing a cohort of graduates four years after school graduation and collects information on the results of schooling path, schooling experience, the progression of studies, the entrance in the labor market and the characteristics of the occupation. We carry out two types of empirical analyses. At the beginning, we quantify the gaps in science choice between gender using a PROBIT model, then we explore these gaps using the Blinder-Oaxaca decomposition method (Blinder, 1973; Oaxaca, 1973). For what concerns the Probit model, the dependent variable is the probability to choose the STEM path, the variable of interest is “female” (the variable takes value 1 if the individual is female). The other control variables are: Failing in school (at least one year); Mother's graduation; Father's Graduation; Unemployed\_Father; Unemployed\_Mother; North West; North East; Center; South; Islands; Modern School; Technical School; High School Diploma with specialization in teacher training; Scientific Grammar School; Classical Grammar School; Linguistic Grammar School; Art education; High school utility for the university path; High school grade and Science, Technology, Engineering and Mathematics; utility for university path.

We also apply the OB decomposition (Blinder, 1973; Oaxaca, 1973), in order to estimate the amount of the differential between male and female STEM enrollment. Through this method we distinguish which part is the result of the differences in characteristics included in model estimations and which part remains unexplained. We estimated the threefold decomposition, dividing the differences in probability to choose STEM into endowments (Endowments, due to differences in the predictors), coefficient (C, the contribution of the unexplained component) and interaction effects (I, indicating simultaneous differences) between the two groups:

$$\text{Endowments} = \{E(XM) - E(XF)\} \beta_M \quad (1)$$

$$\text{Coefficient} = E(XM) (\beta_M - \beta_F) \quad (2)$$

$$\text{Interaction} = \{E(XM) - E(XF)\} (\beta_M - \beta_F) \quad (3)$$

Our reference group are females. Group differences in predictors are weighted by the coefficients of the female group to calculate the endowments effect

$$R = \{E(XM) - E(XF)\} \beta_M + E(XM) (\beta_M - \beta_F) - \{E(XM) - E(XF)\} (\beta_M - \beta_F) \quad (4)$$

The first term of (4) is the endowment effect, and the second term is the “coefficient effect”, the third is interaction effect. It is important to note that the sample of observation used to carry out the estimates are composed of those secondary school graduates that enroll into University. This occurrence could raise the issue of selection bias (Heckman, 1979) because attending University may be not random. If unobserved variables that affect the decision to carry on studying, potentially affecting women and men in a different manner (Mead, 2022), also influence the choice of field of study, results will be biased. This could be a case of

selection bias because the weaker students are more likely to self-select into the group of employees and the stronger choose to continue their studies.

In order to address this issue we consider for future improvements the possibility of using the correction à la Heckman in the Oacaxa Blinder estimates.

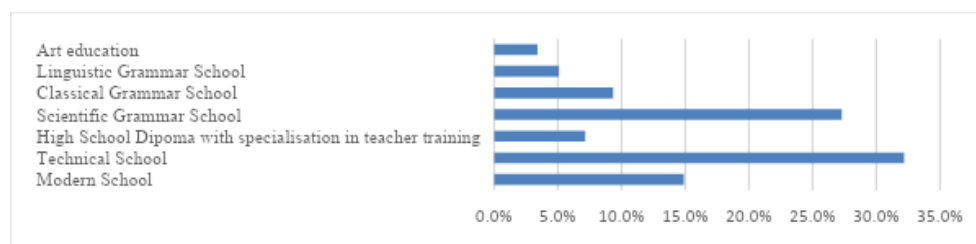
**Table 1** – *Descriptive Statistics.*

Variable	mean	sd	min	max	N
Failing in school (at least one year)	0.18656	0.389565	0	1	26235
Mother's graduation	0.099869	0.299831	0	1	26235
Father's Graduation	0.114909	0.318918	0	1	26235
Unemployed_Father	0.015437	0.123284	0	1	26235
Unemployed_Mother	0.409199	0.491695	0	1	26235
North West	0.224771	0.41744	0	1	26235
North East	0.170307	0.37591	0	1	26235
Center	0.203415	0.402546	0	1	26235
South	0.277440	0.447744	0	1	26235
Islands	0.111381	0.314609	0	1	26235
Modern School	0.148856	0.355953	0	1	26235
Technical School	0.321832	0.467188	0	1	26235
High School Diploma with specialization in teacher training	0.071454	0.257587	0	1	26235
Scientific Grammar School	0.272843	0.445429	0	1	26235
Classical Grammar School	0.093369	0.290955	0	1	26235
Linguistic Grammar School	0.050842	0.21968	0	1	26235
Art education	0.033973	0.181164	0	1	26235
High school utility for the university path	6.575979	2.275569	0	10	11583
High school grade	76.56789	11.84886	60	101	26235
Science, Technology, Engineering and Mathematics	0.275596	0.446831	0	1	13619

Source: Authors' elaboration on ISTAT data

Table 1 shows descriptive statistics. The percentage of individuals who failed in school is 18.7%; mother and father graduation 10% and 11%. The percentage of individuals with an unemployed father is 1.5% and the percentage of unemployed mothers 41%. About the geographic distribution the table shows the same percentage of almost 40% in the North and in South+Islands. In the Center Area a percentage of around 20% is recorded.

**Figure 1.** – *Type of secondary school.*



Source: Authors' elaboration on ISTAT data

Regarding the different types of school, it seems to appear clearly how the Scientific Grammar School (27.3%) and Technical School (32.2%) collected the majority of the STEM students. The graduates do not consider very important the high school for the university path (65.8 of 100) and their High School grade is medium/high (75.6 of 100). They have also chosen Science, Technology, Engineering and Mathematics subjects for the 27.6%.



#### 4. Results

In this section, we investigate the gender gap using a probit model. The table 2 shows that the gender gap in STEM choice is 14.3 p.p. The probability that women choose STEM in university path is 14.3 p.p. lower than men.

In the equation we include other control variables, we focus on some variables that are most significant as types of school, failing in school, high school grade and utility for university path.

**Table 2** –Probability to choose STEM in university path, probit model (marginal effects).

	STEM_choose b/se
Female	-0.1426*** [0.0130]
Failing in school (at least one year)	-0.0425** [0.0213]
Modern School	0 [.]
Technical School	0.1008*** [0.0185]
High School Diploma with specialization in teacher training	-0.0602*** [0.0167]
Grammar School (Scientific )	0.1551*** [0.0182]
Grammar School (Classical )	-0.0104 [0.0213]
Grammar School (Linguistic )	-0.0700*** [0.0212]
Art education	-0.0378* [0.0207]
High school utility for the university path	-0.0083*** [0.0027]
High school grade	0.0047*** [0.0006]
N	11121

Source: Authors' elaboration on ISTAT data. Variables included: Mother's graduation, Father's Graduation, South and Islands, High school utility for the university path, Motivation, Reason for enrolment, Reason for choosing this University, Course choice channels, Father's job, Mother's job.

The table shows that with respect to modern school, the scientific high school increases the probability of choosing a STEM path of 15.5 p.p., such as the technical school diploma (+10.1 p.p.). For what concerns high school with specialization in teacher training and linguistic school, this kind of path decreases the probability to choose a STEM path. As the graduation grade increases, the probability of choosing a STEM path also increases. The variable High school utility for the university path represents the idea that the graduates have in terms of utility of high school for the university path. We observe that this variable is negatively correlated with the choice of STEM path.

In this section, we further investigate the gender gap using decomposition analysis. The table 3 presents the results for the gender gap: the overall gap of 18 percentage points; the decomposition highlights part of the gap which is explained by the differences in observable characteristics (endowments) 4.5 p.p.

This finding suggests that the gender gap in scientific choice is mainly driven by differences in unobservable factors. The effect of the coefficient represents 90% of the difference.

**Table 3.** – *Oaxaca Blinder decomposition, overall results.*

	OBeform_Tebb
	b/se
Overall	
group_1	0.3692*** [0.0077]
group_2	0.1903*** [0.0047]
Difference	0.1789*** [0.0090]
endowments	0.0445*** [0.0091]
coefficients	0.1593*** [0.0096]
interaction	-0.0250** [0.0098]

Source: Authors' elaboration on ISTAT data.

As regard endowments, estimates indicate that in Italy the difference in the probability of STEM enrollment between men and women is about 18 points.

Explained variables show that High School grade affects the probability relate to the choice STEM for the women which determinate the decrease of the differential (-0.0174 p.p.) between males and females. This result seems to suggest that being a «good student» also increases the possibility for women to choose STEM paths. The data match up to numerous literature indications that show that greater self-confidence women could encourage the choice of paths instead of the others. The motivation for choosing the path «To increase future job opportunities» (0.0038 \*\*) is significant for the endowment effect. This result, although the value is small, is significant. However, it suggests that the choice based on the more opportunities is directed towards NON-STEM pathways for women.

This consideration seems to underline how the awareness of a labor market, partly "segregated" by gender, is already rooted in the girls at the time of university choice. At the same time, the awareness of job opportunities can be also addressed by the family influence during the decisional process for choosing the university path. However, this aspect cannot be explored in this work.

If we consider high school attendance, we note that the technical and scientific school increase the difference between men and women (0.0155 \*\*\* and 0.240 \*\*\*) decreasing the women's probability for choosing STEM courses.

With regard to the coefficient effect (Table 5), the results of our analysis suggest that the gender gap in STEM choice is driven largely by other unobservable factors (about 85%).

In the unexplained part of OB decomposition, it is observed how motivation (0.0845\*\*\*), the correspondence between enrollment in the university course and the real student wishes, is significant and tends to increase the gender gap increasing discrimination effects for women.

**Table 4.** – *Oaxaca Blinder decomposition, endowments.*

Endowments	
Failing in school (at least one year)	-0.0026* [0.0016]
High school grade	-0.0174*** [0.0023]
High school utility for the university path	-0.0005 [0.0009]
Motivation	0.0006 [0.0016]
Interest in studying / in the specific university discipline	-0.0029 [0.0022]
To increase future job opportunities	0.0038** [0.0019]
Family pressures o simple advices	-0.0001 [0.0003]
To do something waiting for a job	-0.0019*** [0.0007]
Others (Reason for enrolling in university)	0 [0.0001]
Modern school	-0.0002 [0.0003]
Technical school	0.0262*** [0.0033]
High School Diploma with specialization in teacher training	0.0155*** [0.0053]
Grammar School (Scientific )	0.0240*** [0.0030]
Grammar School (Classical )	0.0033 [0.0021]
Grammar School (Linguistic )	0.0066** [0.0034]
Art education	0.0013 [0.0008]
North West	0.0003 [0.0003]
North East	-0.0001 [0.0002]
Centre	-0.0001 [0.0002]
South	-0.0002 [0.0002]
Islands	0.0002 [0.0003]
N	11121

Source: Authors' elaboration on ISTAT data.

The analysis shows that the gap is widened for individuals living in the northern areas and in particular in the North-West (0.0124\*\*\*) and in the North East (0.0063\*). On the other hand, in the Center, in the South and in the Islands there is a negative coefficient and in particular in the South it is significant (-0.0118\*\*\*). This latest evidence shows how living in the South supports a smaller gap between men and women in the STEM choice.

We deepened these issues with descriptive analysis and about the University enrollments by geographical area with particular reference to the total of the two genders (males and females), we verify that in the northern and central regions the percentage of women enrolled is greater than what we have registered in the South and in the Islands, with a significant difference of almost 8/9 percentage points. In

the same way, men enrolled in the South are also lower than the percentage of those enrolled in the North.

**Table 5.** – *Oaxaca Blinder decomposition, coefficient effect.*

Coefficients	
Failing in school (at least one year)	0.0004 [0.0039]
Mother's Graduation	-0.007 [0.0049]
Father's Graduation	-0.0131** [0.0055]
High school grade	0.2790*** [0.0609]
High school utility for university path	0.0944*** [0.0255]
Motivation	0.0845*** [0.0277]
Interest in studying / in the specific university discipline	0.0054 [0.0193]
To increase future job opportunities	0.0063 [0.0177]
Family pressures o simple advices	-0.0019 [0.0012]
To do something waiting for a job	-0.0045*** [0.0013]
Others (Reason for enrolling in university)	0.0010** [0.0005]
Modern school	0.0011 [0.0014]
Technical school	0.0425*** [0.0067]
High School Diploma with specialisation in teacher training	-0.0018* [0.0010]
Grammar School (Scientific )	0.0151 [0.0101]
Grammar School (Classical )	-0.0037 [0.0030]
Grammar School (Linguistic )	-0.0005 [0.0011]
Art education	-0.0009 [0.0008]
North West	0.0124*** [0.0042]
North East	0.0063* [0.0033]
Centre	-0.0039 [0.0038]
South	-0.0118*** [0.0042]
Islands	-0.0019 [0.0022]
_cons	-0.3823*** [0.0780]
N	11121

Source: Authors' elaboration on ISTAT data.

Analyzing the data relating to STEM / NON STEM enrollments in the geographical macro-areas, it comes out how there are differences regarding the percentage of women who choose STEM subjects, which would seem to be uniform

in the various macro-areas with a small difference in the South, where they represent 20.63%, while it drops to 17.98% in the North West and 17.98% in the North East, and then rises to 19.19% in the Center.

For this reason, we have been able to verify that the people who study in the south universities are overall less and this applies to both males and females, but the women who choose STEM in the South are also slightly higher.

The high school grade and high school utility for the university path play a crucial role for girls. The results confirm the importance of high school grade as a driver for the choice of STEM paths in the unexplained part.

This result seems to highlight that this factor plays a crucial role not only for female students, in the possibility of choosing scientific-mathematical paths as we have seen in the endowments part, but also in terms of discrimination.

It therefore seems that only high-performance students can invest in these paths, but this seems to be more true for girls than boys, who enroll in higher percentages regardless of the final grade achieved. This result, confirmed in the literature by other studies, as previously highlighted, constitutes an indirect confirmation for student females who need external and objective elements, as a high school grade, to make decisions on their paths in those disciplines where they are more insecure.

## **5. Conclusions**

The gender segregation in tertiary education due to STEM fields constitutes a relevant area of study with important implications for women employment.

The under-representation of women in mathematical and scientific fields is seen to be a restriction on economic growth, especially within the European Union, as well as these fields seem to be the most requested in the near future, and where the female presence is still insufficient. Analyzing the Italian case through Istat 2015 data, we highlight how the probability of choosing STEM degree courses is significantly lower for women, despite the higher share of high school graduates and their greater presence in tertiary education. At the endowment level, a high grade increases the probability that women can choose STEM paths, underlining the role of positive strengthening that the grade can represent for the female gender, especially in fields where girls are known to perform lower than boys (Di Castro, Ferri 2021). Also Perez-Felkner et al. (2017) analyzes how beliefs about math skills in secondary school, which are known to change according to gender, influence university choice. In their studies, the authors show how girls' negative perceptions of their own mathematical competence push them away from scientific careers. However, in the decomposition we observe how a "High school grade" and the "High school utility for the university path", constitute inexplicable factors of "discrimination" among the girls and increase their probability of not choosing those paths. It would therefore seem that only high-performance male students can invest in these paths, which suggests the presence of unexplained discrimination.

In fact, a problem of "better performance" (high school grade) seems to emerge in the study as an obstacle to equal access to STEM courses. It can discourage girls from investing in such courses and penalize them compared to male colleagues due

to multiple deeply rooted factors. Finally, through the Blinder-Oaxaca decomposition method (Blinder, 1973; Oaxaca, 1973) the findings suggest that the characteristics observed between males and females represent only 15% of the gender gap in choice STEM. While, the large part of the differential (about 85%) is the consequence of other unobservable factors and therefore by "discrimination" factors. Moreover, these factors have a much higher weight than the differences in the characteristics that can be observed between boys and girls.

All these findings seem to suggest that female students choose the field of path university underestimating their chances of success.

That would be the result of reasons due to insecurity about their own abilities in the scientific and technological fields and to less conscious reasons more deeply rooted that reinforce the existing segregation, penalizing them compared to their male colleagues.

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### SUMMARY

Several studies have highlighted the greater female propensity in the university choice of humanities and non-STEM (Science, Technology, Engineering and Mathematics) studies, contrary to what happens to male students. The persistence of this gender gap in educational choices affects the subsequent female under-representation in the technical-scientific fields, which are most requested and remunerated in the labor market.

Our contribution intends to investigate the probability for a student, at the end of secondary school, to undertake a technical-scientific tertiary education path. This probability is estimated through probit regressions by using the database ISTAT 2015 graduated from High School and it is calculated by taking into account first of all the gender variable and then the family and socio-economic context.

We also investigate the role of the geographical dimension in order to understand if it affects educational gender segregation. The work also intends to offer useful elements for understanding the multiple determinants that contribute increasing gender inequalities in educational models.

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## **THE REVENUES OF LOCAL GOVERNMENTS IN THE STATISTICAL REGISTER FOR PUBLIC ADMINISTRATIONS: INEQUALITY DECOMPOSITION BY SOURCES**

Alessio Guandalini, Domenico Passante, Roberta Varriale

### **1. Introduction**

During the last decade, the Italian national institute of statistics (Istat) has been engaged in a modernization program involving the revision of the statistical production model<sup>1</sup>. The main goal behind this program is the use of statistical registers integrated into a single logical environment, the Italian Integrated System of Statistical Registers (ISSR), for supporting the consistency of statistical production processes and improving the quality of information for users. One object of the ISSR is the satellite statistical REgister for Public Administrations (REPA) that contains information on structural and economic variables on a subset of the Italian PA.

The public institutions are different from each other in structures, dimensions, and scopes. In the present paper, these differences are analysed by looking at their revenues. For this aim, the inequality in the revenues, measured with the Gini index, is decomposed “by sources” (Rao, 1969). Since the total revenues is the sum of several components, the contribution of each source to the overall inequality can be identified. The sources considered in this context are i) current revenue tax based, contributory and equated, ii) the current transfers, iii) the non-tributary revenue. The results provide an explanation of the differences in the revenues of local governments and can help politicians and policymakers to better allocate resources. The structure of the paper is as follows. Section 2 describes the REPA informative contents, that is the data used in this analysis. In Section 3, the decomposition of Gini inequality index is performed for studying the differences between public institutions in terms of revenues and Section 4 reports the obtained results. Section 5 contains concluding remarks.

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<sup>1</sup> [https://ec.europa.eu/eurostat/cros/system/files/building-italia-integrated-system\\_istat\\_0.pdf](https://ec.europa.eu/eurostat/cros/system/files/building-italia-integrated-system_istat_0.pdf).

## 2. The statistical register for public administrations

The statistical register for Public Administrations (REPA) contains information on structural and economic variables on a subset of the Italian PA Institutions. REPA includes different sub-populations, such as local governments, regions and autonomous provinces, ministries, constitutional bodies, social security funds, sanitary districts, etc. Each subpopulation has a particular structure and classification of its economic data: by aggregating a selection of items, the economic variables of Frame PA are obtained. These variables are harmonized for all the Italian PA Institutions.

REPA is still under development, the design and implementation of the register is at a good stage for the subpopulation of local governments, i.e. municipalities, unions of municipalities, provinces, mountain communities and metropolitan cities (Varriale et al., 2021). Therefore, in the following, we will refer to REPA local governments simply as REPA.

Structural information includes the address of the institution, the institutional type, the economic activity (Ateco 2007), the number of employees and the resident population. The latter two variables come from two other registers of SIR.

The economic variable is the result of integration and treatment (imputation) of data coming from administrative sources. It includes accrual and cash values, for both revenues and expenditures. The accrual data for the revenue are the assessments (E1) while the cash data are the collections in accrual (E2) and the residual accounts (E3). For expenditures, the accrual data are the commitments (S1), the cash data are the payments on accrual (S2) and the residual accounts (S3).

The information for both revenues and expenditures is organized into several hierarchical levels. It follows the structure of the certified balance sheet that all local governments are required to publish on an annual basis to certify their primary accounting data for the previous fiscal year. The certified balance sheet, the structure of which is defined in the Legislative Decree no.118 of 2011, modified by Legislative Decree no.126 of 2014, shows the financial flows of salaries and cash flow for the main economic categories and revenue and expenditure items. For each statistical unit (local governments), there are 148 items for revenues and 1431 items for expenditures. By aggregating a selection of items, we obtain the economic variable of Frame PA.

Concerning the revenues, the highest level of aggregation of the items identified by the certified balance sheet is the Titles (1, 2, ..., 7 and 9). The Frame PA variable is the total characteristics revenue (current revenue), and it is the sum of the first three titles:

- Title 1 – current revenue tax based, contributory and equated;
- Title 2 – current transfers

- Title 3 – Non-tributary revenue.

### 3. Inequality decomposition by sources

The decomposition by sources, sometimes also called factor components, is based on the hypothesis that the total of a continuous variable  $X$  is the sum of various sources. Then, as the total of the  $X$  variable, also the inequality in the distribution of  $X$  can be decomposed into the contribution of each source to the overall inequality.

This decomposition is mainly useful to know how the different sources play in determining the inequality in the distribution of the  $X$  and, moreover, it represents an important tool for better understanding the phenomenon.

In our specific case, the  $X$  variable is the revenue of local governments, while the sources are the three titles listed in the previous paragraph (i.e. Title 1, Title 2 and Title 3).

The total revenue of a generic unit  $i$ , i.e. a local government, (with  $i = 1, \dots, N$ ) is denoted by  $x_i$ . The Gini concentration ratio (Gini, 1914), also referred to as the Gini index or the Gini coefficient, is defined as:

$$R = \frac{2 \sum_{i=1}^N x_i(i-1)}{(N-1) t_X} - 1 \quad 0 \leq R \leq 1 \quad (1)$$

where  $N$  is the population size,  $t_X = \sum_{i=1}^N x_i$  is the total revenue of the local government and  $i$  is its rank, within the observed population, for the generic unit, arranged in non-decreasing revenues values. The Gini index is defined between 0 and 1. It assumes a value equal to 0 when all the units in the population has the same value of  $x_i$  (equidistribution or minimum concentration), while it is equal to 1 when just one units has all the total amount of the  $X$  (maximum concentration).

There exists several alternative ways in which the Gini index can be defined (see Giorgi, 1992; Yitzhaki, 1998; Giorgi and Gigliarano, 2018). Among them, a useful expression for the present purpose equivalent to (1), is:

$$R = cov\left(\frac{i}{N}, \frac{x_i}{\mu}\right) \quad (2)$$

(De Vergottini, 1950; Piesch, 1975) that is the expression in the discrete case of the expression proposed by Yitzhaki (1985). In (2), the Gini index is computed as the covariance between the ratio between the rank of the unit  $i$  and the population size  $N$  and its revenue  $x_i$  and the population mean,  $\mu$ .

The total revenue of each unit is made up of all the sources considered, that is  $x_i = \sum_{j=1}^k x_{ij}$ , where  $x_{ij}$  is the revenue of unit  $i$  from the source  $j$ , with  $j = 1, \dots, k$ .

Then, the total revenue of a local government can be written also as  $t_X = \sum_{j=1}^k x_j$  where  $x_j = \sum_{i=1}^n x_{ij}$ .

The Gini concentration ratio in (1) or (2) can be written as the sum of the contribution of each source (Rao, 1969):

$$R = \sum_{j=1}^k F_j = \sum_{j=1}^k q_j R_j E_j. \quad (3)$$

The contribution of each source  $j$ ,  $F_j$ , is given by the product of three factors:

- $q_j = \frac{\mu_j}{\mu}$ ,  $j = 1, \dots, k$  the ratio between the mean income of the source  $j$ ,  $\mu_j$ , and of the population,  $\mu$ ;
- $R_j$  the Gini index computed only on the revenues of the source  $j$ ;
- $E_j = \frac{\underline{R}_j}{R_j}$ ,  $-1 \leq E_j \leq 1$ , the ratio between  $\underline{R}_j$ , the inequality index calculated with (2) for the source  $j$  in accordance with the ranking established on the basis of the total revenue and the Gini concentration ratio calculated for the source  $j$  in accordance with its own internal ranking. Then, it a measure of the concordance between the two ranks.

Since  $R_j = \underline{R}_j$  only when the ranking within source  $j$  coincides with the total revenue one,  $E_j$  provides a measure the “disequalizing effect” induced by the source  $j$  in the revenue distribution of the local governments. This factor is the key element in this analysis. Since  $\mu_j$  and  $R_j$  are not negative,  $E_j$  provides the sign of the contribution of the source  $j$ . When it is negative, the source  $j$  plays in reducing the total inequality. On the contrary, when it is positive source  $j$  contributes to increase the total inequality.  $E_j$  has been introduced as a measure of correlation firstly by Blitz and Brittain (1964). Subsequently, Fields (1979a, b), proposing the Factor Inequality Weights (FIW) named it “relative coefficient of variation” while Lerman and Yitzhaki (1985) and by Schechtman and Yitzhaki (1987) named it “Gini correlation”.

#### 4. Main results

In 2019, the number of local governments was equal to 8,727 (Table 1): 7,914 municipalities, 100 provinces and metropolitan cities, 562 unions of municipalities and 151 mountain communities.

**Table 1** – Number of units and current revenue of local governments by institutional type. Year 2019, values in millions of euros.

Local governments	Number of units	Current revenue
Municipalities	7,914	63,881
Provinces and metropolitan cities	100	7,052
Unions of municipalities	562	1,592
Mountain communities	151	586
<b>Total</b>	<b>8,727</b>	<b>73,111</b>

Current revenue assessed by municipalities during fiscal year 2019 was estimated at 63,881 million euros. Current revenue assessed by provinces and metropolitan cities was estimated at 7,052 million euros, while for unions of municipalities was at 1,592 million euros and for mountain communities was at 586 million euros.

**Figure 1** – Gini index by institutional type. Year 2019.

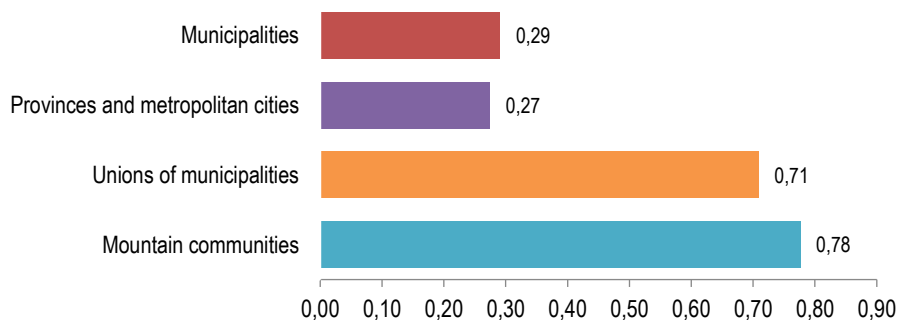
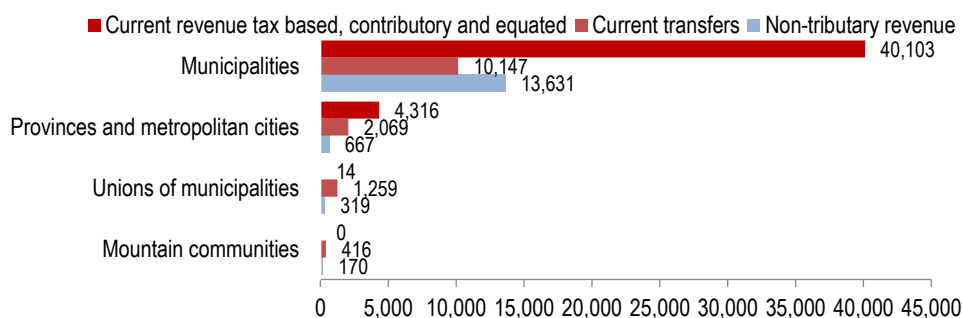


Figure notes: Gini index of municipalities, provinces and metropolitan cities is based on per capita value.

Figure 1 shows that the Gini index assumes different values in relation to the different types of local governments. In particular, the municipalities, provinces and metropolitan cities registered lower values of Gini index and, therefore, a low level of inequality in the distribution of current revenue. Unions of municipalities and mountain communities registered higher values of Gini index and more inequality in the final balance sheet structure: this result is linked to the impossibility of using the per capita values of current revenue, but also to the greater influence of the different characteristics of the territory, that causes a greater inequality of accounting structure. In particular, the Gini index for the municipalities at the national level was

equal to 0.29, while for provinces and metropolitan cities was equal to 0.27. The inequality of the current revenue for unions of municipalities and mountain communities, was respectively 0.71 and 0.78.

**Figure 2** – Current revenue by item and institutional type. Year 2019, in millions of euros.



The sources considered in this context are: (i) the current revenue tax based, contributory and equated (ii) the current transfers and (iii) the non-tributary revenue (Figure 2). The decomposition of the Gini index is useful to know how the different sources determine the inequality in the current revenue distribution and allows to provide useful information to policymakers to evaluate the efficiency in the acquisition of revenue (Figure 3). Therefore, for the municipalities, the contribution to inequality measured by the Gini index was equal to 30.4% for current revenue tax based, 38.4% for current transfers and 31.3% for non-tributary revenue.

**Figure 3** – Composition of Gini index by item and institutional type. Year 2019, percentage values.

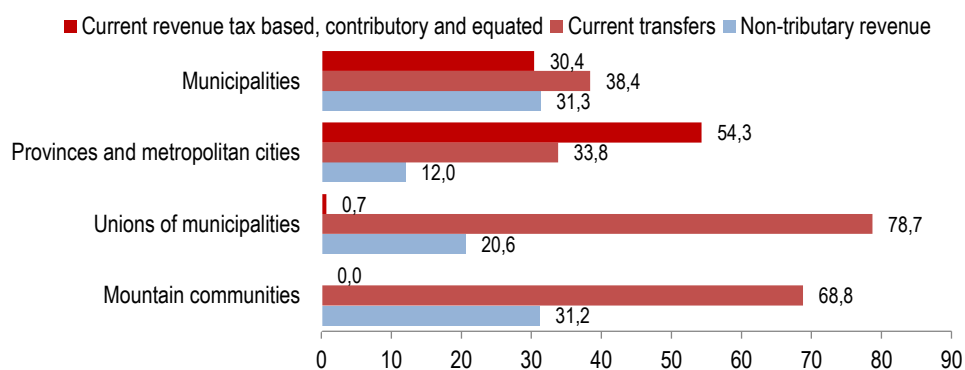


Figure 4 – Gini index of municipalities by region. Year 2019.

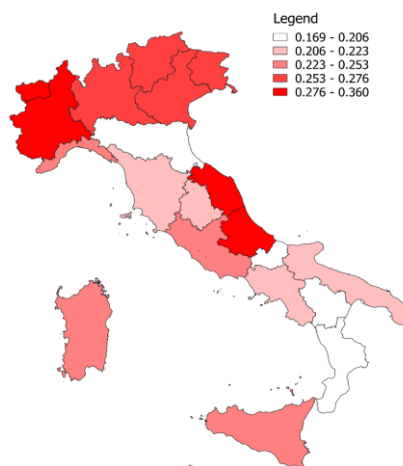
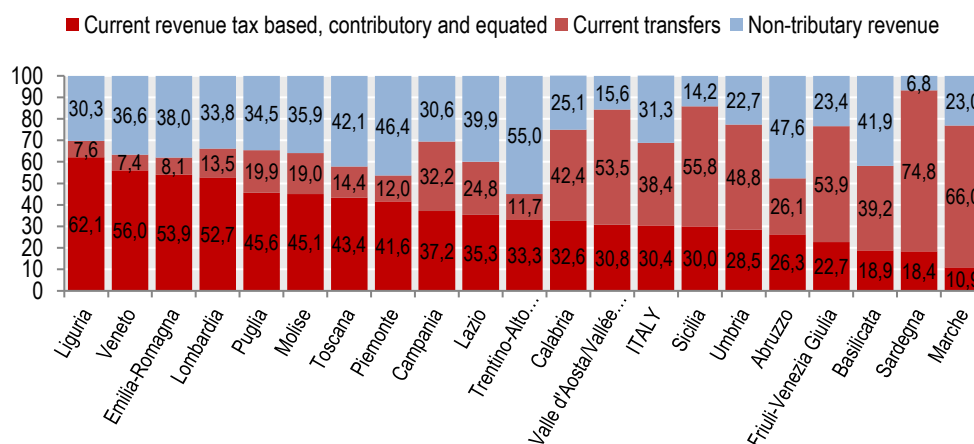


Figure 5 – Composition of municipal Gini index by item and region. Year 2019, percentage values.



The contribution of current transfers to the overall inequality was greater for municipalities, while for provinces and metropolitan cities was the contribution of current revenue tax based, contributory and equated. For unions of municipalities and mountain communities, contribution of current transfers was greater, considering the different accounting structure of these institutional types where tax revenues are limited or absent.

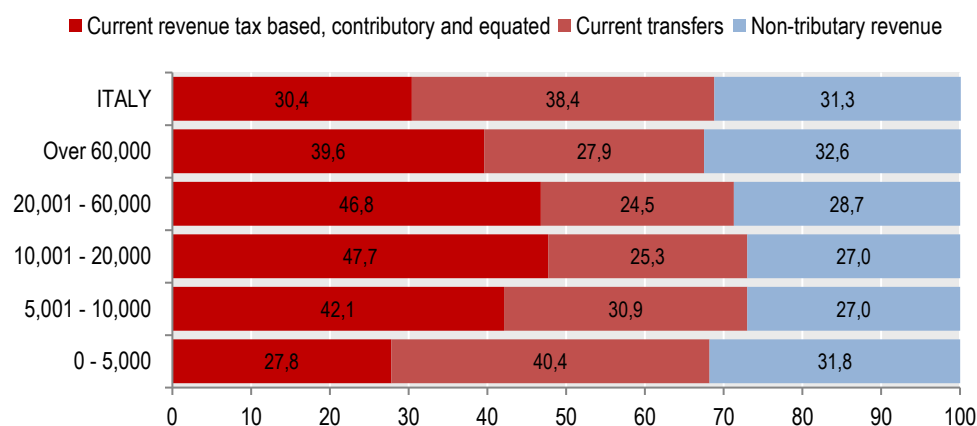
In Figure 4, municipalities were classified in five classes by Gini index and region. The highest level is in the municipalities of Valle d’Aosta/Vallée d’Aoste

(0.36) and the lowest level in Emilia-Romagna (0.17). This result highlights that, even at the regional level, there is inequality in the distribution of current revenues among the municipalities, in consideration of the greater autonomy in budget management to meet the different needs of citizens.

Furthermore, the inequality in the current revenue distribution could also be due to inefficient revenue management by local administrators. The greatest inequality was concentrated above all in some northern regions (Valle d'Aosta, Piemonte, Friuli-Venezia Giulia, Veneto and Lombardia) and in some regions of center/south of Italy (Marche and Abruzzo).

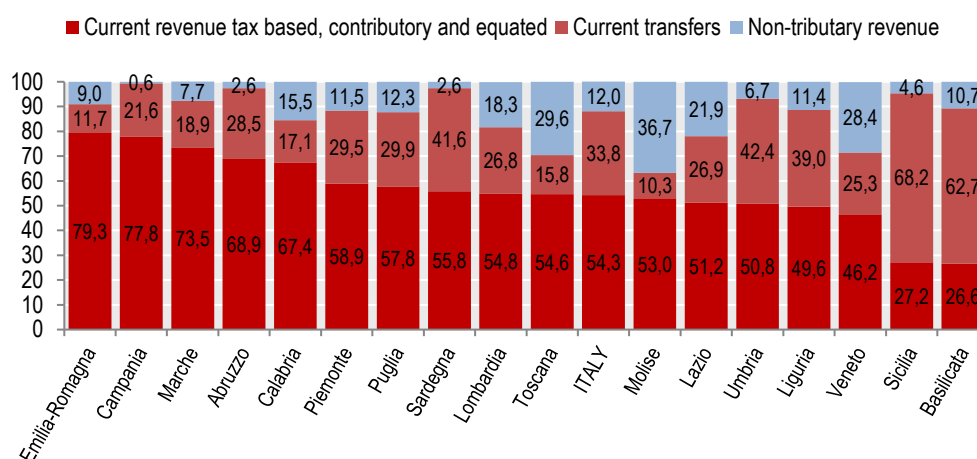
Figure 5 shows the role of different sources in determining the inequality at the regional level. Decomposing by sources the Gini index of the municipal revenue, it is possible to see that in Liguria the incidence of current revenue tax based, contributory and equated was the highest (62.1%), while Marche presented the lowest percentage (10.9%). The municipalities of Sardinia presented the highest percentage of current transfers. This information is particularly useful for regional and national governments who can intervene with measures aimed at reducing the weight of current revenue tax based, contributory and equated, or current transfers, to ensure greater efficiency in the accounting structure of local governments of a particular region.

**Figure 6** – *Composition of municipal Gini index by item and demographic class. Year 2019, percentage values.*





**Figure 7** – Composition of provinces and metropolitan cities Gini index by item and region. Year 2019, percentage values.



The analysis by demographic class (Figure 6) showed that the central classes 10,001-20,000 and 20,001-60,000 presented the highest incidence of current revenue tax based, contributory and equated, respectively 47.7% and 46.8%. Municipalities with more of 60,000 people registered a value of 39.6%. Municipalities in class 0-5,000 presented the highest value of current transfers. This result is probably due to the fact that in small municipalities, the use of local taxes is not sufficient to cover expenses and more transfers are needed: this impact on the inequality. Data regarding the composition of Gini index were also analysed with reference to the provinces and metropolitan cities (Figure 7).

The governments of the autonomous provinces of Trento and Bolzano-Bozen were excluded since their financial flows were already incorporated in the summary of regional and autonomous province final balance sheets. In Valle d'Aosta-Vallée d'Aoste and Friuli-Venezia Giulia, the regional government or municipalities have the jurisdiction for functions that are managed by provinces elsewhere.

More than half of contribute to inequality measured by the Gini index at national level was devoted to the current revenue tax based, contributory and equated (54.3%). The contribution of the three sources differs greatly at regional level, therefore the highest level is in the provinces and metropolitan cities of Emilia-Romagna (79.3%) and the lowest level in Basilicata (26.6%).

**Figure 8** – Gini index of mountain communities and unions of municipalities by geographical area. Year 2019.

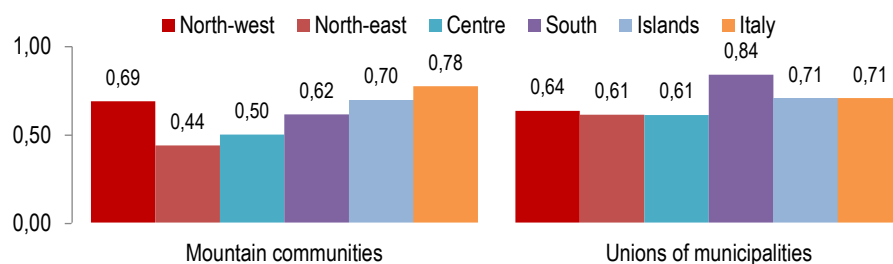


Figure 8 shows the Gini index of the revenue for mountain communities and unions of municipalities by geographical area, the data can be compared among the different areas and with the value assumed at the national level. The highest inequality was registered in mountain communities of Islands (0.70), while the unions of municipalities registered the highest value in south (0.84).

**Table 2** – Composition of mountain communities and unions of municipalities Gini index by item and geographical area. Year 2019, percentage values.

Geographical area	Mountain communities			Unions of municipalities		
	Current revenue tax based, contributory and equated	Current transfers	Non-tributary revenue	Current revenue tax based, contributory and equated	Current transfers	Non-tributary revenue
North-west	0.0	81.7	18.3	1.7	76.0	22.3
North-east	0.0	65.7	34.3	0	83.0	17.0
Centre	0.0	74.3	25.7	0.3	68.2	31.5
South	0.0	75.3	24.7	3.3	93.4	3.3
Islands	0.2	99.4	0.4	0.7	74.3	25.0
Italy	0.0	68.8	31.2	0.7	78.7	20.6

Concluding, Table 2 shows the Gini decomposition by item and geographical area related to mountain communities and unions of municipalities. Mountain communities in the Islands (99.4) and North-west (81.7) presented higher percentage values as regards the current transfers, while unions of municipalities registered higher values in the South and North-east for the same item. For mountain communities, in some areas such as Islands, the inequality produced by current transfers is very high and shows a low degree of financial and taxation autonomy.

A similar consideration can be made for the unions of municipalities of South. This result allows national and local administrators to check for inefficiencies in current revenue management in that geographical area.

## 5. Conclusions and future research

The satellite statistical register for Public Administrations REPA is an object of the Italian Integrated System of Statistical Registers. The register, containing information on structural and economic variables on a subset of the Italian PA, is still under development, and more in depth analyses will be necessary for assessing the quality of its production process and its outcomes.

In this work, we analysed the differences between public institutions in terms of current revenue, by using the decomposition of the Gini index “by sources” to identify the contribution of each title among Title 1, 2 and 3.

The obtained results can explain the differences in the current revenues of local governments and help politicians and policymakers to better allocate resources. In particular, the analyses highlight the different accounting structure of the different types of local governments and therefore the role played by tax revenues (Title 1), which represent the levy made on taxpayers at the local level, compared to the other components represented by Transfers made by both the state or the regions (Title 2) and Non-tributary revenue (Title 3).

In the future, the same methodology can be used to evaluate differences between local governments in terms of expenditures: employment income, goods and services acquisition. Furthermore, a multivariate extension of the Gini index can be used. Furthermore, it will be important to evaluate if there are some statistical units to contribute in an extreme way to the Gini index results.

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### SUMMARY

The statistical register for Public Administrations (Frame PA) contains peculiar information on structural and economic variables on a subset of the Italian PA Institutions. Moreover, Frame PA includes different sub-populations. Focusing on the subpopulation of local governments, i.e. municipalities, unions of municipalities, provinces, mountain communities and metropolitan cities, the differences between public institutions in terms of revenues are analysed. The revenues of local government stem mainly from three sources: i) the current revenue tax based, contributory and equated, ii) the current transfers, iii) the non-tributary revenue. In the present paper, the decomposition of the Gini index "by sources" is used to better understand the differences in the revenues of local governments and can help politicians and policymakers to better allocate resources.

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## THE NEW FRONTIERS OF SUSTAINABLE DEVELOPMENT AND SDGS. A CONTENT ANALYSIS<sup>1</sup>

Graziella Sicoli, Pietro Iaquinta, Dominga Anna Ippolito

### 1. Introduction

The adoption of good practices in Corporate social responsibility (CRS) plays a particularly significant role to achieve the sustainable development goals, henceforth SDGs (Sullivan *et al.*, 2018; Ike *et al.*, 2019).

The SDGs objectives identified by Agenda 2030 are a total of 17 and refer to people, the planet and prosperity to be achieved in the next 15 years and up to 2030.

The research work intends to verify whether the information on sustainability of the companies in the sample is in line with the SDGs and if there is a positive relationship between the disclosure of the SDGs and the performance of companies.

After a brief theoretical framework on the importance of sustainability and the SDGs, the composition of the sample is described; the methodology used to implement the qualitative-quantitative empirical study is illustrated below. Finally, the results achieved are presented and analysed.

### 2. Sustainability and SDGs

Companies around the world agree on the importance of sustainable development. Companies need to integrate sustainability into their business strategy. Corporate choices, decisions and behaviours are no longer measured on traditional results, such as profit, but considering the triple button line (Elkington, 1998). The seventeen SDGs require that sustainable development must be combined with economic development, social inclusion and environmental sustainability (Redman, 2018). Entrepreneurial action is driven by a broader perimeter of factors that certainly includes corporate sustainability whose purpose is to pursue economic objectives by reducing or eliminating the impact of its activities on the environment and at the same time satisfying the needs of current stakeholders without

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<sup>1</sup> Paragraphs 1 and 5 are attributed to Pietro Iaquinta, paragraphs 2 and 3 are attributed to Dominga Ippolito and paragraphs 4.1 and 4.2 are attributed to Graziella Sicoli.

compromising those of future stakeholders. The inclusion of sustainability in corporate strategies contributes to the achievement of the SDGs declared by the United Nations 2030 Agenda, and at the same time allows companies to use a reference framework (that of the Sustainable Development Goals) to conceive, direct and communicate the results of its objectives and activities, obtaining various benefits in exchange. (Schramade, 2017). Different authors have tried to understand if and to what extent the disclosure of the SDGs affects company performance (Maletic *et al.*, 2021). According to some authors, sustainability improves the competitive advantage of the company and has a positive impact on performance results; in this case, companies can improve their reputation by attracting investors and stakeholders. According to others, however, there is no relationship between sustainability and performance. Still others have not found statistically significant results between good sustainability practices and company performance (Jabbour *et al.*, 2015).) That the company's ability to communicate and report behaviors, decisions, actions and progress on the subject of SDGs in company documents allows each of them to improve their image and gain new and lasting competitive advantages.

Among the company documents, the appropriately integrated sustainability report of the SDGs allows you to get out of the sphere of self-referentiality by demonstrating to stakeholders what has been done and what could still be done (Bebbington and Unerman, 2018). This improves reputation, legitimacy and social consensus (Braam *et al.*, 2016).

Furthermore, it is considered one of the main tools for dialogue with stakeholders about sustainable reporting and the SDGs (Hu *et al.*, 2020; Petrescu *et al.*, 2020).

### **3. Sample and Methodology**

The work analyzed the sustainability reports some sectors of the Italian stock exchange: Industry sector and Consumer Good sector for three years: 2018-2020. The analysis was conducted on listed companies because they larger size and are more careful in communicating with the market (Hahn and Kuhnen, 2013). The choice of the analysis on the industrial and consumer goods sectors was made because they are very numerous and highly polluting sectors. Moreover, as regards companies operating in the Industry sector, they are particularly sensitive to aspects related to corporate sustainability, already the subject of analysis of different studies in the literature (Truant *et al.*, 2021).

It was not possible to find the sustainability report for all 80 companies that make up the sample and for this reason 24 companies were excluded from the analysis. To achieve the research goal three different linear regression models (OLS) were

estimated with the aim of studying how sustainable disclosure affects the performance of each company. Data were collected through content analysis, widely adopted in voluntary disclosure studies (Beattie and Thompson, 2007; Krippendorff, 2004).

#### 4. Discussion and Results

On the basis of the UN document of 2015 that describes the SDGs, a data set of the most significant words in terms of sustainable development was built. The data set was used for the implementation of the content analysis on the sustainability reports of the sample of companies (Guthrie and Petty, 2000).

##### 4.1 Descriptive statistics

To achieve the objective of the study, the following basic equations were defined which represent the main variables that affect the company's sustainability performance:<sup>2</sup>

$$\text{Sustainability index}(\text{environmental}) = \alpha + B_1(\text{regulatory}) + B_2(\text{collocation}) + B_3(\text{SDGs}) + e$$

$$\text{Sustainability index}(\text{economic}) = \alpha + B_1(\text{regulatory}) + B_2(\text{collocation}) + B_3(\text{SDGs}) + e$$

$$\text{Sustainability index}(\text{social}) = \alpha + B_1(\text{regulatory}) + B_2(\text{collocation}) + B_3(\text{SDGs}) + e$$

The dependent variables used in the three OLS models, both with reference to the Industry sector and for the Consumer Goods sector, are represented by an index built on the basis of the Key Performance Index (KPI) proposed by Bocconi University in 2015<sup>3</sup> and also considering a subsequent study proposed by Hriston *et al.* (2019),

<sup>2</sup>*Sustainability index (environmental)*, *Sustainability index (economic)* and *Sustainability index (social)* are indices of, respectively, environmental, economic and social sustainability performance; *regulatory* is a dummy for the implementation of DNF legislation, equal to 1 if the sustainability report of the company is governed according to d. lgs. no. 254/2016; *collocation* is a dummy variable, equal to 1 if the sustainability report is drawn up as an independent document, 0 if it is an integral part of another corporate document; *SDGs* is the sum of the SDGs counted in the sustainability document of the company.

<sup>3</sup> <https://greentire.it/wp-content/uploads/2019/03/sdabocconi-ricerca-greentire.pdf>

which aims to describe the sustainable performance of companies. First, the environmentally sustainable performance index was built by comparing the CO<sub>2</sub> emissions of individual companies with their share capital.<sup>4</sup>

$$\text{Sustainability index (environmental)} = (CO_2 / CS) * 1000$$

Subsequently, the index of sustainable economic performance was developed considering the operating profit as reported in the financial statements of each individual company.

Finally, the index of social sustainable performance was developed, relating the number of female employees to the number of male employees:

$$\text{Sustainability index (social)} = n. \text{ female employees} / n. \text{ male employees.}$$

As regards the explanatory variables collected, the SDGs variable measures the disclosure of information related to the goals of Agenda 2030 by each company. The attribution of a score for each SDGs took place through content analysis, considering that the non-financial information contained in the prospectuses is of a purely qualitative nature. The remaining variables are the result of a dichotomy of the same (necessary to investigate the qualitative aspects). The regulatory variable, represents the implementation of the legislation, has a value of 1 if the NFS is drawn up according to the legislative decree that determines its obligation (Decree n. 254 of 2016), 0 if the document is drawn up on a voluntary basis.

The collocation variable takes on a value of 1 if the NFS is drawn up as an independent document, 0 if it is an integral part of another company document. The content analysis made it possible to initially measure which companies during the three-year period most communicate the SDGs promoted by Agenda 2030 (Figure 1).

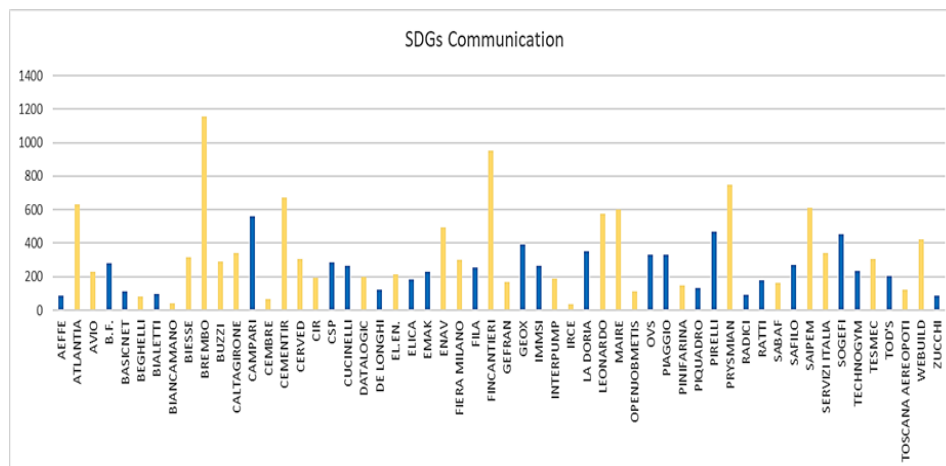
The disclosure of sustainability by all the companies in the sample is aligned with the SDGs. In fact, although in a non-homogeneous way, there is a certain attention to the disclosure of the SDGs by each individual company. However, the companies that communicate the most for industry sector (color yellow figure n.1) are Brembo, Fincantieri and Prysmian. For the sector consumer goods are Campari, Pirelli and Sogefi (figure n. 1 color blue).

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<sup>4</sup> The *sustainability index (environmental)* is defined as the ration between CO<sub>2</sub> emissions and capital share (CS).



Figure 1 – SDGs Communication.



Source: our elaboration.

4.2 Discussion of the results

Table 1 shows the estimates of the first regression model linked to environmentally sustainable performance in the sector Industry.

The model uses variables considered as panel data. The R-square index tests the goodness of fit of the model, reporting a value of 0,124395, explaining a moderate percentage of the model. A positive coefficient of 6214.56 is attributed to the variable representing the SDGs. From this it can be said that the disclosure of the SDGs has a positive impact on the environmental sustainability index. In fact, as the SDG count increases by one unit, the sustainable performance index increases by a value equal to the coefficient returned by the variable itself.

The impact of the coefficient is to be considered positive and at the same time it can be considered significant, as evidenced by the comparison between the critical alpha value (0.10) and that of the p-value equal to 0.0944.

**Table 1-** *SDGs regression model on sustainable environmental performance (Industry).*

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>p-value</i>
const	11.34	31.83	0.36	0.72
SDGs	6214.56	3675.64	1.69	0.09 *
collocation	-45.96	14.37	-3.20	0.00 ***
regulatory	30.39	29.02	1.05	0.30

Mean dependent variable	18,83	SQM dependent variable	51,63
Residual sum squared	214772,30	E.S. regression	49,12
R <sup>2</sup>	0,12	R <sup>2</sup> correct	0,09
F(3,89)	4,21	P-value(F)	0,01
Log-Likelihood	-492,09	Akaike criterion	992,18
Schwarz criterion	1002,31	Hannan-Quinn	996,27

Source: our elaboration.

In Table 2 shows the estimates of the second regression model linked to sustainable economic performance always in the sector Industry.

**Table 2 -** *SDGs regression model on sustainable economic performance (Industry).*

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>p-value</i>
const	-217.89	176.44	-1.23	0.22
SDGs	20315.50	20375.40	0.99	0.32
collocation	198.87	79.64	2.50	0.02 **
regulatory	44.02	160.86	0.27	0.78

Mean dependent variable	49.64	SQM dependent variable	279.54
Residual sum squared	6599730	E.S. regression	272.31
R <sup>2</sup>	0.08	R <sup>2</sup> correct	0.05
F(3,89)	2,650508	P-value(F)	0.05
Log-Likelihood	-651.36	Akaike Criterion	1310.73
Schwarz criterion	1320.86	Hannan-Quinn	1314.82

Source: our elaboration.

The second estimated model always uses variables considered as panel data. The R-square index tests the goodness of fit of the model, reporting a value of 0,082015, explaining a moderately low percentage of the model. A positive coefficient of 20315.5 is attributed to the SDGs. From this it can be said that the disclosure of the SDGs has a positive impact on the economic sustainability index. In fact, as the count

of the SDGs increases by one unit, the sustainable performance index increases by a value equal to the coefficient returned by the variable itself.

Finally, the third and last model estimated compares sustainable performance from a social point of view with the explanatory variables previously described, as reported in table 3.

**Table 3** - *SDGs regression model on sustainable social performance (Industry).*

	<i>Coefficient</i>	<i>Std.Error</i>	<i>t</i>	<i>p-value</i>
const	0.33	0.49	0.68	0.49
SDGs	-156.04	56.27	-2.77	0.00 *
collocation	0.49	0.22	2.27	0.02 **
regulatory	0.23	0.44	0.53	0.59

Mean dependent variable	0,55	QM dependente variable	0,79
Residual sum squared	50,33	E.S. regression	0,75
R <sup>2</sup>	0,12	R <sup>2</sup> correct	0,09
F(3,89)	4,20	P-value(F)	0,02
Log-Likelihood	-103,41	Akaike criterion	214,82
Schwarz criterion	224,95	Hannan-Quinn	218,91

Source: our elaboration.

The R-square index tests the goodness of fit of the model, reporting a value of 0,124013, explaining a moderate percentage of the model.

He results that the model returns compared to the previous ones gives the SDGs a negative coefficient equal to -156.037. In this case, it is clear that the disclosure of the SDGs has a negative impact on the social sustainability index. In fact, as the count of the SDGs increases by one unit, the sustainable performance index decreases by a value equal to the coefficient returned by the variable itself.

His variable is also significant as evidenced by the critical alpha values equal to 0.10, 0.05 and 0.01 compared with the p-value equal to 0.0068.

The same econometric models used for the industrial sector have also been implemented for the Consumer Goods sector. Table 4 shows the estimates of the first regression model linked to environmentally sustainable performance

The first model estimated for the Consumer Goods sector always uses variables considered as panel data. The R-square index tests the goodness of fit of the model, reporting a value of 0,090833, explaining a moderately low percentage of the model. A positive coefficient equal to  $4.24956e + 07$  is attributed to the SDGs. From this it can be said that the disclosure of the SDGs has a positive impact on the environmental sustainability index.

**Table 4** – *SDGs regression model on sustainable environmental performance (Consumer Goods).*

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>p-value</i>
const	29100000	13300000	2.19	0.03 **
SDGs	42500000	11900000	3.58	0.00 ***
collocation	-100000	12100000	-0.98	0.33
regulatory	-1130000	5040000	-0.22	0.82

Mean dependent variable	33801000	QM dependent variable	72202531
Residual sum squared	7.77e+17	E.S. regression	69483764
R <sup>2</sup>	0.09	R <sup>2</sup> correct	0.07
F(3,161)	5.36	P-value(F)	0.00
Log-Likelihood	-3211.44	Akaike criterion	6430.88
Schwarz criterion	6443.30	Hannan-Quinn	6435.92

Source: our elaboration.

**Table 5** - *SDGs regression model on sustainable economic performance (Consumer Goods).*

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>p-value</i>
const	-9.01	42.00	-0.21	0.83
SDGs	1.54	37.54	0.04	0.97
collocation	73.44	38.26	1.92	0.06 *
regulatory	-1.54	15.92	-0.09	0.92

Mean dependent variable	43,02	SQM dependent variable	220.19
Residual sum squared	7762983	E.S. regression	219.58
R <sup>2</sup>	0,02	R <sup>2</sup> correct	0.01
F(3,161)	1,30	P-value(F)	0.27
Log-Likelihood	-1121.74	Akaike criterion	2251.47
Schwarz criterion	2263.90	Hannan-Quinn	2256.52

Source: our elaboration.

In fact, as the count of the SDGs increases by one unit, the environmentally sustainable performance index increases by a value equal to the coefficient returned by the variable itself. This variable is significant as evidenced by the comparison between the critical value of alpha equal to 0.01, 0.05 and 0.10 and that of the p-value of 0.0005. Table 5 shows the estimates of the second regression model linked to sustainable economic performance

The second model estimated for the Consumer Goods sector always uses variables considered as panel data. The R-square index tests the goodness of fit of the model, reporting a value of 0,023733, explaining a moderately low percentage of the model. A positive coefficient of 1.53871 is attributed to the SDGs. From this it can be said that the disclosure of the SDGs has a positive impact on the economic sustainability index. In fact, as the count of the SDGs increases by one unit, the sustainable economic performance index increases by a value equal to the coefficient returned by the variable itself.

Finally, the third and last estimated model compares sustainable performance from a social point of view with the explanatory variables previously described, as reported in table 6.

**Table 6** - *SDGs regression model on sustainable social performance (Consumer Goods).*

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>p-value</i>	
const	5.22	2.67	1.95	0.05	*
SDGs	3.96	2.39	1.66	0.09	*
collocation	-3.32	2.43	-1.36	0.17	
regulatory	-0.81	1.01	-0.80	0.42	
Mean dependent variable	3.17	SQM dependent variable	14.07		
Residual sum squared	31359.55	E.S. regression	13.96		
R <sup>2</sup>	0.03	R <sup>2</sup> correct	0.02		
F(3,161)	1.90	P-value(F)	0.13		
Log-Likelihood	-667.03	Akaike criterion	1342.06		
Schwarz criterion	1354.48	Hannan-Quinn	1347.10		

Source: our elaboration.

The R-square index tests the goodness of fit of the model, reporting a value of 0,034165, explaining a moderately low percentage of the model.

A positive coefficient of 3.95861 is attributed to the SDGs. From this it can be said that the disclosure of the SDGs has a positive impact on the social sustainability index. In fact, as the count of the SDGs increases by one unit, the social sustainable performance index increases by a value equal to the coefficient returned by the variable itself. This variable is significant as evidenced by the comparison between the critical value of alpha equal to 0.10 and that of the p-value of 0.0991.

## 5. Conclusion

The proposed work contributes to the scientific debate on the theme of sustainability of the SDGs by opening new frontiers of the disclosure of sustainable development. The results are in line with an important challenge on the part of companies and a strong awareness on the part of individuals all involved and committed to promoting and spreading a culture inspired by the sustainability of the environment and territory. The data collected with the help of content analysis made it possible to implement three different linear regression models (OLS), which provided useful clarifications on the relationship between sustainable corporate performance and the disclosure of the SDGs. The results of the descriptive analysis support our research question and allow us to state that, although not in a completely homogeneous, each company in the sample pays particular attention to the disclosure of the SDGs.

However, some of companies, such as Brembo, Fincantieri and Prysmian for the Industry sector and Campari, Pirelli and Sogefi for the Consumer Goods sector, are more committed to the disclosure of sustainability. This could be linked to the specific activity they carry out, the results of which certainly have a greater impact in terms of information to be provided to stakeholders.

The regression analysis for Industry sector, returns a positive relationship between the disclosure of the SDGs and sustainable performance in both the environmental and economic fields. This cannot be confirmed, however, with reference to the performance of the social sphere whose relationship with the SDGs is negative. As regards the Consumer Goods sector, the results highlight a positive relationship between the disclosure of the SDGs and sustainable performance in the areas investigated: environmental, economic and social. from an immediate comparison between the industry sector and the consumer goods sector we can conclude that the disclosure of the SDGs by the Consumer Goods sector has a greater impact on sustainable corporate performance.

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### SUMMARY

One of the main forces encouraging companies towards sustainability are the seventeen SDGs. The latter require that the economic development of companies must be combined with social inclusion and environmental sustainability. The company's ability to communicate and report behaviours, decisions and actions related to sustainability and SDGs in company's documents allows each of them to improve their image and gain new and lasting competitive advantages.

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## ON AN ANALYSIS ON SOME INDICATORS OF WELL-BEING IN ITALY

Gabriella Schoier, Massimiliano Giacalone

### 1. Introduction

In the last decades the progress made in science and technology has contributed to the evidence of an evolving world.

The new perspectives in knowledge discovery in databases upon economic and social data apply data mining mechanisms that monitor models and patterns, compare them, detect changes, and describe these changes. Having this in mind, some data mining researchers have developed methods and techniques to study the evolution of different phenomena (see eg. Aggarwal, 2005).

In particular, as regards the problem of explaining the economic evolution of the well-being of people and households, some macro-economic statistics such as GDP seem to not give a detailed picture of the living conditions of common people (see, e.g. Maggino, 2017; Chelli *et al.*, 2016).

For this reason the Italian National Institute of Statistics (ISTAT) declined a multidimensional approach at a detailed territorial level, that is, at the provincial level (NUTS3) using a wide spectrum of indicators grouped into domains. (see, e.g., Mazziotta and Pareto, 2017) related to Health, Education, Work and Life balance, Economic well-being, Social relationships, Politics and institutions, Security, <sup>1</sup>Landscape and cultural heritage, Environment, Innovation research and creativity, and Quality of services. These indicators can help in describing the territories because they can spot situations concerning different places. Different authors work on the Sustainable and Equitable Well-Being at local level<sup>2</sup> using multidimensional techniques (see e.g. Monte *et al.*, 2022, Giacalone *et al.*, 2022).

The Organization for Economic Co-operation and Development (OECD) states, “the OECD Framework for Measuring Well-Being and Progress is built around three distinct domains: material conditions, quality of life and sustainability, each with their relevant dimensions” (OECD, 2019).

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<sup>1</sup>

<sup>2</sup> See: <https://www.istat.it/it/files//2019/05/Nota-metodologica.pdf>; <https://www.istat.it/en/well-being-and-sustainability/the-measurement-of-wellbeing/bes-at-local-level>; [www.besdelleprovince.it](http://www.besdelleprovince.it).

In this paper, we address the problem of monitoring the well-being in Italy. This can help decision makers of different areas make better economic and political decisions.

The indicators, one for each of the equitable and sustainable well-being domain, have been used to measure it. They were selected from the ISTAT database (see ISTAT(c), 2022) on the base of objective criteria.

The aim of this research is to understand how equitable and sustainable well-being in the territories (provinces) influence different variables.

The new idea regards the application of decision trees to some indicators, one for each of the equitable and sustainable well-being domain for Italian provinces.

We consider both classification and regression trees; two different dependent variables have been chosen:

-classification trees dependent variable Macroregion according to NUTS 1: North West, North East, Center, Islands and South of Italy,

- regression trees dependent variable Life Expectancy at Birth .

Our objective is to see how different indicators (one for each domain) move to analyze and then monitor well-being in Italy in particular regarding the chosen dependent variables.

## 2. Equitable and sustainable well-being at territorial level

The economic evolution regarding the well-being of people and households can be analyzed by using the equitable and sustainable well-being (BES) a multidimensional approach, that identifies 12 well-being domains<sup>3</sup>; for each of them, a set of indicators is given (at NUTS2 level).

BES is becoming a more and more important tool to evaluate the progress of society from an economic, social, and environmental point of view. Consequently, the Italian Economic and Financial Document has included some BES selected indicators since 2017<sup>4</sup>. The interest in BES has been growing over time, especially for Italian provinces and cities (NUTS3) (see Taralli, 2013), so in the 2018, ISTAT issued for the first time a system of BES indicators at the NUTS3 level.

The BES domains at the local level are the same as those at national level, with an exception made for the subjective well-being domain because of the lack of subjective indicators at the local level. The 11 domains and the chosen indicators are listed in Table 1 they belong to the 2022 (10/3/2022) version of the database (see ISTAT(c), 2022).

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<sup>3</sup> [https://www.istat.it/it/files//2013/03/bes\\_2013.pdf](https://www.istat.it/it/files//2013/03/bes_2013.pdf).

<sup>4</sup> See <https://www.gazzettaufficiale.it/eli/id/2017/11/15/17A07695/sg>.

**Table 1** – Domain, name and description of considered indicators.

Domain	Name	Description
Health	Life_Exp	Life expectancy at birth
Education	Neet	People not in education, employment, or training (Neet)
Work and life balance	Unempl	Non-participation rate
Economic well-being	Loans	Rate of bad debts of bank loans to families
Social relationships	Acc_Sc	Accessible schools
Politics and institutions	Women	Women and political representation at municipality level
Security	Crimes	Number of other crimes reported (theft of any kind and robberies at home) on total population per 10,000 inhabitants
Landscape and cultural heritage	Rural	Spread of rural tourism facilities
Environment	Waste	Separate collection of municipal waste
Innovation, research and creativity	Cult_Emp	Cultural employment (% of total employment)
Quality of services	Elect	Irregularities in electric power distribution

In 2022, a set of indicators consisting of 70 measures has been published; each domain is not formed by the same number of indicators, and almost half of the indicators do not give values before 2008. Three domains (Social relations, Landscape and cultural heritage, and Innovation research and creativity) do not have data from before the 2008. Furthermore, the data related to the Social relations domain are still missing up to 2014. Some indicators present values only in well-defined years, that is, Voter turnout in European elections and Voter turnout in regional elections (Politics and institutions domain).

The criteria for the choice of each indicator inside the dimension is done as in Monte *et al.*, 2022, i.e. the correlations within each domain, the variability indexes (i.e. coefficient of variation and the quartile difference for standardized data) and the adequacy of the indicator to the analysis to be carried out.

### 3. The methodology: decisional trees

As it is well known decision trees are a part of hierarchical classification or segmentation techniques. These techniques have the purpose of "sorting" statistical units into the various classes of a dependent variable on the basis of the values of one or more explanatory variables.

In 1984 Breiman and others introduced an innovative segmentation technique. This technique is called Classification and RegressionTrees (CART). It is presented as a recursive and binary partition methodology.

The hierarchical segmentation process used in the construction of decisional trees consists in divide the statistical units in a finite number of disjoint subgroups in order to guarantee an internal homogeneity higher than that of the initial dataset and a high heterogeneity between the subgroups.

A tree has many analogies in real life, and turns out that it has influenced a wide area of machine learning, covering both classification and regression.

In decision analysis, a decision tree can be used to visually and explicitly represent decisions and decision making. As the name says, it uses a tree-like model of decisions. Though it is a commonly used tool in data mining for deriving a strategy to reach a particular goal, it is also widely used in machine learning. They are easy to interpret and make for visualizations, they make possible to reproduce work, they can handle both numerical and categorical data, they perform well on large dataset and are extremely fast. This type of models are used for both classification and regression (see eg. Gareth *et al.*, 2021).

The performance of a tree can be further increased by pruning in particular by using CART (see Breiman *et al.*, 1984) example of indices used for pruning are Gini and Entropy for classification trees and RSS (residual sum of squares) for regression trees.

$$G = 1 - \sum_j f_j^2 \text{ Gini index} \quad (1)$$

$$H = - \sum_j f_j \log \log f_j \text{ Shannon index} \quad (2)$$

where  $f_j$  relative frequency.

It involves removing the branches that make use of features having low importance. In so doing the complexity of tree is reduced and the power by reducing overfitting is increased. The simplest method of pruning starts at leaves and removes each node with most popular class in that leaf, this change is kept if it does not deteriorate accuracy. It is also called reduced error pruning. More sophisticated pruning methods can be used such as cost complexity pruning where a learning parameter (alpha) is used to weigh whether nodes can be removed based on the size of the sub-tree. In order to obtain the sequence of trees of decreasing dimension, one defines, for every tree  $T \leq T_{\max}$  a cost complexity function  $R_\alpha(T)$

$$R_\alpha(T) = \hat{R}(T) + \alpha |\tilde{T}| \quad (3)$$

where  $\hat{R}(T)$  estimate of rate of wrong classification,  $|\tilde{T}|$  the numbers of leaves.

## 4. The application

This section describes the data<sup>5</sup> used and the results of applying decision trees. As previously anticipated, we use the ISTAT database “*Misure del benessere dei territori. Tavole di dati (2022)*”<sup>6</sup>. We apply one indicator for each domain<sup>7</sup>. This is because of the following considerations:

- the different number of indicators by domain would lead to an initial distortion, resulting in different weights for each domain;
- there are cases in which the choice of only one comparable indicator is the only possible, because of the presence of numerous missing data in the table in relation to some domains;
- a similar approach is used by Ciommi *et al.* (2017), in which the domains of the territorial BES are described by a single indicator given the limited availability of homogeneous data.

### 4.1. Classification trees

As regards classification trees we have considered as dependent variable Macroregion according to NUTS 1: North West, North East, Center, Islands and South of Italy.

We have applied different models with and without pruning. At the end on the base of a compromise between complexity and rate of error we have chosen a classification tree with split and prune Gini index.

As we can see on the base of the model the rate of error is very low for Islands, North West and South and higher for North East and Center (Table 2).

**Table 2** □ *Confusion matrix based on the model.*

Macroregion	Center	Islands	North East	North West	South	Error rate
Center	16	1	0	0	5	0.2727
Islands	0	12	0	0	1	0.0769
North East	3	0	14	5	0	0.3636
North West	1	0	1	23	0	0.0800
South	0	1	0	0	23	0.0417

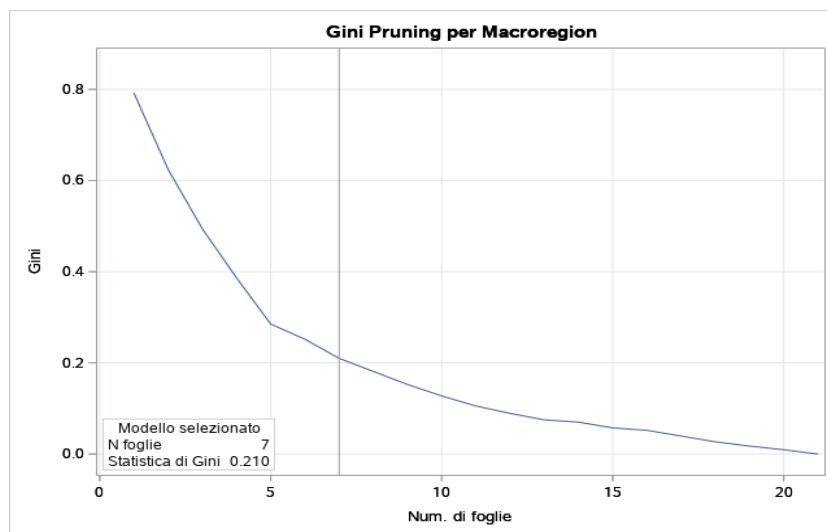
<sup>5</sup> We have considered 106 provinces as the data for Olbia Tempio Pausania, Ogliastra, Medio Campidano, South Sardegna, Carbonia Iglesias are not available.

<sup>6</sup> The 11 domains and the chosen indicators are listed in Table 1. The data are available at the url <https://www.istat.it/en/well-being-and-sustainability/the-measurement-of-well-being/bes-at-local-level>

<sup>7</sup> We have performed the analysis using SAS language.

In Figure 1 the selected model using the Gini's index for the pruning is reported.

**Figure 1** – *The selected model using the Gini's index for pruning.*



As one can see the number of chosen leaf according to the Gini index are 7 ; the value of the Gini index is 0.210 while the entropy of Shannon is higher that is 0.547.

The importance of the variables for the construction of the classification trees is reported in Table 3

**Table 3** – *Variable importance.*

Variable	Relative importance	Importance	Count
Unempl2021	1.0000	5.3405	2
Life_Exp2020	0.6957	3.7155	1
Women2021	0.6323	3.3769	1
Elect2020	0.3948	2.1082	1
Neet2021	0.3512	1.8755	1

In the next figure the obtained classification tree is produced. The leaves (terminal nodes) are: node3, node 6, node 7, node 8, node A, node B, node C.

Figure 2 – Classification tree.

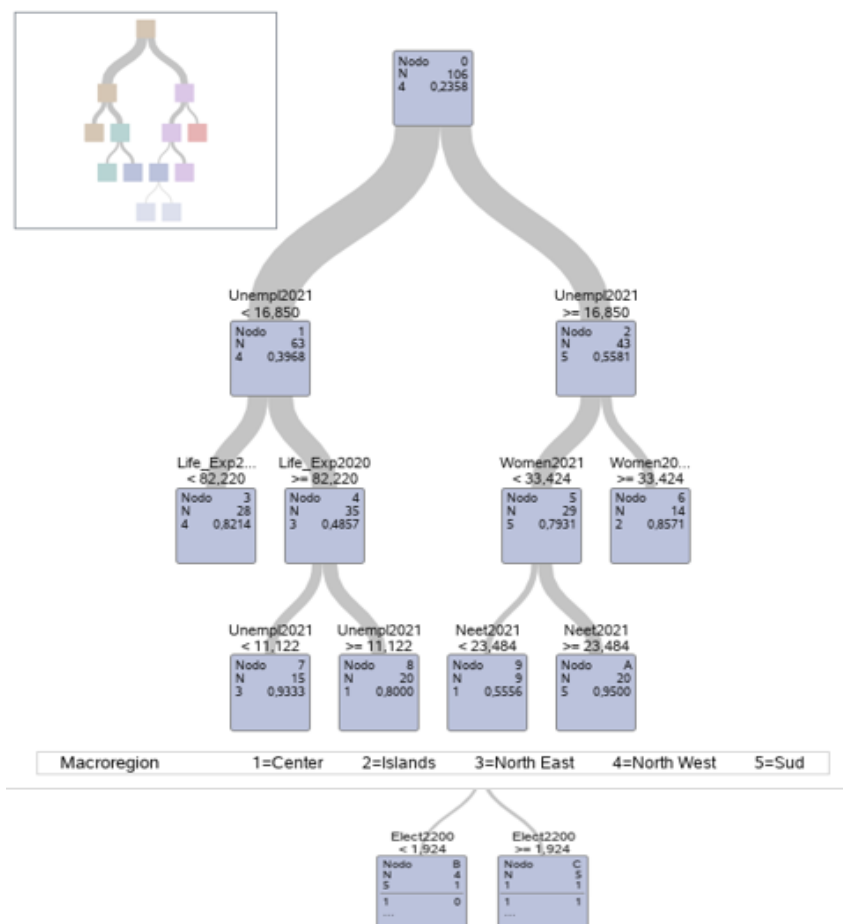


Figure note: Node 9 is divided in node B and node C.

There are 106 units in the root node (node 0). These units are divided into 63 units with *Unempl2021* <16.850 (node 1) and 43 units for node 2 with *Unempl2021* ≥ 16.850 (node 2). Node 1 is assigned to class 4 (North East) while node 2 to class 5 (South).

The variable *Unempl2021* and the division point 16.850 are chosen to minimize the impurity of the root node measured by the Gini index.

The units of node 1 have been divided into 28 units for which *Life\_Exp2020* <82,220 (node 3) assigned to class 4 (North West) and 35 for which *Life\_Exp2020* ≥82,220 (node 4) assigned to class 3 (North East).

The units of node 2 have been divided into 29 units for which  $Women_{2021} < 33.424$  (node 5) and 14 units for which  $Women_{2021} \geq 33.424$  (node 6).

The classification tree provides simple rules for predicting Macroregion. For example, a unit for which it is expected that  $Unempl_{2021} \geq 16.850$  the percentage of unemployed is greater than 16.850 and the percentage of Women and political representation at municipality level is greater than 33,424 is assigned to the Islands.

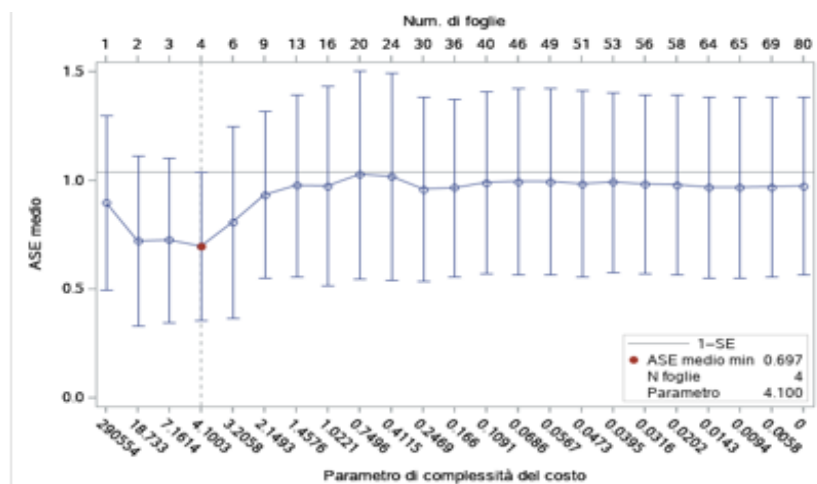
#### 4.2. Regression trees

In order to apply regression trees we have chosen as dependent variable Life Expectancy at Birth. We try to predict the dependent variable on the base of the other variables.

We have applied different models with and without pruning. At the end on the base of a compromise between complexity and rate of error we have chosen a regression tree with split RSS and prune cost complexity.

We have carried out the pruning of the tree to avoid overfitting of the model on the data and to find a compromise between simplicity and discriminatory power. As regards the pruning we have preferred cost complexity which is an algorithm based on a trade off between the complexity (size) of the tree and the error rate to prevent overfitting. The final tree has a depth equal to 5 leaves and a parameter of cost complexity of 4.100. The ASE (Average Square Error for Regression) is given by the ratio between RSS (residual sum of squares) and the number of units of the node. In our case the ASE medium minimum is equal to 0.697.

**Figure 3** – The selected model using pruning cost complexity.



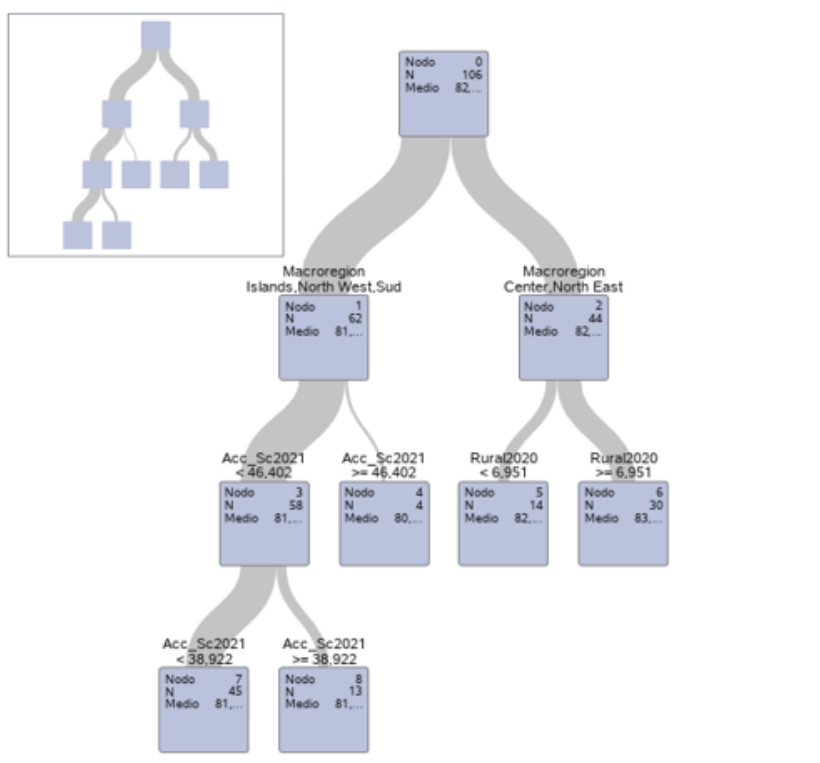


Considering variable importance from Table 3 we can see which variables are the most important: Macroregion, Accessible schools and Spread of rural tourism facilities. The presence of the Macroregion variable shows us once again that there is actually a basic difference between the various Italian macro areas.

**Table 4 – Variable importance.**

Variable	Relative importance	Importance	Count
Macroregion	1.0000	5.3903	1
Acc_Sc2021	0.7484	4.0340	2
Rural2020	0.3846	2.0730	1

**Figure 4 – Regression trees with pruning costcomplexity**



There are 106 units in the root node (node 0). These units are divided into 62 units which belong to Islands, North West and South (node 1) and 44 units with Macroregion Center and North East (node 2). Node 1 is assigned to people with Life Expectancy at birth of approximately 81 years while node 2 to people with Life Expectancy at birth of approximately 82 years.

The units of node 1 have been divided into 28 units for which  $Acc\_Sc2021 < 46.402$  (node 3) with Life Expectancy at birth of approximately 81 years and 4 for  $Acc\_Sc2021 \geq 46.402$  (node 4) with Life Expectancy at birth of approximately 80 years.

The units of node 2 have been divided into 14 units for which  $Rural2020 < 6.951$  (node 5) and 30 units for which  $Rural2020 \geq 6.951$  (node 6).

The regression tree provides simple rules for predicting Life Expectancy at birth. For example, a unit for which it is expected that lives in the North East with a value for  $Rural2020 > 6.951$  is expected to live in mean approximately 83 years.

## 5. Conclusions

The purpose of this paper is to see how, on the basis of the data relating to sustainable equitable well-being defined through some indicators, there is the possibility of predicting the trend of variables of interest. In order to obtain this result decision trees have been used; as regards classification trees the chosen dependent variable has been Macroregion while for applying regression trees the dependent variable has been Life Expectancy at Birth.

Future developments regards the applications of decisional trees in conjunction with random forest. Random forest can to improve the forecasting of regression trees as it is, one of the most popular machine learning prediction algorithms. It can be considered an elaboration of regression trees by averaging the predictions of a large number of randomly subsampled regression trees so to obtain a more stable solution.

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## SUMMARY

The starting point of this paper has been the consideration that the use of GDP as an indicator of the well-being nowadays is not sufficient to describe the economic situation of a country in terms of sustainable well-being in Italian Benessere Equo Sostenibile (BES). The Italian National Institute of Statistics (ISTAT) consider a multidimensional approach to measure equitable and sustainable well-being. Following this approach we have chosen a certain number of indicators, on the basis of their features, *i.e.* Health, Education, Work and life balance, Economic well-being, Social relationships, Politics and institutions, Security, Landscape and cultural heritage, Environment. These indicators can help in describing the territories in particular in our case the provinces (NUTS3).

To have a description of some aspects of the economic situation multivariate analysis have been applied. The new idea regards the application of decision trees.

We consider both classification and regression trees; two different variables have been chosen. As regards classification trees the dependent variable is Macroregion while for regression trees dependent variable is Life Expectancy at Birth.

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## INSULARITY AND INTERNATIONAL TRADE: THE CASE OF SICILY<sup>1</sup>

Lucio Siviero, Benedetto Torrìsi

### 1. Introduction

Territorial development has become increasingly central to an economics debate when analysing the factors that influence the aspects of such development. There can be no development without opening a region up to interregional and international commercial activities.

Within a territorial context where commercial relationships are essential to a marginal location or an island, it has become crucial for a scientific community to question the effects on an “insularity condition” when deciding which aspects are to be developed in relation to international trade.

The issue remains crucial because various authors have already evidenced how international trade relationships are correlated with international competition and how these relationships apply statistical forces and intensities that differ depending upon territorial continuity (Martí Puertas and García, 2014).

Factors such as infrastructure development pertaining to a centralised relational context appear to be vital to international trade development and the consequent enrichment of a region.

The geographical characteristics that favour transport connections define the capability of a region to link with trade partners and are fundamental to successful commercial activities. This capability is also determined by infrastructures that reduce transport times and relative costs, that can translate to added value (Carlucci *et al.*, 2018). There are many scientific contributions that address these aspects (Martinez-Zarzoso and Márquez-Ramos, 2008; Skonieczny and Torrìsi 2011).

One of the crucial elements that explain international trade development within a region, however, is linked to its topography and/or other territorial characteristics that any adequate infrastructure has developed to contribute to increase trade and the

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<sup>1</sup> This contribution derives from the NEMO research programme with PI Benedetto Torrìsi. The paper is the result of shared evaluations made by the authors. Sections 3 and 4 are attributed to Lucio Siviero, sections 1 and 5 to Benedetto Torrìsi and section 2 is attributed to Lucio Siviero and Benedetto Torrìsi. Salvatore Scuderi collaborated towards realisation and elaboration of the datasets.

related added economic benefits must be taken into consideration. It seems that economic theory lacks significant contributions regarding this aspect, as highlighted in the works by Márquez-Ramos and Aparisi-Caudeli (2013) and Celbis, Nijkamp and Poot (2014) where the lack of literature regarding the impact of territorial characteristics or physical aspects as factors that could explain international trade development is noted.

This is where we need to reopen the debate in order to prove that territorial characteristics and continuity represent a fundamental feature for logistics development, and that an adequate distribution of intermodal structures and a sufficient number of logistics companies are necessary to guarantee that any detachment between the related trade areas decreases, resulting in an increase in competitiveness.

At this point, given the context of an island lacking territorial continuity, what effect can infrastructures or logistics hubs produce with regard to competitiveness in international trade? This is still an open question on which the scientific community places particular emphasis when justifying policies used to simulate island territories as central hubs involved in international trade.

The paper is organized as follows. Section 2 shows the collected data and the definition of variables to the model implementation. Section 3 deals with the econometric methodology adopted and section 4 involves the main results obtained by different models modifying the fixed effects specifications. Finally in section 5 some implications of policy emerge from the above results.

## **2. International trade statistical sources and data**

The first difficulty found with the dataset layout is linked to the completeness of data provided by official sources. Nevertheless, we were able to construct a dataset capable of dialogue between 20 Italian regions and 20 European countries involved in international trade. The dataset is characterised by various dimensions of structural and regional competitiveness that explain incoming and outgoing trading capabilities for various sectors within the international trade system.

The dataset was constructed by placing trade relations in the manufacturing sector into a 20 x 20 panel data for the period 2007-2018 and taking GDP and pro-capita GDP for the regions and countries as being representative of the territorial economic mass, together with the geographical distances, the distance-related and time-related costs of road transport between European regions at the NUTS 2 level, the efficiency of the trading partner transport and logistics systems expressed by the World Bank LPI (Logistics Performance Index), trade logistics data that indicate global transport/logistics performance. Additional global and other specific indicators were

also included in order to acquire greater details concerning various network performance parameters.

A set of summarised competitiveness level indicators concerning production systems in the Italian regions was also acquired and constructed, along with infrastructure endowment levels and territorial transport/logistics network efficiency. It should be noted that these data entered the evaluated empirical specifications as explicative variables, while import and export flows function as dependent variables; given the size of the dataset, however, specifications that foresee different result variables such as GDP and/or others may be modelled.

A longitudinal type panel dataset covering the 2007-2018 time period containing 3560 observations has resulted from the variable combinations concerning multi-sector import and export flows.

Our choice to construct the dataset at the regional level NUTS-2 comes from our intention to investigate the effect on foreign trade caused by the territorial discontinuity of Sicily as a whole considering the relevance of the main regional transport and logistics hubs, especially ports, for international trade. It must be highlighted that many Italian provinces (NUTS-3) do not have any ports and the presence of zero values would have increased considering the NUTS-3 provincial units in the dataset. The sources and descriptions of the variables that have been considered to develop the Italian infrastructure endowment gravity regional models are collated in Table 1 while Table 2 contains the regions and the partner countries considered in the following models.

**Table 1 – Variable Definitions.**

	Description	Source
$Y$	Total export of the manufacturing sectors - ATECO Section "C" in current Euros	ISTAT - Coeweb
$X_1$	Natural log of Gross Domestic Product of the Italian regions in current Euros	ISTAT - EUROSTAT
$X_2$	Natural log of Gross Domestic Product of the importer counties in current US Dollars	CEPII Dataset
$X_3$	a) Natural log of Distance-related costs of freight road transport between Italian regions and partner countries; b) Natural log of Time-related costs of freight road transport between Italian regions and partner countries	Regional Transport Costs. European Commission, Joint Research Centre (JRC), Persyn <i>et al.</i> 2020
$X_4$	Natural log of the road regional endowment expressed in km of the regional network per square km of regional surface	ISTAT - Territorial Indicator
$X_5$	Natural log of the electrified regional rail network on the total rail network	ISTAT-Territorial Indicator
$X_6$	Natural log of Number of berths of the regional ports per square km of regional surface	ISTAT - ASTI

**Table 2 – Territory Definition vs Foreign Countries.**

Regions	Countries
Abruzzo	Austria
Basilicata	Belgium
Calabria	Bulgaria
Campania	Croatia
Emilia-Romagna	Denmark
Friuli Venezia Giulia	France
Lazio	Germany
Liguria	Greece
Lombardy	Ireland
Marche	Netherlands
Molise	Poland
Piedmont	Portugal
Apulia	United Kingdom
Sardinia	Czech Republic
Sicily	Romania
Tuscany	Slovacchia
Trentino-Alto Adige	Slovenia
Umbria	Spain
Valle d'Aosta	Sweden
Veneto	Hungary

### 3. Econometric model

Empirical studies in literature highlight the application of relational models often based on OLS or GLM, or even LISREL models. The models that produce the best results regarding the measurement of trading relationship effects actually belong to the gravitational type.

The gravity model is commonly used to model international and interregional trade flows. As reviewed by Head and Mayer (2014), the gravity equation can be justified by a broad range of trade theories, such as those based on differences in factor-endowments (Deardorff, 1998), monopolistic competition (Helpman and Krugman, 1985), home-preferences (Anderson and Van Wincoop, 2003) or increasing returns to scale (Helpman and Krugman 1985; Evenett and Keller, 2002).

A basic gravity model of trade is a model of bilateral trade interactions in which size and distance effects enter multiplicatively: a gravity equation of this kind, dubbed as ‘naive’ by Head and Mayer (2014), can be represented as:

$$X_{ij} = G Y_i^\alpha Y_j^\beta d_{ij}^\gamma \quad (1)$$



Where  $X_{ij}$  represents the bilateral flow from country  $i$  to country  $j$ ,  $G$  is a ‘gravitational’ constant,  $Y_i$  and  $Y_j$  are the economic mass of the trading countries such as GDP,  $d_{ij}$  is market accessibility such as distance costs between the two independent regions.

The lin-log transformation can be taken and adding a time dimension for a panel dataset estimated more easily. The basic empirical model uses an augmented gravity structure to control for the countries’ unilateral and bilateral (dyadic) characteristics:

$$X_{ijt} = \exp [\alpha_0 + \alpha_1 \ln(GDP_{it}) + \alpha_2 \ln(GDP_{jt}) + \alpha_3 \ln(\text{distance cost}_{it}) + \alpha_4 \ln(\text{inf}_{it}) + \rho_{it} + \gamma_{ji} + \pi_{ijt}] \eta_{ijt} \quad (2)$$

The model specification of the equation (2) includes exporter-time fixed effects ( $\rho_{it}$ ) and importer-time fixed effects ( $\gamma_{ji}$ ), pair fixed effects ( $\pi_{ijt}$ ) are also included in order to control for all possible (observable and unobservable) trade costs at bilateral level. The pair fixed effects will absorb most of the linkages between the endogenous trade policy variables and the error term  $\eta_{ijt}$  in order to control for potential endogeneity of the former. In principle, the error term in gravity equations may carry some systematic information about trade costs. However, due to the structure of the fixed effects, researchers should be more confident to deal with them and interpret them ( $\eta_{ijt}$ ) as a true measurement error (Yotov et al., 2016). Finally, it doesn’t matter for the PPML estimator whether the error term in equation (2) is introduced as additive or multiplicative (Santos Silva and Tenreyro, 2006).

The potential of Poisson Pseudo-Maximum-Likelihood (PPML) estimation was recognized early in the spatial sciences by Davies and Guy (1987) who recommended using pseudo-likelihood methods instead of the more popular Poisson regression for the modelling of spatial flows. However, it was not until Santos Silva and Tenreyro (2006) that PPML took off particularly in the international trade literature. With this method, as the dependent variable enters the specification in levels and not in logarithms, it is possible to include zero trade flows in the regression.

The increasing availability of larger panel-type datasets, coupled with advances in estimation techniques for linear regression models with high-dimensional fixed effects (HDFE), has allowed researchers to control for multiple sources of heterogeneity. In this study, we apply the PPML HDFE regression implemented in Stata which pays close attention to verify the existence of a maximum likelihood solution, adapting the innovations and suggested approaches described in Correia, Guimaraes and Zylkin (2020). It also introduces some novel acceleration techniques concerning existing algorithms for HDFE nonlinear estimation that eliminate some

unnecessary steps and leads to faster the computation of the parameters of interest and offer the full functionality of factorial variables to control for fixed effects.

Fixed effects can be included in the regression model in order to account for unobserved factors. Using fixed effects for both the exporting country and the importing country is common practice, and these fixed effects can account for unobserved characteristics of the exporting and importing country. Furthermore, time-dummies are always included to account for time specific fixed effects such as crises and for the deflation of nominal monetary values (Wessel, 2019). In particular we control for region/country pair and region/country-time fixed effects (for both importer and exporter regions/countries). It is general practice to use robust standards error clustered at the country-pair level (Yotov *et al.*, 2016).

The clustered panel regression confirmed by the robust Hausman test reported at the bottom of Tables 3 that a fixed effects specification should be adopted.

In the basic model we consider the Gross Domestic Product of the region of origin and of the country of destination. The bilateral trade costs are approximated by the average distance between Italian regions and the regions belonging to the importing European countries, measured in terms of road freight transport costs variable with distance for a shipment by a representative 40 tons articulated truck (Perysin *et al.*, 2020). The infrastructural variables ( $inf_{it}$ ) for each export flow region of origin considered in the basic regional gravity model are: a) the natural log of the road regional endowment expressed in km of the regional network per square km of regional surface, b) the natural log of the electrified regional rail network on the total rail network, c) the natural log of the number of berths in the regional ports per square km of regional surface.

#### 4. Results

The results are interesting with regard to the size of the effect generated in both general territorial contexts and in island contexts. Infrastructural indicators for railways and ports indicators are positive and very significant and have a positive impact on international trade relations, while the indicator for roadways is significant and negative.

In order to capture the effects on international trade relations that infrastructures can generate and to highlight the weaknesses of continuous and central nodal network connections, we have formulated the model with island fixed effects specific to Sicily (Table 4).

**Table 3 – General model results**

Variables	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	Constant
Y	2.744*** (0.314)	0.740*** (0.0741)	-17.63*** (0.823)	-1.89e-08*** (3.51e-09)	7.56e-09** (3.52e-09)	0.0111*** (0.00418)	38.59*** (9.743)
Obs	Wald chi2	r2_p	ll_0	deviance	ll		
3560	661.5	0.990	-2.250e+12	4.310e+10	-2150e+10		

Clustered Robust Hausman Test  $\chi^2(5) = 35.09$  (prob=0.0000)  
Country-Year Fixed Effects Yes  
Importer and Exporter Fixed Effects Yes  
\* p<0.1, \*\* p<0.05, \*\*\* p<0.01. Clustered Robust Standard errors in parentheses.

**Table 4 – Sicily Model Results (with island effects  $X_5, X_7, X_9 = 1$ )**

	$X_1$	$X_2$	$X_3$	$X_4=0$	$X_5=1$
Y	3.012*** (-0.255)	0.702*** (-0.0449)	-0.952** (-0.487)	-1.90e-08** (-7.92E-09)	-4.97e-08*** (-1.42E-09)
continue	$X_6=0$ 9.46e-09*** (-3.31E-09)	$X_7=1$ -1.33e-08*** (-6.85E-10)	$X_8=0$ 0.0193*** (-0.00494)	$X_9=1$ 0.00890*** (-0.000932)	Constant -89.40*** (-10.03)
Obs	Wald chi2	r2_p	ll_0	deviance	ll
3560	8.51e+08	0.988	2.25e+12	5.59e+10	-2.79e+10

Country-Year Fixed Effects Yes  
Importer and Exporter Fixed Effects Yes  
\* p<0.1, \*\* p<0.05, \*\*\* p<0.01. Clustered Robust Standard errors in parentheses.

These preliminary results show how the infrastructure indicator that determines positive effects on Sicilian trade is that of the ports, while roadways and electrified railways indicators are significant and negative. These results are also confirmed considering the time-related costs as spatial “impedance factor” ( $X_3$ ) which include travel time over the road segment, salaries in the transport sector, national speed limits, and the European transport regulations on resting times for a shipment by a representative 40 tons articulated truck (Perysin et al., 2020) (Table 5).

These results are naturally in line with Sicily’s ‘insularity conditions’ where a large part of the exported goods is transported by sea. Investment in the maritime infrastructure could greatly increase the value of Sicilian exports.

**Table 5 – Sicily Model Results (with island effects  $X_5, X_7, X_9 = 1$ )**

	$X_1$	$X_2$	$X_3$	$X_4=0$	$X_5=1$
Y	3.012*** (0.254)	0.702*** (0.0452)	-1.560*** (0.524)	-1.90e-08** (7.92e-09)	-4.97e-08*** (1.40e-09)
continue	$X_6=0$ 9.50e-09*** (3.32e-09)	$X_7=1$ -1.33e-08*** (6.91e-10)	$X_8=0$ 0.0193*** (0.00494)	$X_9=1$ 0.00890*** (0.000870)	Constant -86.53*** -9.894
Obs	Wald chi2	r2_p	ll_0	deviance	ll
3560	4.96e+11	0.988	-2.25e+15	5.50e+15	-2.75e+13

## 5. Conclusion

These initial results show an interesting scenario thanks to the application of gravitational models, without which the aspects linked to particular territorial characteristics, would not have emerged.

If the variable effects under examination are analysed based on international exports in a general territorial context where territorial continuity exists, all the variables are significant and each one clearly indicates its effect on trade relations; the other major relevancy emerges when the same variables are applied to an island location with territorial discontinuity.

According to this logic, the policy indications emerging from the results are clear: where investment continues to be made for infrastructure development, such as intermodal links within an area of territorial continuity, the effects greatly benefit commercial activity, while they are less effective for island territories where infrastructure development is mainly necessary to ports and shipping. The impact generated by road or rail networks is significant but with negative signs due to the insular location and lack of territorial continuity, isolating them from the national transport network and crucial logistics hubs.

It is possible to surmise a policy scenario from these conclusions that foresees a strong relationship in terms of investment in infrastructures that guarantee territorial continuity, thus raising regional competitiveness capability indicators for international trade.

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## SUMMARY

There is a broad consensus that international trade plays a role in promoting economic growth. Among the main drivers of international competitiveness, geographical factors and transport infrastructure cover a relevant role. Trivially, the distance between a region and its trading partners is, in itself, a determinant of the region's competitiveness in international markets, since a closer region would have an advantage. However, in the modern economy, logistics plays an increasingly important role in strengthening international competitiveness,

as globalization has expanded the trade network by making the physical distance between regions less important. In this paper we study the case of Sicily, the largest island in the Mediterranean Sea, to see if insularity plays a role in explaining this region's total exports given its infrastructure endowment. Consistent with a broad strand of the international trade literature, this aim is achieved by means of gravity models estimated via Poisson Pseudo-Likelihood regression with multiple levels of Fixed Effects (PPML HDFE implemented in Stata). Using a novel panel dataset on the 20 Italian regions and their main international trading European partners from 2007 to 2018, we show the impact of maritime transport, roads and railways on total export of Sicily. In particular, we find a positive significant role of ports on international trade for the island. These results offer useful suggestions on what infrastructure is best to invest in to increase Sicily's total exports.

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## INFLATION AND CONTRACTUAL WAGES: THE ITALIAN BARGAINING SYSTEM

Livia Fioroni

### 1. Introduction

The relationship between inflation and wages has always been a central topic in macroeconomic and becoming more relevant in the recent period, due to the unexpected increase of level prices, observed in the most developed economies. Recent international studies focused on the factors that characterized the bargaining system over the world to analyse the responsiveness of negotiated wages to economic conditions (among them Babic et al., 2022; D'Amuri, 2022; Suthaharan et al., 2022; Ardagna, 2021; Rizzotti et al., 2021).

In Italy, inflation starting growth since August 2021, driven by the increase in energy goods prices. In May, the acquired inflation for 2022, measured by the harmonized index of consumer prices (HICP) was 6.4 percent. In the last months, inflation return to the level of the yearly 1990s. The measurement of compensation used in this work is the contractual wage that represents approximately the 80 percent of total remuneration<sup>1</sup>. To better understand the relationship between inflation and wages in Italy, it is necessary to explore some characteristics of the Italian bargaining system because the formation of total compensation origins mainly on it.

This study makes a focus on the peculiar factors of bargaining system that most influence contractual wage changes: 1) the inflation forecasting indicator used to set contractual increases - Harmonized Index Excluding Imported Energy Goods – HICP; 2) the duration of national collective bargaining agreements; 3) the share of collective bargaining agreements in force (ISTAT, 2021).

The dynamic of contractual wages and inflation is analysed in time series, from 2009, year of bargaining system reform, to 2021 and an overview for the year 2022 is presented.

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<sup>1</sup> The percentage is calculated between gross remuneration per employee - full-time equivalent (*National Account*) and cash wages per employee according to collective agreement (*Contractual wages survey*).

## 2. The Italian bargaining system

Unlike the largest part of State of Europe, in Italy doesn't exist "minimum wage" defined by law and valid for all employees in every sectors<sup>2</sup>, but minimum wages are set through national collective bargaining agreements (NCBAs), which play a central role in the definition of total compensation for regular employees. In Italy the bargaining system takes place at two level: 1) *national level* (first level), is the most important and involves trade unions and employers associations for each economic activities in the Italian territory; 2) *company - territorial level* (second level), that integrates first level.

The National Collective Bargaining Agreement (NCBA), the result of first level of negotiation, sets basic wages and general rules (i.e. hour of work, day off, employment condition etc.). Looking at National Council for Economics and Labour database<sup>3</sup> there are more than one thousand contracts registered for private sector (release of 16 May 2022). NCBAs are fundamental in the composition of total remuneration for regular employees. There are not official statistics on the coverage of collective bargaining, but according to the result of the *Structure of Earnings Survey*, in 2018, the 98% of companies with more than 10 employees are covered by collective agreements<sup>4</sup> (ISTAT, Audition of 29 January 2020) and the compensation defined by NCBA represents more than three quarters of the total gross wage, in all activity sectors. In 2021 contractual wages make up the 85 percent of total remuneration for total economy, 75 percent of the industrial sector, the 88 percent of private services and the 83 percent for public administration (Figure 1)<sup>5</sup>.

Firm and territorial agreements (second level) play a limited role in industrial relations in Italy, because of the small size of companies (negotiations represents higher cost for companies) and because second-level contracts remain substantially subordinate to the national contract. The information available from the INVIND survey of Bank of Italy, regarding companies with at least 20 or more employees in the non-financial private sector, report that the companies that adopt a second level bargaining has remained stable at around 20 per cent in the period 2010-2016 and

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<sup>2</sup> The largest part of European countries has a minimum wage fixed by law. At of 1 January 2022, 21 out of the 27 European Union state member, have a minimum wage, except: Denmark, Italy, Cyprus, Austria, Finland and Sweden (OECD).

<sup>3</sup> <https://www.cnel.it/Archivio-Contratti>.

<sup>4</sup> Excluding agriculture sector.

<sup>5</sup> Elaboration on: *National Account, domestic wage and salaries per employee (full time equivalent) data and Contractual wages Survey, cash contractual wages per employee for economic activity data*.



involved only the 30-40 percent of workers in private-sector (D'Amuri and Nizzi, 2017).

**Figure 1** – Share of total remuneration explained by contractual wages. Main aggregates - Year 2021.



Sources: Istat, National Account and Contractual wages Survey

The Italian bargaining system was reformed in 2009 by the “*Accordo Quadro sulla riforma degli assetti contrattuali*”<sup>6</sup> signed between trade unions and CISL, UIL and later by UGL, and in 2018 by the inter confederal agreement “*Patto di fabbrica*” signed only by Confindustria<sup>7</sup>. The most important innovations of 2009 agreement are: 1) the length of collective agreement passed from four years to three years, for both economic and condition working part (in the 1993 agreements, the negotiations should take place every two years for economic part and every four years for condition working); 2) to determine pay rise at the time of renewals, a three-years forecast index inflation based on the HICP (Harmonized European Consumer Price index), excluding the trend of imported energy goods price, is used (from 1993 to 2009, the planned inflation rate (TIP) was the index used to adjust contractual wages to inflation).

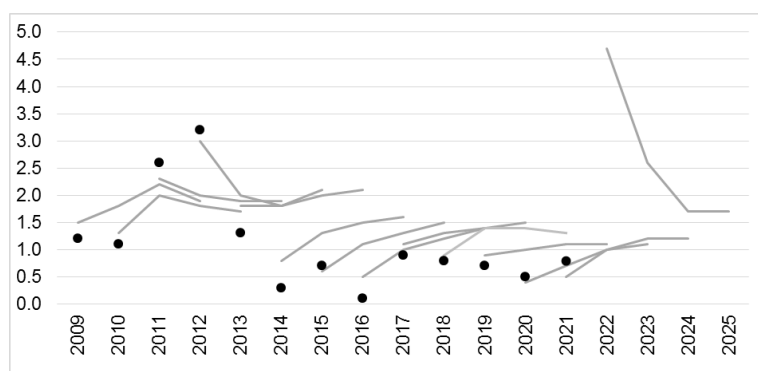
<sup>6</sup> The 2009 agreement was experimental and had a duration of four year, but it continues to be applied.

<sup>7</sup> The most important innovation is that collective agreement can modify the value of remuneration to take account of the processes of transformation and organizational innovation.

### 3. Forecast of provisional HICP excluding energy goods price

The Harmonized Index Excluding Imported Energy Goods - HICP is calculated by National Institute of Statistic (ISTAT) and every year in May/June releases the forecast of provisional index for current year and for the following three years. Since 2010, ISTAT also publishes the realized HICP excluding imported energy goods of previous year (i.e. in June 2022, ISTAT produced forecasts for 2022, 2023, 2024 and 2025 and released the realized HICP in 2021). Figure 2 shows the difference between forecasts and realization of HICP net imported energy goods. Black points represent the inflation values realized in every year; lines, composed by four points, disclose the inflation previsions for current years and following three years.

**Figure 2** – *HICP excluding imported energy goods: difference between forecast 2009-2025 (line) and realization 2009-2021 (point).*



Sources: Isae, Istat, communication on forecast HICP net imported energy goods.

Over the period 2009-2020, HICP excluding imported energy goods presents important mismatching between forecast and realization. Since 2013 to 2019, the difference between forecast and realization has always been positive for every annual forecast, leading to an increase in contractual wages in real term; in fact, HICP and HICP net imported energy goods from 2009 to 2021 presents a very similar growth (Figure 3). Only in 2011 and 2012 the realization has been always higher than forecasts, due to an unexpected and significant increase of energy price level (11.2% y/y in 2011 and 13.9% y/y in 2021); while for 2021 and 2022 realization values exceed forecasts only the first year of previsions. Each forecasts set covers a period of four year. For example, the forecast made in May 2013 concern 2013, 2014, 2015

and 2016. Its possible individuate two contractual period: 2013-2015 and 2014-2016 (as mentioned above the contractual length is three year). Table 1 reports the difference between the sum of three forecasts for every contractual period and the realized inflation, from 2009 to 2021 (there is no information about realized inflation for 2022 that will be release by ISTAT on May/June 2023).

**Table 1** – *HICP excluding imported energy goods: difference between forecasts and realization. Year 2009-2021.*

Data forecast	Contractual period										
	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021
May 2009	0.6	-1.0									
May 2010		-1.8	-1.6								
May 2011			-0.9	1.0							
Aug. 2012				2.0	3.6						
May 2013					3.3	4.8					
May 2014						2.5	2.7				
May 2015							1.3	2.1			
May 2016								0.9	1.2		
May 2017									1.4	2.2	
May 2018										1.7	2.1
May 2019											1.0

Source: elaboration on communication on forecast HICP excluding imported energy goods.

For 2010-2012 and 2011-2013 contractual period, inflation forecasts have always been lower than realized values (marked in red), implying that renewals occurred in that period linking the economic increases to current provisional values, generated a lost in real term. At the contrary, in the period 2009-2011 and since 2012-2014, economic pay generate always a gain in real term.

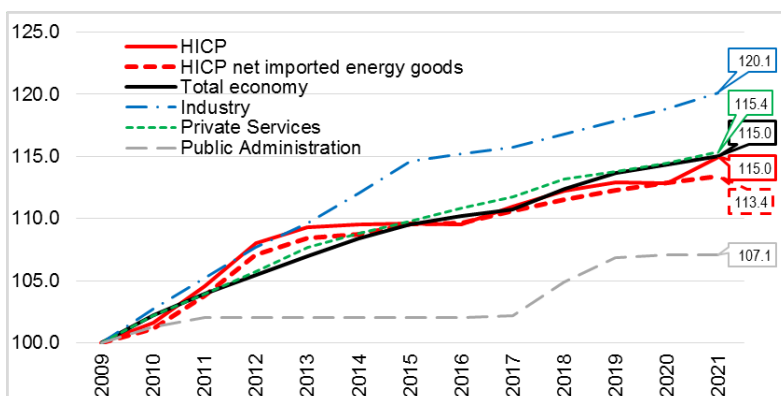
#### 4. Inflation and contractual wages growth

The contractual wage used in this study is calculated by ISTAT from the monthly *contractual wage and salaries* survey ([Retribuzioni-contrattuali-Nota-informativa.pdf \(istat.it\)](#)). Data refer to a representative sample of 73 national collective bargaining agreements (December 2015=100) that involve about 12.6 million of employees, except apprentices and managers. The survey covers all the economic activity sectors. The national collective bargaining agreements are the most representative for number of employees respect to the other contracts of the same sector. The remuneration elements considered have a general and continuous feature, including additional monthly payments and other amounts made on a higher

than monthly periodicity; it excludes occasional bonuses, overtime work, arrears and lump sum payments and the amounts established by decentralized agreements (second level). From 2009 to 2021 the HICP annual average rate was 1.2 percent, the same of contractual wages growth in total economy. In the end of the period, both HICP and wages increased by 15.0 percent with differences across sectors (Figure 3). The HICP excluding imported energy goods was slightly lower, increasing by 13.4 percent. The annual average rate of nominal contractual wages rose more than inflation for industrial sector, 20.1 percent, and for private services, 15.4 percent. Public administration lost more than the other sectors in real terms, because nominal contractual wages only grow by 7.1 percent. In this sector, contractual wage were frozen to 2009 level until 2018. Only in 2018 the renewals started, referred to 2016-2018 contractual period.

Data show that in absence of inflationary shocks and with a slight and constant increase of prices level, wages grow in line with inflation.

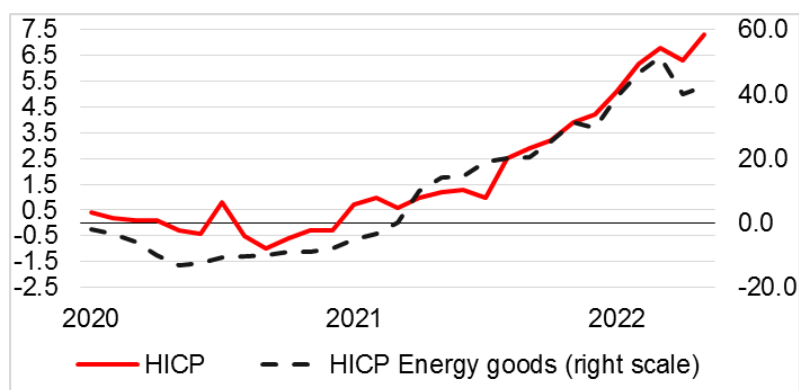
**Figure 3** – Inflation and contractual wages growth. Index numbers (2009=100). Years 2009-2021.



Sources: Istat, CPI survey, communication on forecast HICP net imported energy goods, contractual wages survey

Starting from the second half of 2021, level prices has been increasing, driven by the rise in energy goods and, as more energy good price is variable, as more forecasts of HICP, using to determinate contractual pay, become difficult.

In only two years, the energy goods price passed to -13.1 percent of May 2020 to 42.6 percent of May 2022. The inflation, measured by HICP, rise to 7.3 percent reaching the early 1990s' (Figure 4).

**Figure 4** – HICP and energy goods price. Monthly changes. January 2020- May 2022.

Sources: Istat, CPI survey

The current period of elevated inflation has, so far, a weak impact on contractual wage dynamic. The renewals, signed after June 2021 and before June 2022, linked economic increases of 2021-2023 contractual period, to the forecasts published in June 2021 and equal to 0.5 percent y/y in 2021, 1 percent y/y in 2022 and 1.2 percent y/y both in 2022 and 2023, implying that inflationary pressure will not be transmitted to wages in this round of negotiations<sup>8</sup>. On 7<sup>th</sup> June 2022 ISTAT published a new set of inflation forecasts that will be used in the ongoing wage negotiations. The new forecasts (4.7 percent in 2022, 2.6 percent in 2023 and 1.7 percent both in 2024 and 2025) reflect the higher level of inflation that represent the basis for wages increasing in the renewals upcoming in the 2022 second semester. According to the information available in March 2022, concerning the share of agreements that will remain in force and the increases already negotiated by the contracts that will be paid in the following months, the projection for 2022 of the wage dynamic is 0.8 percent (this percentage could increase more after some contract renewal), while the HICP acquired inflation in May 2022 over the whole year is 6.4 percent<sup>9</sup>.

<sup>8</sup> According *Contractual wage survey*, from July 2021 to March 2022, 13 contractual agreements have been renewed and refers to about 11.2 percent of total employees. Among this only construction applied higher increases than the forecast HICP. For more details: Contratti collettivi e retribuzioni contrattuali - I trimestre 2022 (istat.it).

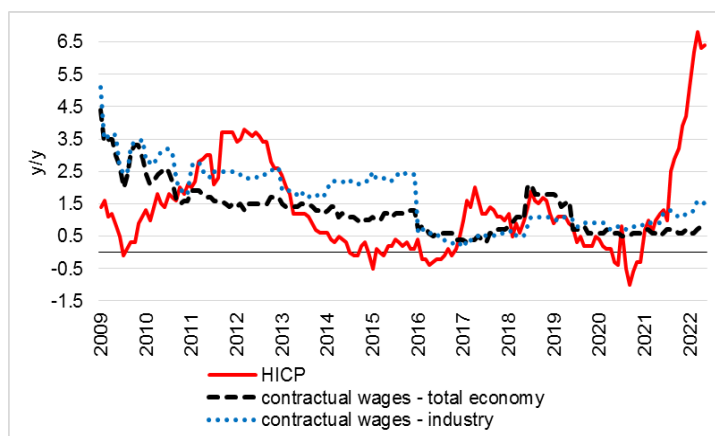
<sup>9</sup> For more details: <https://www.istat.it/it/archivio/271998>.

## 5. The “stickiness” of contractual wages

The elements that generate stickiness of contractual wages are: 1) the use of forecast inflation index, excluding the dynamic of energy goods (the aim of linking contractual rises to HICP less imported energy good was precisely to avoid the rebound of wages driven by a higher level of energy prices, considering their great volatility); 2) the three-year length of the agreement; 3) the timelessness of contractual renewals.

The increases that will be paid over the contractual period, are fixed *ex ante* during negotiations and are linked to the inflation observed at that time; this implies that when price level suddenly increase (i.e. due to a rise in energy price) contractual wages can't adjust immediately and the consequence could be a temporary loss of purchasing power for many employees. Moreover, although contracts may contain recovery clauses, they are often not used<sup>10</sup>.

**Figure 5** – Adjustment lag between contractual wages and HICP (change y/y). January 2009-May 2022.



Sources: Istat, consumer price index survey, contractual wages survey.

Figure 5 shows, from January 2009 to May 2022, the lag of contractual wage adjustments, for total economy and industrial sector, respect changes in inflation

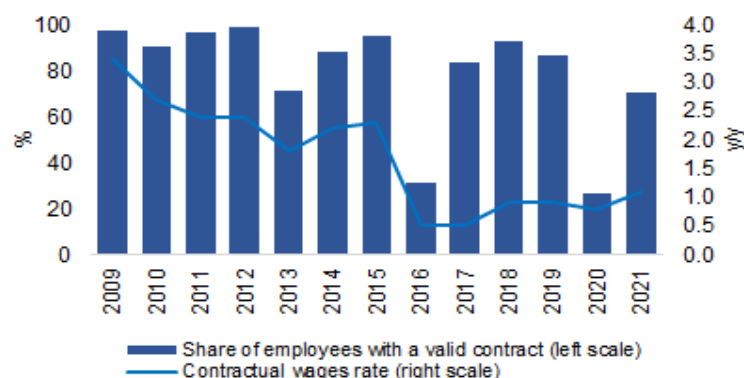
<sup>10</sup> The 2009 agreement introduces the possibility to adopt recovery rules when realized inflation is higher or lower than forecasted HICP to adjust compensation to inflation level but doesn't exist an automatic compensation (only the agreement for metal industry experienced it for the period 2016-2019). Often the trade unions and worker's associations, decide to verify the potential compensation with some delays (i.e. the collective agreement for energy and oil sector, signed on 21 of July 2022, will applicate possible compensation on July 2024 for the period 2022-2023.)

rate. Between 2013 and 2016, contractual wages are always higher than inflation. It happens because wages don't adjust immediately respect changes in price level. The large part of renewal, especially in industrial sector, occurring between 2011 and 2012, covering the following three years (2012-2014 for contract signed in 2011 and 2013-2015 for contract signed in 2012) and linked the contractual increases to a provisional inflation available at the time of renewals, when the price level was higher than the following years (2.9 percent y/y in 2011 and 3.3 percent y/y in 2012)<sup>11</sup>.

The intensity of contractual wages increases also reflects the share of contracts in force in the period.

Contract renewals can take significant time. They are not automatic and although they should take place every three years, a delays are present very often (for example the contract for private pharmacies expired in 2013 and was signed only in 2021).

**Figure 6** – Share of employees with valid contract and contractual wages rate. Industry. Years 2009-2021.



Source: Elaboration on contractual wages survey data

Over the period 2009-2021, negotiations on renewals occurred regularly and promptly for industrial sector (Figure 6). The share of employees with a valid contract<sup>12</sup> has always been, in the average of the period, about 80 percent of total

<sup>11</sup> The forecasts inflation in the communication of May 2011 were: +2.3 percent in 2011+2.0% in 2012, +1.9% in 2013 and 1.9% in 2014. The forecast inflation in the communication of August 2012 were: 3.0% in 2012, +2.0% in 2013, +1.8% in 2014 and +2.1% in 2015.

<sup>12</sup> The share of employees with a valid contract is calculated like the difference between 100 and the share of employees awaiting for a renewals, monthly released by Istat on the database I.Stat.

employees of the sector, except in 2016 and 2020 (respectively 31.4 percent and 27 percent). In 2020 COVID-19 pandemic slowed down negotiations (only 4 out of 11 expired contracts have been signed for industrial sector). Figure 7 shows a different situation for private services. In the same period, negotiation took place slowly and only the 50 percent of employees had a valid contract.

**Figure 7** – Share of employees with valid contract and contractual wages rate. Private services. Years 2009-2021.



Source: Elaboration on contractual wages survey data

Data clearly show that a larger share of contracts in force, is associated with a higher change rate in contractual remuneration. For industrial sector, the change rate of contractual wage is 1.7 percent in the annual average of the period, higher than private services increases, only 1.3 percent. This evidence confirms that new contract renewals could improve wages level in a sector.

## 6. Conclusion

The high level of energy price become a central issue in industrial relation, generating a debate on the opportunity to use a different inflation indicator. The problem with recent renewals, however, was not only the use of the HICP net imported energy goods to calculate increases, but rather the choice to determine economic increases *ex ante*, during the renewal and fixing them in annual tranches (Nespoli F., 2022). A valid tool would be represented by the definition *ex post* of contractual increases thought the application of recovery clauses, introduced by the



2009 reform of bargaining system but rarely implemented. A higher wages growth could be allowed also by a greater use of territorial and company's agreements.

In the upcoming renewals, it will be necessary find a balance between worker's association, who demand for a higher remunerations, and trade unions. A wage increase represents an additional cost for companies, who have already supported the higher prices in raw material and energy (D'Amuri, 2022).

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## SUMMARY

This study intends to analyse, over time, the relationship between inflation and contractual wages in Italy, starting from 2009, year of bargaining system reform. Considering the importance, in Italy, of bargaining's system on the formation of total compensation, a focus has been conducted on the main characteristics.

To analyse the relationship, the work uses contractual wages calculated by ISTAT.

In absence of inflationary shock, the bargaining system worked and contractual wages growth in line with inflation. The real test will be in autumn, when the high inflation level could reduce the purchasing power for many employees. The results confirm the existence of wage stickiness in Italy. According to the structural features of bargaining system, contractual remuneration can't adjust immediately to changes in price level.

## M&A IN THE ITALIAN ENERGY MARKET

Irene Bosco, Vito Pipitone

### 1. Introduction

Mergers and Acquisitions often represent a good tool for two companies, for example of little dimension, in cooperation and that want to enforce their position in the market becoming a unique entity. Mergers and Acquisitions can occur in different contexts. They represent a solution taken by competitors when they want to stop being an obstacle to each other. Companies in cooperation who exchange synergies, instead, will opt for M&A to complete their business through the acquisition of new product lines, new production process and knowledge. In fact, M&A can be seen as an alternative way of making investment since from it derives the exchange of skills and expertise which can enhance the firm's productivity, (Pautler, 2003). Finally, M&A are also a tool to increase the value of the firm and its stocks (DeYoung *et al.*, 2009).

Mergers are of different kinds and among them the two most known are horizontal/vertical mergers. A merger is horizontal if the two companies share the same product line and market. A merger is vertical if one of the two companies is a customer or a supplier of the other one. In economics, mergers produce positive externalities. From a contractual point of view, it is reasonable that, in a duopoly, a firm will accept the offer of a merger only if the bid is at least as high as its profit.

Therefore, the firm who desires to merge will make an offer that will be accepted only if the profit in monopoly is greater than the profit in duopoly:  $\pi^m = \pi(1) > 2\pi(2)$ . The conclusion is that in a market in which firms of homogeneous product operate, a merger to monopoly is always profitable. Results are different in markets wherein there are more than two firms: mergers and acquisitions will be profitable only if the market is concentrated and not fragmented. This success in profitability will depend on two effects. First, the firm born from the merge will reduce its quantity implying as a result an increase in its profit. This effect must be big enough to compensate the second effect: firms outside from the merge will increase their quantity, in Cournot competition, making the merge less profitable. This condition is satisfied only if the market is concentrated (Belleflamme and Peitz, 2010).

The industry studied is the one of the energies. We focused our analysis on the Italian energy market since it is in evolution especially in the recent years as the transition towards the sustainability and renewability has become more marked.

In Italy the birth of new energetic firms has been encouraged by the decentralisation process which has made the energy market more fragmented and pluralistic. However, from a bureaucratic point of view, this has created new slowdowns in the transition towards the renewability due to the lack of coordination (Di Nucci and Prontera, 2021).

The European Union has proposed the energy efficiency as a tool in order to achieve this target. In this, the Energy Efficiency Directive (2012/27/EU) steps in, which provides binding measures to meet goals as the transition towards renewable energy and reduction in emission. This directive has recorded success in eight European countries where obsoleted plants have been substituted by new technology (Malinauskaite *et al.*, 2019).

## 2. Analysis of the Context

M&A operations have recorded a rise in their importance and widespread over time. Since the early 1990s, the number of mergers and acquisitions in the Energy industry increased in line with the development of the European market.

This was possible thanks also to the introduction of the unique currency which allowed to cross-border deals (Belleflamme and Peitz, 2010).

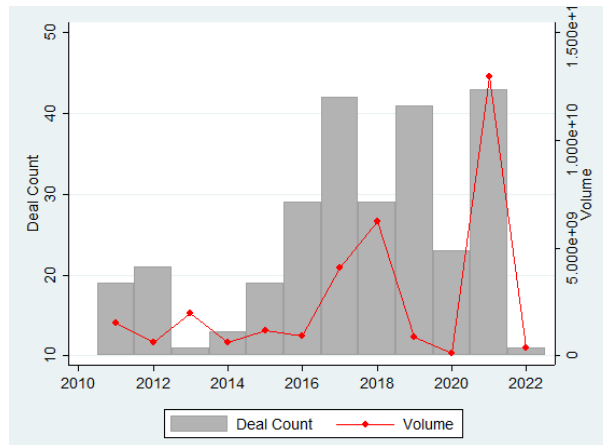
The chart above summarises the number of mergers and acquisitions and their volume for the time period 2011-2022. It is possible to observe that by the middle of the first period 2011-2014, the number of deal count has recorded a decrease. This may be reconduct to the residual effects of the Great Recession in 2008. It is true indeed that mergers occur easier in periods of growth, while they reduce in recessions, (Banal-Estañol *et al.*, 2006).

In the following years, the number of deals count increased, until the 2018, year in which there was again a reduction. Then, there was an increase until the 2020, in which there was recorded a decrease both in number and especially in the volume of M&A, in correspondence of the Covid-19 pandemic.

The next year was characterised by an increase in the two components.

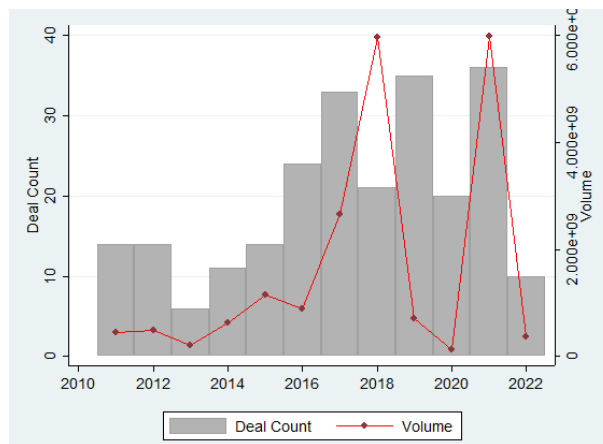
This may reasonable since this year, the 2021, encompasses M&As of both 2020 and 2021 itself. This graph summarises the same trend but only for Italian renewable energy firms. The path towards the green energy can be easily seen by the number of deals count which represents a substantial share of the total number of M&A.

**Figure 1** – Volume (in Dollars) and Deal Count of M&A in the (General) Italian Energy Industry.

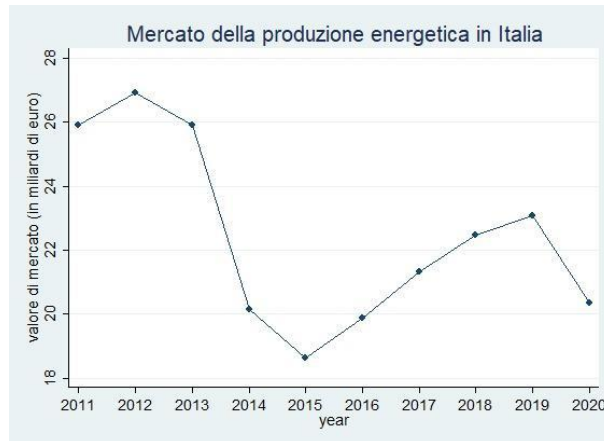


Source: Bloomberg.

**Figure 2** – Volume (in Dollars) and Deal Count of M&A in the Renewable Italian Energy Industry.



Source: Bloomberg.

**Figure 3** – Volume (in Euro) of the Italian Energy Industry.

Data Source: Aida.

The energy industry volume reached its trough in 2015. In the previous three years the negative trend was due to the economic crisis of that time. Furthermore, together with the reduction in the national production, there was the increase in the imports and therefore in the dependency degree abroad.

The trend started its increasing path until 2020, year in which, because of the Covid-19 Pandemic, the shock both in the demand and supply has led to a decrease in the production and consumption of energy.

**Figure 4** – Number of Firms and Market Share in the Italian Energy Industry.

Data Source: Aida

Figure 4 shows a chart which summarises the Italian energy market trend over time. By 2012, the number of firms operating in this industry followed an increasing path making the market more fragmented. This fragmentation is explained also by the market share, which, despite it has recorded a rise over time, it has always been below 0,001%, which indicates indeed a market that is not concentrated.

### 3. Research Question and Econometric Analysis

Our aim in this paper is to understand mergers and acquisitions in the Italian energy industry. In particular, our goal is to investigate the probability that a firm has to be acquired and the factors that affect this probability.

#### 3.1 Data

In this paper, we have made use of the Aida database provided by Bureau van Dijk. Aida collects and classifies data from the balance sheets of a massive number of firms: joint-stock companies, cooperative firms, consortia, insurance companies, domestic subsidiaries of foreign companies, European groups of significant economic interests, and local institutions. Our data consists of 7209 firms in Italy from 2011 to 2020. From the Aida database, we selected the following variables: revenues as a measure of firm's dimension (variable name: *Revenue*); labor costs as a measure of firm's production costs (variable name: *Labor Cost*); liquidity index as a measure of firm's creditworthiness (variable name: *Liquidity*); labour productivity as a proxy of efficiency (variable name: *Productivity*).

The choice of the variable *Revenue* can be reconducted to the fact that firm's dimension is one of crucial qualities in M&A. Costs arise from M&A, and among these there is the one named "cost of digesting": the larger is the dimension of the firm, the greater will be the cost to digest the acquired or merged firm (Palepu, 1986, cited in Meisel, 2007).

Moreover, we included two other variables to take into account the potential impact of corporate ownership structure on mergers and acquisitions: Chief Executive Officer's nationality (variable name: *CEO\_nationality*) which takes value 1 if CEO is Italian, otherwise 0; management's control (variable name: *Management*) which takes value 1 if the management is composed by a sole administrator otherwise 0. Finally, for the dependent variable, we selected data on the mergers and acquisitions which assumes value 1 if the merger or the acquisition has occurred otherwise 0.

The choice of the variable on management nationality is relevant since cross-border M&A are increasingly establishing themselves. Cross-border M&A, in fact, represent a way to enter the global market increasing market power and avoiding entry barriers, (Brakman *et al.*, 2008, Hitt *et al.*, 2001b cited in Hitt *et al.*, 2012).

### 3.2 Methodology

In the building of the econometric analysis, we have followed the method used by Harris *et al.* (1982). We have implemented three models that make use of a probit regression which uses as dependent variable the probability of being acquired/merged in the time range 2018-2022. The choice of this time period, which comprehends also the Covid-19 pandemic outbreak in 2020, is justified by the fact that this volatile range is characterised by two troughs respectively in 2018 and 2020, and two peaks respectively in 2019 and 2021.

Concerning the independent variables, we have used the average value which synthesises values for the previous three years, namely 2015-2016-2017.

The first model studies whether the probability of being merged is affected by labour productivity. It follows a probit regression in which the probability of M&As is used as dependent variable and labour productivity is used as independent variables. The hypothesis that we want to verify is whether the firms that are acquired are also the most efficient in terms of labor productivity.

$$M\&A_i = Productivity_i + \varepsilon_i \quad (1)$$

The second model provides a probit regression in which we have included the main firm dimensions: revenue, labor cost, and liquidity.

$$M\&A_i = Revenue_i + Labor\_Cost_i + Liquidity_i + \varepsilon_i \quad (2)$$

The third model provides a full probit model which includes financial and management variables: revenue, labor cost, CEO nationality, and management control. In this last model we exclude variables that in previous estimates have not produced statistically significant estimates (such as productivity and liquidity index).

$$M\&A_i = Revenue_i + Labor\ Cost_i + CEO\ Nationality_i + Management_i + \varepsilon_i \quad (3)$$



## 5. Results

Table 1 reports results for the three probit models.

**Table 1 – Estimation.**

	(mod 1)	(mod 2)	(mod 3)
Productivity	5.48e-08 (1.95)		
Revenue		7.28e-09** (3.21)	6.78e-09* (2.53)
Labor Cost		-1.15e-6** (-3.29)	-1.14e-6** (-3.26)
Liquidity		0.0142 (1.00)	
CEO nationality			-1.925*** (-20.20)
Management			-1.433*** (-13.69)
Constant	-1.728*** (-25.95)	-1.397*** (-34.68)	-0.189*** (-4.17)
<i>N</i>	1178	4407	4525

*t* statistics in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The first column shows results for the first model (1). Labour productivity is not statistically significant. This finding shows that mergers and acquisitions, in the energy industry, are not likely to target firms with the highest levels of efficiency. It is not the efficiency of the individual company which justifies the acquisition, but the final outcome obtained by the new business structure.

Results for the second model are reported in column 2. Revenue and Labor Cost are both statistically significant. Intuitively, the probability of being acquired increases as revenue increases, and it comes down to increasing labor costs.

Liquidity index is not statistically significant. In other words, it seems that in the Italian case study, firm's creditworthiness is not a determinant of the cases of mergers and acquisition. The third column refers to estimates given by the third model. Adding the two management variables, CEO nationality and management, the third estimation is able to explain quite well the variability in the data since the pseudo  $R^2$  is 45%. Revenue are positive and significant, while Labor Costs are negative and significant. On the other hand, CEO nationality and management result

negative and significant, telling us that the probability of M&As in the most recent years is affected by the corporate governance structure. The economic interpretation of these results suggests us that firms are more likely to be acquired and merged if they record high revenues and low costs, and if the management is foreign and plural.

## **6. Conclusions**

Merges and acquisitions are strategic managerial operations that are good for firms which want to increase their market value.

The Italian energy market has undergone a big growth, in terms of number of firms, since 2012 thanks to the transitions towards decentralisation and fragmentation. Although M&A occur less likely when the market is fragmented, we studied the conditions in which firms are more likely to be merged.

We have implemented a probit analysis which consists of three models and that studies in which conditions mergers and acquisitions are more probable to occur.

From the analysis we have run, it seems that the high revenues are a good requisite for M&As that have occurred from 2018 until 2022, contrary to costs which discourage merges and acquisitions. Instead, the firm's disposable liquid money and labour productivity does not affect the probability of being merged/acquired or not. It seems also that corporate governance has great importance. Firms that have a management which is Italian and composed by a sole administrator are instead less likely to be merged or acquired.

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## SUMMARY

The Italian Energy industry has undergone changes and it had to adapt to alterations given by the economic and environmental trend in the last decades, especially in the last months with the war outbreak. The transition to the green economy and to the renewable energy has put this market in front of challenges of various perspectives leading it to a new framework. The passage from a centralised to a more decentralised arrangement, both in terms of consumption and production, has affected the organisational structure of the interested firms. Furthermore, new EU policies have been enacted in order to face the severe environmental issue, using the energy efficiency as a tool to incentivise the improvement on sustainability and renewability.

This paper investigates the Italian energy industry and the effects given by M&A in it. Mergers and Acquisitions are operations relevant not only from a financial or corporate point of view, but they also imply effects on the economy related to the market and its forces. We focus our study on the merger and acquisitions of the firms involved in the research. We build a model which studies the probability of being acquired of the firms involved in the analysis and all the factors that influence this probability, since the latter implies a higher concentration in the market. The analysis is implemented by using the stochastic frontier analysis. In addition, we include in the analysis all the variables that may affect the dependent variable such as the revenues, costs management, nationality others.

The analysis makes use of data on M&A collected on Bloomberg and data on firms' balance sheet collected on the Aida database, both for the period from 2011 to 2020. According to this analysis, this paper sets his aim on the study of the energy market based on the evolution which interested the most recent past.

## **ANALYSIS OF ACCOUNTING DATA FROM THE EXPLANATORY NOTES TO THE FINANCIAL STATEMENTS FOR THE ESTIMATION OF THE ENTERPRISES INVESTMENTS<sup>1</sup>**

Antonio Regano, Valeria Tomeo, Roberta Varriale

### **1. The usability of a new administrative source in Istat production processes for estimating Investments**

The Italian national institute of statistics (Istat) produces estimates on the main economic variables of enterprises, both from a Structural Business Statistics (SBS) and a National Accounts (NA) perspective. The two production processes present similarities and discrepancies. Both processes use survey data and administrative data. Survey data are collected through the Business Account Survey (also known as SBS surveys), divided into the Large Enterprises (LE) census survey on all enterprises with 250 employees and over, and the Small and Medium-sized Enterprise (SME) survey on a sample of enterprises with less than 250 employees. Administrative data come from different sources and are used in different steps of the estimation process (frame definition, editing and imputation, production of estimates, etc.). Among the administrative sources, the Financial Statements of enterprises represents one of the most important, including a very rich source of information: beside filling in the accounting forms, firms report explanatory notes that include a summary of significant accounting policies and details of the reported values in their financial statement and clarifications on the economic situation of the company. Because of the different informative content, we will refer to the accounting forms of Financial Statements (*FS* hereafter) and Explanatory Notes to the Financial Statements (*Explanatory Notes* hereafter) as different administrative sources.

As far the production process of estimates on “acquisitions of fixed assets” during the year, also known as “enterprise investments” (*Investments* hereafter), both SBS and NA processes use survey data, but only NA process also uses administrative information. In particular, FS does not report information on Investments, while the Explanatory Notes do: these are used in the NA production process together with other administrative sources, but not by SBS. More specifically, SBS impute total

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<sup>1</sup> The paper is the result of the close collaboration of the authors. Sections 1, 3, 5 are mainly attributable to Valeria Tomeo, Section 2 and Subsection 4.1 to Antonio Regano and Section 4 to Roberta Varriale.

non response by donor, and, only for the large enterprises, compare the results with longitudinal data; NA use auxiliary information from administrative sources to edit influential errors on respondent data and impute total non response by applying a selective editing procedure.

The aim of the present work is to evaluate the content of the information on Investments, at the level of the legal unit, from the administrative source of the Explanatory Notes, beside the administrative sources already used in Istat processes. This work represents an exploratory and study phase to evaluate the usability of this source in the production processes of Investments of both SBS and NA. In Section 2, we describe the available administrative sources in Istat on the Investments. Section 3 compares the information on Investments from the Explanatory Notes and SBS survey, both from a structural and an empirical point of view. Section 4 describes the current NA production process of estimates on Investments by using different administrative sources. Section 5 concludes the work.

## **2. Availability of administrative sources on Investments**

Information on Investments is present in different administrative sources: Table 1 reports the administrative sources available in Istat and their content related to the target variable Investments.

As introduced, one of the most important administrative sources in the business context is the Financial Statements of enterprises. In FS, Investments are those costs that do not exhaust their usefulness in a single administrative period, but manifest their economic benefits over a period of time that covers several financial years. These are divided into Tangible Assets, characterized by the requirement of materiality (for example machines, plants, vehicles, etc.), and Intangible Assets, which are fixed assets without physical consistency (for example patents, plant and expansion costs, goodwill, etc.). The value of the stock of fixed assets at the end of the year is reported in the balance sheet of the FS, while the details on their movement during the year (acquisitions, disposals, depreciation, write-downs, transfers, etc.) must be reported in the Explanatory Notes. Istat has access to the Explanatory Notes of corporations and limited enterprises containing information on the target variable Investments from Infocamere (in the form of XBRL<sup>2</sup> files and according to FS national standards) and from CRIF (for enterprises that compile FS according to the International Accounting Standard IAS or International Financial Reporting Standards IFRS). In the following, we will use the terms XBRL and CRIF to refer to Investments from the Infocamere and CRIF source, respectively.

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<sup>2</sup> XBRL (eXtensible Business Reporting Language) is a global framework and a standards-based way to communicate and to exchange business information.

**Table 1** – Available administrative sources and variables related to business Investments.

Legal form	Accounting Principles	Data provider	Variable in the administrative source	Administrative source	Consistency between available variable and Investments
Enterprises on the Basis of Liabilities	National standards	Infocamere	XBRL Investments (Splitted in Tangible and Intangible Assets)	Explanatory Notes	Total
			Delta Stock	FS	Partially
Enterprises on the Basis of Liabilities	IAS or IFRS 16-17	CRIF	CRIF Investments (Splitted in Tangible and Intangible Assets)	Explanatory Notes	Total
			Delta Stock	FS	Partially
Enterprises on the Basis of Members		Agenzia dell'Entrate	Expenses for amortizable goods (VAT)	Value Added Tax declarations	Partially

Beside the Exploratory Notes, information on Investments are available in Istat from other administrative sources, as shown in Table 1. The first one is the information on expenditure for amortizable goods (*VAT variable* hereafter) reported in Value Added Tax declarations of Agenzia delle Entrate (AA.VV., 2020). The variable VAT is likely to be a good proxy of the target variable Investments only when business investment refers mainly to: purchases of land and/or assets produced on own account and/or assets acquired when acquired through a financial lease. The second available information related to Investments is a derived variable that can be computed from FS (*DELTA\_STOCK variable* hereafter), based on the assets at the end of the year minus the assets at the end of the previous year (i.e. at the beginning of the year) plus depreciation and revaluation (AA.VV., 2020). In enterprises' financial statements, acquisition of fixed assets (i.e., Investments) is one of the components that explain the difference between the value of net asset at the beginning of the accounting period and the value at the end of the accounting period. Therefore  $NETSTOCK_{t,end} = NETSTOCK_{t,beg} + INVE_t + REVAL_t - SOLD_t - AMOR_t - WOFF_t + MA_t$ , where  $NETSTOCK_{t,end}$  and  $NETSTOCK_{t,beg}$  are, respectively, net assets at the end and at the beginning of year  $t$ ,  $INVE_t$  is the acquisition of investments in year  $t$ ,  $REVAL_t$  is the revaluation of existing assets in the year  $t$ ,  $SOLD_t$  is the net book value (i.e., net of cumulated depreciation) of existing assets sold in the year  $t$ ,  $AMOR_t$  is depreciation of existing assets in the year  $t$ ,  $WOFF_t$  is write-off of existing assets in the year  $t$  and  $MA_t$  is the effect of mergers and acquisitions. Then from FS, we can compute the proxy of investment:  $DELTA\_STOCK_t = NETSTOCK_{t,end} - NETSTOCK_{t,beg} + AMOR_t + WOFF_t$ . Since  $DELTA\_STOCK_t = INVE_t + REVAL_t -$

$SOLD_t + Ma_t$ , then  $DELTA\_STOCK_t$  is a good proxy of investment when revaluations and selling of existing assets and mergers and acquisition are not very important.

Not all enterprises are covered by all sources of information: over 80% of the enterprises in Asia 2017 are linked to at least one of the selected administrative sources; about 63% of enterprises with less than 250 employees are linked to a single source, while 76% of enterprises with more than 250 employees are present in three sources; 19% of enterprises with less than 250 employees are not present in any source.

### 3. Investments in Explanatory Notes and SBS surveys

In this Section, we describe the comparison between the information on Investments from the Explanatory Notes in XBRL and SBS survey, from two different points of view: the structure of the information, and empirical results.

Istat collects the administrative source FS from Infocamere, which manages the data of the Chambers of Commerce. The data supply consists of over 900,000 FS, together with their Explanatory Notes; a first supply is in September of the year  $t+1$  (where year  $t$  is the reference for the data) and a second in March of the year  $t+2$ . The level of detail and the instructions for filling in the LE and SME questionnaires relating to the Investments are not completely consistent with the accounting rules of enterprises. Table 2 compares the information in the LE and SME surveys with that one in the Explanatory Notes. With regard to Tangible Assets, the main difference between the LE and SME questionnaires and the Explanatory Notes is that in the SME questionnaire, the item "Tangible assets in progress and advances" (var11) is not present. This implies that enterprises respond to the questionnaire in two ways: *i*) by not considering the value of assets under construction and advances (and therefore reporting an overall value of the acquisitions of assets different from that recorded in their financial statements); *ii*) by attributing the value of the acquisitions of fixed assets in progress to the related assets (and therefore reporting in the questionnaire an overall value of the acquisitions of fixed assets equal to that recorded in their financial statements, but with different values in terms of detail by type of asset) (Brunaccini F. *et al.*, 2016).



**Table 2** – Comparison between the detailed items of the acquisitions of Tangible and Intangible Fixed Assets (Investments) between the LE and SME surveys and the Explanatory Notes.

	LE	SME	Explanatory Notes
<i>Tangible Fixed Assets</i>			
var1	Land	Land	
var2	Dwellings	Dwellings and Other buildings (var2)	Land and Dwellings
var3	Other buildings		
var4	Machinery and equipment	Machinery and equipment	Machinery and equipment
var5	Industrial and commercial facilities		Industrial and commercial facilities
var6	ICT equipment	ICT equipment	
var7	Furniture	Furniture	
var8	Transport fixed equipment	Transport equipment	Other tangible fixed assets
var9	Valuable goods	Valuable goods	
var10	Other tangible assets		
var11	Tangible fixed assets in progress and advances		Tangible fixed assets in progress and advances
var12	Total Tangible Fixed Assets	var1+var2+var4+var6+var7+var8+var9	Total Tangible Fixed Assets
<i>Intangible Fixed Assets</i>			
var13	Industrial patent rights		
var14	Rights of use of intellectual property (artistic and literary originals)	Artistic and literary originals, patents (var14)	Industrial patent rights and rights of use of intellectual works
var15	Concessions, licenses and trademarks (excluding software)		Concessions, licenses and trademarks
var16	Software	Software	
var17	Research and development		Research and development
var18	Other intangible fixed assets	Other intangible fixed assets (var18)	Start-up costs Plant expansion costs Intangible fixed assets in progress and advances Other intangible fixed assets
var19	Total Intangible Fixed Assets	var14+var16+var18	Total Intangible Fixed Assets
var20	var12+var19	Total Fixed Assets	Total Tangible Fixed Assets + Total Intangible Fixed Assets

In addition, therefore, to the mismatch between the SME data and those of the FS and the loss of homogeneity between the respondents to SME, there is also a lack of homogeneity with respect to the LE survey, in which the item is instead present. As far the information on Intangible Assets is concerned, however, the LE and SME

questionnaires have a very different structure from that typical of financial statements. In SME, information is requested only for three asset types: "Artistic and literary originals, patents" (var14), "Software" (var16) and "Other intangible fixed assets" (var18); the first two do not have a correspondence with the typical items of the Explanatory Notes, but are rather "of which", while it is required to include all the other intangible asset types in the third item "others".

The LE questionnaire is closer to the representation in the Explanatory Notes, but does not consider the items relating to "Stat-up costs", "Plant expansion costs" and "Intangible fixed assets in progress and advances". Another possible problem with the LE questionnaire is related to software investments. In correspondence with the item "Software", it is requested to include both the purchased and the self-produced one, while it is specified to exclude software with reference to the item "Concessions, licenses and trademarks" (var15). In reality, according to what is reported by the OIC (the Italian Standards Setter) accounting principles, enterprises can capitalize the software purchased as "Concessions, licenses and trademarks" or as industrial patent rights and intellectual property rights (var13 and var14), depending on the method of purchase, while software produced for own use (and capitalized) should be included in "Industrial patent rights" if protected by copyright laws and in "Other intangible fixed assets" (var18) if not protected. Therefore, specifying "excluding software" only with reference to the item "Concessions, licenses and trademarks" can be misleading and can generate inconsistency with what is reported in the Explanatory Notes.

The analysis of the empirical results in this Section uses data from 2017, to compare the information on Investments from the Explanatory Notes and the LE and SME surveys, already available for the reference year. For the surveys, only the respondent enterprises were selected for a total of 37,729 units, 34,790 for SME and 2,939 for LE. By integrating this dataset with that of the Explanatory Notes, which consists of 941,184 observations after the pre-treatment operations, the reference universe dropped to 21,136 enterprises, 18,945 of SME and 2,191 of LE.

Figure 1 reports the comparison between the data extracted from the Explanatory Notes and those collected by the SME and LE surveys: the bars represent the percentage incidence in terms of number of enterprises and their monetary values of the units with a difference of  $\pm 5\%$  between SBS and Explanatory Notes sources.

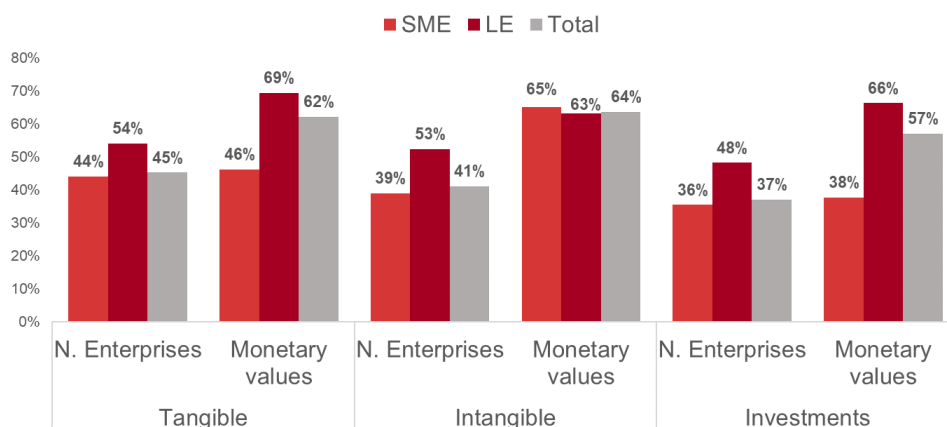
Figure 1 highlights:

- for the total investments, coherence between the data of the administrative source and those of the surveys at the microdata level which stands at 37% in terms of the number of enterprises on the entire sample;
- for the total investments, 57% of the monetary values indicated by the enterprises fall within the considered range, a share which rises to 66% for LE and stops at 38% for SME;

- considering the SME survey, the monetary values for intangible fixed assets perform better results than intangible (65% vs 46%).

On the other side, the critical issues concern both the component relating to tangible fixed assets for the SME survey, due to the lack of the detail item relating to fixed assets in progress and advances, and the intangible component for both surveys, due to a different reporting scheme compared to as adopted in the Explanatory Notes; and the presence of possible measurement errors and zero values in one of the two sources.

**Figure 1** – Enterprises and monetary values in the range of percentage difference of  $\pm 5\%$  between sources, by type of investment and survey (percentage incidence). Year 2017.



Source: elaboration on SBS and Explanatory Notes data. Authors' elaboration.

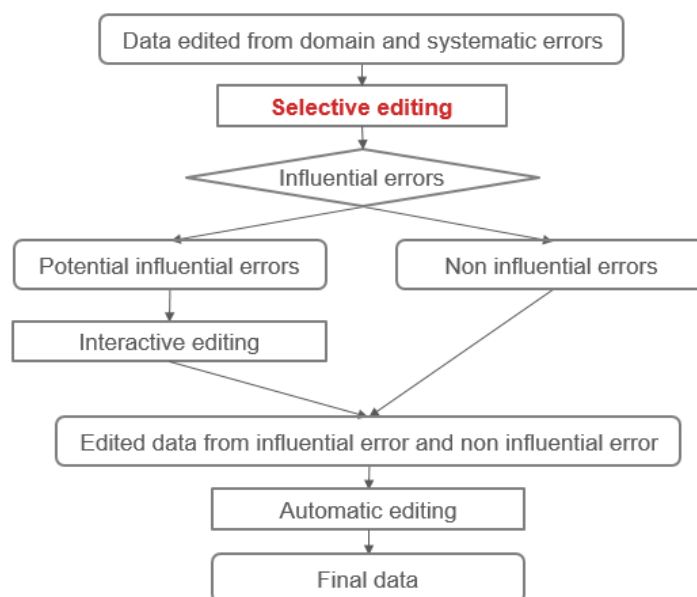
#### 4. NA production process for estimating Investments

The NA current procedure for estimating Investments is different for the subset of units belonging to the SME and LE population. Since the aim of the present work is to evaluate the content of the information on Investments, at the level of the legal unit, from the administrative source Explanatory Notes, we focus on the LE population. Indeed, the LE is a census survey and it allows making evaluations at micro level on all the population without taking into account the sampling error.

The NA production process of Investments for the enterprises of the LE survey exploits the auxiliary information from administrative sources to correct the survey data by applying a selective editing procedure.

Figure 2 represents the NA editing and imputation (*E&I* hereafter) model flow for the estimation of Investments, based on that one proposed by the Generic Statistical Data Editing Model (GSDEM; UNECE, 2019), that is the reference framework for statistical data editing developed by UNECE. In GSDEM, the *E&I* process is interpreted as a set of standardized, consistently described information objects that are the inputs and outputs in the design of the overall data processing flow. In Figure 2, process steps are represented by rectangles, data states are represented by ellipses, a trivial process control is represented by an arrow and non-trivial process control is represented by a diamond.

**Figure 2** – NA editing and imputation model flow for Investments.



Source: Authors' elaboration.

After the control for domain and systematic errors, selective editing makes it possible to localize (potential) influential errors, i.e. those observations that have the greatest influence on the estimates. The method is implemented by using the *SeleMix* package of R. After this step, the (potential) influential errors are evaluated and treated with a manual check. Subsequently, the phase of imputation of the total missing responses follows, by using auxiliary variables coming from the available administrative sources. The latter step is run with an automatic editing procedure. In

the NA current production process, the sources providing information on Investments are: CRIF, VAT and DELTA\_STOCK variables (Section 2).

As mentioned, the aim of the present work is to evaluate the content of the information on Investments, at the level of the legal unit, from the administrative source Explanatory Notes. Therefore, the same methodology for selective editing is applied: the auxiliary administrative source XBRL is used in addition.

Before applying the selective editing model implemented in the SeleMix package of R, some pre-processing step has to be done, such as the distinction between missing values and “genuine zeros” in the target variable Investments.

The method for selective editing implemented in the SeleMix package is based on a latent class model: a Gaussian model is assumed for true data and an “intermittent” error mechanism such that a proportion of data is “contaminated” by an additive Gaussian error. Details on SeleMix package can be found in Guarnera and Buglielli (2020). The practical steps in the application of selective editing by using SeleMix are: analysis of data in order to choose the response variables  $Y$  and verify if auxiliary information  $X$  (covariates) is available; estimation of the contamination model parameters (estimation phase); identification of critical units corresponding to the most influential errors (prediction and selection phase); interactive editing of critical units and automatic editing of non-critical ones.

In order to avoid singularities, the contamination model is applied to all the data characterised by an observed value of the Investment greater than zero and different - up to a tolerance factor - from the values of all the covariates (VAT, DELTA\_STOCK and XBRL). Specifically, the survey data where the Investment value agrees with at least one of the covariates are considered correct (not subject to the selective editing procedure) and are excluded from the estimation process (Di Zio M. et al., 2015). Another important aspect in the application of selective editing in this context, is the one concerning the different missing patterns for the covariates, in fact for different units different sets of covariates may be available. This requires the estimation of different models for different patterns, where, for each pattern, the units included in the estimation process are all those where (at least) the covariates corresponding to the current pattern are available.

In addition to the three covariates, an always observed stratification variable is also used, so that the above procedure is applied separately within each stratum. The stratification variable is the enterprise size in terms of number of employees. Precisely, two size classes are used (“250-499” and “>499”).

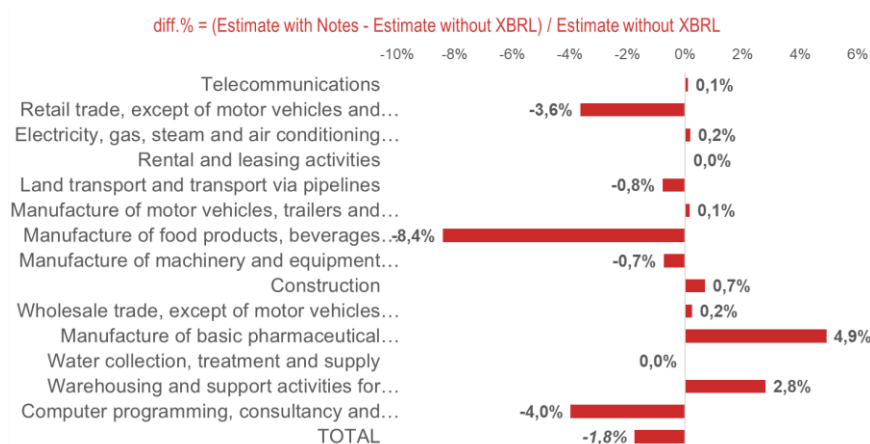
A final remark is about the treatment of missing data in the target variable. The models used for selective editing are also applied in order to impute missing data in the target variable. The estimation domains on which the impact of errors has been evaluated are 64 industries corresponding to the classification of economic activity

A\*64 that is used to disseminate NA data; the threshold used for the selection of critical units has been set equal is 4% (Di Zio M. *et al.*, 2015).

#### 4.1 Changes in the NA estimates of Investments

Figure 3 represents the percentage differences, by industry, which are most significant in terms of the incidence of the value of Investments.

**Figure 3** – Difference % between the estimate of Investments by using the XBRL source and the estimate without XBRL, by industry. Enterprises with over 250 employees. Year 2017.



Source: elaboration on LE data. Authors' elaboration.

Results are obtained comparing two models, which use Investments from the LE survey as target variable. Model 1 uses the VAT variable as the main covariate together with DELTA STOCK and CRIF and Model 2 uses XBRL as an additional covariate. Overall, the estimate of the amount of Investments using Model 2 is 1.8% lower than the estimate with Model 1. The results reveal an overestimation of the acquisitions of fixed assets in the model using as the main covariate the VAT variable, which has some definitional differences compared to the target estimate variable. Furthermore, the estimate has a partial conceptual coherence (expenditure for amortizable goods do not totally coincide with the acquisitions of firms, they could be more consistent among small businesses) and tends to overestimate.

The estimates computed with the use of the Explanatory Notes (Model 2), together with the other administrative sources, produced overall satisfactory results for almost all domains.

## 5. Results and future work

The aim of this work was to analyse the information contribution of the administrative source Explanatory Notes, with respect to the Investments made by enterprises during a specific reference year. In particular, the reported analyses represent an important exploratory phase to evaluate the usability of this source in the production processes of Investments of both SBS and NA.

After mapping of the available administrative sources on Investments in Istat, we compared the data extracted from the Explanatory Notes and those collected from the LE and SME surveys on the economic accounts of the enterprises to assess the degree of matching between the sources. An empirical analysis was run on data from 2017. The results can be used to harmonize the information collected through the surveys' questionnaires with that extracted from the Explanatory Notes. Subsequently, we studied the use of the Explanatory Notes in the production process for estimating Investments by industry, adopted by the NA.

All the exploratory analyses provided satisfactory results, which need in-depth study in the future. Possible future implications may be the use of the Explanatory Notes in the editing and imputation process of SBS surveys, a methodological alignment between SBS and NA for the estimation of Investments, and, finally, the inclusion of the Investment variable in the Frame-SBS (Extended Register of the main economic variables of enterprises), representing an object of the Istat integrated system of registers.

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## SUMMARY

The Italian national institute of statistics (Istat) produces estimates on the main economic variables of enterprises, both from a Structural Business Statistics (SBS) and a National Accounts (NA) perspective. The two production processes present similarities and discrepancies. Both processes use survey data and administrative data. Survey data are collected through the Business Account Survey, divided into the Large Enterprises (LE) census survey on all enterprises with 250 employees and over, and the Small and Medium-sized Enterprise (SME) survey on a sample of enterprises with less than 250 employees. Administrative data come from different sources and are used in different steps of the estimation process. Among the administrative sources, the Financial Statements of enterprises represents one of the most important, including a very rich source of information: beside filling in the accounting forms, firms report Explanatory Notes that include a summary of significant accounting policies and details of the reported values in their financial statement and clarifications on the economic situation of the company.

As far the production process of estimates on “acquisitions of fixed assets” during the year, also known as “enterprise investments”, both SBS and NA processes use survey data, but only NA process also uses administrative information.

The aim of the present work is to evaluate the content of the information on Investments, at the level of the legal unit, from the administrative source of the Explanatory Notes, beside the administrative sources already used in Istat processes. This work represents an exploratory and study phase to evaluate the usability of this source in the production processes of Investments of both SBS and NA. Possible future implications may be the inclusion of the Investment variable in the Extended Register of the main economic variables of enterprises, representing an object of the Istat integrated system of registers.

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## THE IMPACT OF MONETARY POLICY SHOCK ON PUBLIC DEBT: A DSGE APPROACH

Francesco Busato, Marina Albanese, Monica Varlese

### 1. Introduction

In the actual context, increase in public debt and in inflation represents the main concern among economists and policymakers. Expansionary fiscal policies implemented by governments to face the more recent crisis caused by the Covid-19 Pandemic have entailed public debt raises at global level (de Soyres *et al.*, 2021). At the same time, the war in Ukraine has contributed to an increase in inflation reaching a high value of 8.6% in May 2022 in the United States (Rockeman, 2022).

In that context, two questions have sparked a lively debate among economists: first, is inflation increases a transitory or permanent phenomenon? Second, could high inflation act as a deflator of public debt?

As for the first question, most economists seem concerned inflation keeps at high levels for a long time (Beckmann *et al.*, 2021; Blanchard, 2021; Summers, 2021; Tepper, 2022). As for the second debate, it is very difficult to predict if high inflation may reduce public debt-to-GDP ratio in the medium and long term. This depends on whether higher inflation can or not be anticipated by financial markets and on its expected persistence. However, at first glance, inflation erodes the real value of debt.

This is what we demonstrate here. Specifically, this paper addresses two questions: what are the effects of inflation increases in a model with fiscal sector and price distortion? What are different impacts on agents? To answer these questions, we simulate a positive monetary policy shock in a New Keynesian Dynamic Stochastic General Equilibrium (NK-DSGE) model à la Leeper *et al.*, (2017) with monopolistic competition in goods, sticky-price, and distortionary taxation. Savers and hand-to-mouth households populate the economy: the former have access to financial and capital markets while hand-to-mouth households consume all their disposable income.

Results show that an increase in inflation positively affects savers' disposable income in the short term. As consequence, they increase their consumption and bond investments by entailing public debt raises. On the opposite, hand-to-mouth households face losses in terms of income. Overall, aggregate demand growth up following an increase in investments, savers' consumption, and public spending.

However, the positive effect on output caused by higher inflation prevails with respect to the negative effect on government's budget constraint in terms of public debt raises. As result, the debt-to-GDP ratio reduces. This implies that an increase in inflation improves public debt sustainability in short-term.

This paper contributes to the theoretical literature on monetary and fiscal policy interaction (Krause and Moyen (2016), Cardani *et al* (2020), Bhattarai *et al* (2014), Leeper *et al* (2017), Kliem *et al* (2016), Bianchi and Melosi (2019), Bianchi *et al* (2020)). Moreover, it contributes to empirical literature analyzing the link between inflation and public debt (Taghavi (2000), Reinhart and Rogoff (2010), Lopes da Veiga *et al* (2016), Akitoby *et al* (2017), Hilscher *et al* (2022)).

The paper is structured as follows. Section 2 summarizes the model. Section 3 reports the calibration of parameters. Impulse response functions are shown in Section 4. Section 5 concludes.

## 2. Model

This section shows the main model's equation. A fraction  $\mu$  of households are hand-to-mouth (H) while the remaining fraction  $1-\mu$  are savers (S) à la Leeper *et al.*, 2017. The economy includes firms, the government and the central bank as well. Monetary authority follows a Taylor rule in setting the nominal interest rate.

### 2.1. Savers

Savers consume private and public goods and supply labor services. Their utility function is the following:

$$\max E^0 \sum_{t=0}^{\infty} \beta_{\{S\}}^{\{t\}} \left[ \log C_{\{S,t\}} - \left( \frac{(N_{\{S,t\}})^{1+\eta}}{1+\eta} \right) \right], \quad (1)$$

where  $\beta_{\{S\}}^{\{t\}}$  is the discount factor;  $C_{\{S,t\}}$  denotes a composite consumption for savers given by the sum of private and public consumption; finally,  $N_{\{S,t\}}$  represents the working hours and  $\eta$  denotes labor elasticity. Their budget constraint is:

$$P_{\{t\}} C_{\{S,t\}} (1 + \tau^C) + P_{\{t\}}^{\{B\}} B_{\{t\}} + \left( \frac{B_{\{S,t\}}}{R_{\{S,t\}}} \right) = \\ \left( 1 + \rho P_{\{t\}}^{\{B\}} \right) B_{\{t-1\}} + B_{\{S,t-1\}} + (1 - \tau^N) w_{\{S,t\}} N_{\{S,t\}} + (1 - \tau^K) r_{\{t\}}^K K_{\{S,t\}} \quad (2)$$

where  $P_{\{t\}}$  denotes prices;  $B_{\{S,t\}}$  are one-period bonds that can be purchased at the present discounted value  $R_{\{S,t\}}^{-1} B_{\{S,t\}}$ ;  $B_{\{t\}}$  are long-term government bond that can

be purchased at price  $P_{\{t\}}^{\{B\}}$ ;  $\rho \in [0,1]$  represents a maturity and  $(1-\beta\rho)^{-1}$  denotes duration.  $\tau^C$  is tax rate on nominal consumption;  $\tau^K$  and  $\tau^N$  are capital and labor incomes taxes, respectively. Wages are represented by  $w_{\{S,t\}}$  and rental rate of regular capital is represented by  $r_{\{t\}}^K$ .

The capital stock  $K_{\{S,t\}}$  own by savers, evolves according to the following law of motion:

$$K_{\{S,t+1\}} = I_{\{S,t\}} + (1 - \delta)K_{\{S,t\}} \quad (3)$$

where  $I_{\{S,t\}}$  denotes investments and  $\delta$  is the capital depreciation rate.

### 2.2. Hand-to-mouth

Hand-to-mouth households maximize the same utility function as savers.

They consume their after-tax income, period by period and are subject to the following budget constraint:

$$P_{\{t\}}C_{\{H,t\}}(1 + \tau^C) = (1 - \tau^N)w_{\{H,t\}}N_{\{H,t\}} \quad (4)$$

where  $C_{\{H,t\}}$  indicates consumption of hand-to-mouth households;  $w_{\{H,t\}}$  and  $N_{\{H,t\}}$  represent wages and working hours of hand-to-mouth' households, respectively.

### 2.3. Firms

The final goods firms operate under perfect competition and flexible prices. They aggregate intermediate goods  $Y(z)_{\{t\}}$  according to the following production function:

$$Y_{\{t\}} = \left[ \int_0^1 Y(z)_{\{t\}}^{\left\{\frac{\varepsilon-1}{\varepsilon}\right\}} dz \right]^{\left\{\frac{\varepsilon}{\varepsilon-1}\right\}}, \quad (5)$$

where  $\varepsilon > 1$  represents the elasticity of substitution between intermediate goods. The final good firm chooses  $Y(z)_{\{t\}}$  to minimize its costs, resulting in demand of intermediate good  $z$ :

$$Y(z)_{\{t\}} = \left( \frac{P(z)_{\{t\}}}{P_{\{t\}}} \right)^{\{-\varepsilon\}} Y_{\{t\}} \quad (6)$$

where  $P(z)_{\{t\}}$  is the price of intermediate goods. The price index is:

$$P_{\{t\}} = \left[ \int_0^1 P(z)_{\{t\}}^{\{1-\varepsilon\}} dz \right]^{\left\{\frac{1}{\varepsilon-1}\right\}}. \quad (7)$$

#### 2.4. Intermediate goods producers

We assume that intermediate firms compete monopolistically producing goods according to the following technology:

$$Y(z)_{\{t\}} = (K_{\{t\}})^{\{\xi\}} \left( N_{\{S,t\}}^{\{\alpha\}} N_{\{H,t\}}^{\{(1-\alpha)\}} \right)^{\{1-\xi\}} \quad (8)$$

where  $\xi, \alpha \in [0,1]$  denote elasticities in production function.

Intermediate firms choose capital and labor services to maximize their expected profits. They convert household labor and capital into the final good and prices are sticky à la Calvo (1983) with indexation.  $1-\theta \in [0,1]$  is a constant probability of firms' being able to choose the sale price. The optimal price  $P(z)_{\{t\}}^{\{*\}}$  is chosen to maximize the discounted value of expected future profits. The firms' maximization problem is the following:

$$\sum_{\{s=0\}}^{\{\infty\}} (\theta \beta_{\{s\}})^{\{s\}} \left( \frac{P_{\{t\}}}{\lambda_{\{t\}}} \right) \left( \frac{\lambda_{\{t+s\}}}{P_{\{t+s\}}} \right) \left[ P(z)_{\{t\}}^{\{*\}} \prod_{k=1}^s \pi_{\{t+k-1\}}^{\chi} - P_{\{t+s\}} mc_{\{t+s\}} \right] Y(z)_{\{t+s\}}^{\{*\}} \quad (9)$$

where  $\pi_{\{t\}}^{\chi}$  represents inflation with price indexation  $\chi$ ;  $mc_{\{t\}}$  is the marginal cost, or the inverse of the markup  $X_{\{t\}}$ .  $\left( \frac{\lambda_{\{t+s\}}}{\lambda_{\{t\}}} \right)$  denotes the stochastic discount factor of savers, who own the firms. Eq. (9) is subject to:

$$Y(z)_{\{t+s\}}^{\{*\}} = \left( \left( \frac{P(z)_{\{t\}}^{\{*\}} \prod_{k=1}^s \pi_{\{t+k-1\}}^{\chi}}{P_{\{t+s\}}} \right) \right)^{\{-\varepsilon\}} Y_{\{t+s\}}^{\{d\}} \quad (10)$$

where  $Y_{\{t\}}^{\{d\}}$  indicates the aggregate demand.

#### 2.5. Aggregation

The market clearing condition for the goods is:

$$Y_{\{t\}} = Y_{\{t\}}^{\{d\}} * s_{\{t\}} \quad (11)$$

where  $s_{\{t\}}$  represents the price dispersion in the Calvo model as follows:

$$s_{\{t\}} = (1 - \theta) \left( P(z)_{\{t\}}^{\{*\}} \right)^{\{-\varepsilon\}} + \theta \left( \frac{\pi_{\{t\}}}{\pi_{\{t-1\}}^{\chi}} \right)^{\{\varepsilon\}} s_{\{t-1\}}; \quad (12)$$

$P_{\{t\}}^{\{*\}}$  indicates the aggregate price level that satisfies the following equation:

$$1 = \theta \pi_{\{t\}}^{\{(\varepsilon-1)\}} \left( \pi_{\{t-1\}}^{\{\chi\}} \right)^{\{(1-\varepsilon)\}} + (1 - \theta) \left( P(z)_{\{t\}}^{\{*\}} \right)^{\{(1-\varepsilon)\}}. \quad (13)$$

$Y_{\{t\}}^{\{d\}}$  denotes the aggregate demand:

$$Y_{\{t\}}^{\{d\}} = C_{\{t\}} + I_{\{t\}} + G_{\{t\}}, \quad (14)$$

where  $C_{\{t\}}$  is the aggregate consumption and it is given by:

$$C_{\{t\}} = \mu C_{\{H,t\}} + (1 - \mu) C_{\{S,t\}}. \quad (15)$$

$K_{\{t\}}$  and  $I_{\{t\}}$  indicate aggregate capital and investment:

$$K_{\{t\}} = (1 - \mu) K_{\{S,t\}}, \quad (16)$$

$$I_{\{t\}} = (1 - \mu) I_{\{S,t\}}. \quad (17)$$

## 2.6. Fiscal sector and Monetary Policy

Government issues new long-term bonds and collects taxes to finance public expenditures  $G_{\{t\}}$  and expiring long-term debt. While assuming that short-term bonds are in zero net supply, government' nominal budget constraint can be described as follows:

$$\begin{aligned} & \left( 1 + \rho P_{\{t\}}^{\{B\}} \right) B_{\{t-1\}} + P_{\{t\}} G_{\{t\}} = \\ & P_{\{t\}}^{\{B\}} B_{\{t\}} + \tau^{\{N\}} w_{\{S,t\}} N_{\{S,t\}} + \tau^{\{N\}} w_{\{H,t\}} N_{\{H,t\}} + \tau^{\{K\}} r_{\{t\}}^{\{K\}} K_{\{S,t\}} + \tau^{\{C\}} P_{\{t\}} C_{\{t\}}. \end{aligned} \quad (18)$$

$$B_{\{t\}} = b_{\{t\}} Y_{\{t\}} \quad \text{where } b_{\{t\}} \text{ indicates public debt-to-GDP ratio;} \quad (19)$$

$$G_{\{t\}} = g_{\{t\}} Y_{\{t\}} \quad \text{where } g_{\{t\}} \text{ denotes real public expenditure.} \quad (20)$$

We assume that the Central Bank sets the nominal interest rate following the standard Taylor rule:

$$\left( \frac{R_{\{t\}}}{R^{\{*\}}} \right) = \left( \frac{\pi_{\{t\}}}{\pi^{\{*\}}} \right)^{\{\varphi_{\{\pi\}}^{\{R\}}\}} \left( \frac{Y_{\{t\}}}{Y^{\{*\}}} \right)^{\{\varphi_{\{y\}}^{\{R\}}\}} \varepsilon^R, \quad (21)$$

where  $R^{\{*\}}$  denotes the target nominal interest rate;  $\pi^{\{*\}}$  and  $y^{\{*\}}$  denote the steady state inflation rate and output, respectively. Finally,  $\varepsilon^R$  is monetary policy shock.  $\varphi_{\{\pi\}}^{\{R\}}$  and  $\varphi_{\{y\}}^{\{R\}}$  denote the response of nominal interest rate to inflation and output gap, respectively. Then, we define a Taylor-type rule that relates public debt-to-GDP ratio  $b_{\{t\}}$  and the inflation target, as follows:

$$\left(\frac{b_{\{t\}}}{b_{\{*\}}}\right) = \left(\left(\frac{\pi_{\{t\}}}{\pi_{\{*\}}}\right)\right)^{-\varphi_{\{b\}}} \quad (22)$$

where  $\varphi_{\{b\}}$  is a policy' parameter measuring the public debt-to-GDP ratio response to inflation gap.

**Table 1 – Parameters Values.**

<i>Parameter</i>	<i>Value</i>	<i>Description</i>
<b>Households</b>		
$\beta_{\{s\}} = \beta_{\{H\}}$	0.99	Discount factor
H	1.77	Parameter associated with labor elasticity
$\Delta$	0.025	Capital depreciation rate
P	0.959	Maturity of long-term bonds
$\alpha_{\{G\}}$	-0.240	Sustainability of public consumption
M	0.11	Share of hand-to-mouth households
<b>Firms</b>		
$\Xi$	0.33	Elasticity in production function
A	0.25	Elasticity in production function
E	6	Price elasticity of demand
$\Theta$	0.920	Calvo price
X	0.66	Price indexation
<b>Monetary Policy</b>		
$\varphi_{\{\pi\}}^{\{R\}}$	1.5	Inflation stabilization
$\varphi_{\{y\}}^{\{R\}}$	0.5	Output stabilization
$\varepsilon_{\{R\}}$	0.66	Shock' persistence
<b>Fiscal sector</b>		
$\tau^{\{C\}}$	0.023	Tax rate on consumption
$\tau^{\{N\}}$	0.186	Tax rate on labor
$\tau^{\{K\}}$	0.218	Tax rate on capital
G	0.11	Public spending to GDP ratio
$\varphi_{\{b\}}$	1.5	Policy parameter for inflation response

### 3. Calibration

This Section summarizes parameter values. Table 1 shows their description and details. For structural parameters' calibration, we follow Leeper *et al.* (2017) consistent with the US data. Hand-to-mouth households' share is set at 0.11 as in Kaplan *et al.* (2014) while the decay rate of the maturity of long-term government bonds is calibrated at 0.9593, following Bianchi *et al.* (2020).

As for the firms, parameters representing elasticity of production function with respect to capital and working hours are set to 0.33 and 0.25, respectively. The price elasticity of demand  $\varepsilon$ , is calibrated at 6 as in Cantore and Freund (2021) while the price indexation  $\chi$  to 0.66, as in Smets and Wouters (2007).

As for monetary policy, we set parameters denoting the response of nominal interest rate to inflation  $\varphi_{\{\pi\}}^{\{R\}}$  and output  $\varphi_{\{y\}}^{\{R\}}$  to 1.5 and 0.5 respectively, in line with the classical Taylor rule specification. Moreover, we set the parameter representing the persistence of monetary policy shock to 0.66. Eventually, with respect to fiscal sector, we calibrate parameter governing the response of public debt-to-GDP ratio to inflation rate  $\varphi_{\{b\}}$ , at 1.3.

#### 4. Results

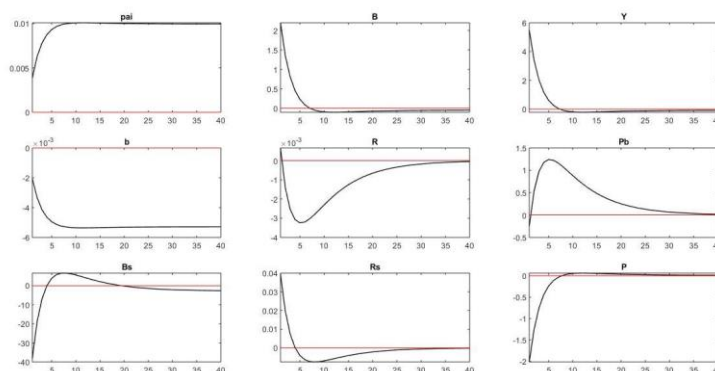
Figures 1 and 2 show impulse response functions of main macroeconomic variables, following a positive monetary policy shock.

The increase in the nominal interest rate causes inflation growth up.

As a result, bond prices ( $P_{\{t\}}^{\{B\}}$ ) decrease since they move inversely with the nominal interest rate. At the same time short-term bonds' nominal interest rate increases as well. However, since savers are forward-looking agents, they expect that in the future short-term bond prices will increase less than those of long-term bonds.

This is the reason why savers prefer to invest all their savings in long-term bonds. As result, short-term bonds reduce while long-term bonds raise, namely public debt increases. Overall, an increase in inflation positively affects the output in the short-run. However, as it grows up more than public debt, the debt-to-GDP ratio falls down.

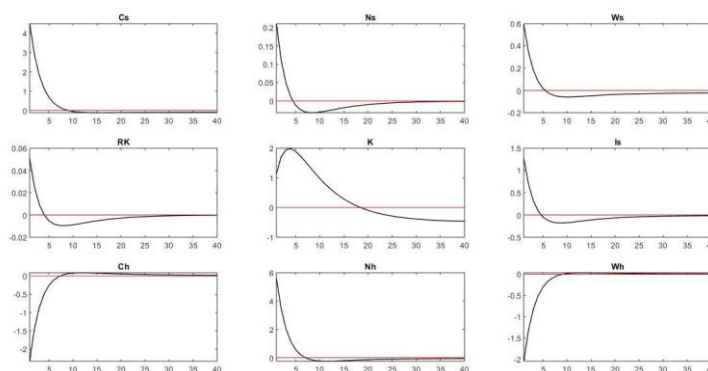
**Figure 1** – Impulse response functions: Monetary policy shock.



Let's now assess the effects of a positive monetary policy shock on households. Savers benefit from the increase in inflation in the short run. Indeed their wages increase entailing a gain in terms of income. As consequence, savers work and

consume more. After, when effects of higher inflation materialize (namely in medium term), the opposite occurs. The reason lies in the fact that savers as firms' owners, concerned about the sticky-price distortion, prefer situations with low inflation rates.

**Figure 2** – *Impulse response functions: Monetary policy shock*



Hand-to-mouth households - who do not have access to financial and capital markets - suffer a loss of income. Indeed, wage reduction induces them to consume less and work more. As for the production sector, the increase in the regular rental rate of capital causes firms to invest more and demand more capital.

However, positive effects on savers' and the government's consumption and in investment more than compensate for negative effects on hand-to-mouth households' consumption. As result, a positive monetary shock initially entails a positive variation in aggregate demand.

Eventually, once inflation stabilizes at higher values, some main macroeconomic variables move inversely undershooting their steady state.

## 5. Conclusion

This paper investigates the effects of a positive monetary policy shock in a model with fiscal sector and price distortion. The aim is to study what transmission mechanisms that entail in public debt-to-GDP reduction. Moreover, we ask what the redistributive effects on the agents are.

Consistently to the literature, results show that a positive monetary policy shock entails inflation increases. This, in turn, causes different effects on savers and hand-to-mouth households. As for the former, they initially benefit from inflation raises in terms of income. As result, they consume more and invest more in long-term



bonds. On the opposite, hand-to-mouth households - who do not have access to the financial and capital market - work more and consume less. Overall, a positive monetary policy shock causes output grows up in short term.

While analyzing effects of high inflation, we find that the increase in output is larger than in public debt. As a result, debt-to-GDP ratio falls down.

This paper contributes to the literature focusing on monetary policy. Different from the existing studies, we focus on the effects of inflation increases on public debt. However, this work neglects some important features including the wage-setting mechanism. Moreover, it would be interesting to investigate the effects of permanent inflation target increases and carry out a welfare analysis. Eventually, it would be useful to consider in the analysis of fiscal policy shock as well. We leave these extensions for future research.

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## SUMMARY

Nowadays, the increase in public debt and inflation are key concerns of the political debate among policymakers. In this regard, some economists have argued that the reason why inflation is higher lies in a transitory rise of commodity prices; others, instead, have asserted that permanent changes in the labor market caused by the Covid-19 pandemic, may also contribute to keeping inflation high for a long time.

This paper aims to investigate the effects of a positive monetary policy shock on the public debt-to-GDP ratio. Moreover, it assesses its different impacts on households. For these purposes, the paper employs an extended version of the New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model à la Leeper *et al.*, (2017) considering an economy populated by savers and hand-to-mouth households, with distortionary taxation.

Our analysis confirms that an increase in inflation contributes to public debt-to-GDP ratio reduction, thanks to the positive impact on output in the short term. Moreover, results highlight a trade-off between agents: savers as forward-looking agents invest their savings in the short term by increasing their income; on the opposite, hand-to-mouth households suffer a loss of income.

This paper contributes to the literature on monetary and fiscal policy, which focuses on the relationship between public debt and inflation.

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## **THE 7<sup>TH</sup> GENERAL CENSUS OF AGRICULTURE: TRADITION AND INNOVATION IN DATA COLLECTION**

Lucia Mongelli, Rosalia Coniglio, Sabrina Angiona, Barbara Boninfante, Lorella Sicuro, Domenico Tucci, Roberto Antonello Palumbo<sup>1</sup>

### **1. Introduction**

In the last decade the demand for statistical data has grown in terms of territoriality, timeliness and comparability. This represented a challenge, especially for the National Institute of Statistics (Istat) which has renewed and expanded the processes and the information offer. The Covid-19 pandemic represented a moment of crisis in all sectors, but it did not interrupt the statistical production and the dissemination of official statistics data. Indeed, not only Istat has given greater importance to the "numbers" of the Covid-19 and its repercussions in the socio-economic context - thanks to ad hoc surveys<sup>2</sup> - but it has also continued the statistical production. In particular, the 7th General Census of Agriculture has been the first Census carried out in full pandemic. The Census of Agriculture provides a detailed reading of agricultural and livestock farms at national, regional and local level. Besides, it collects information on the territorial geolocation of the various production activities; it analyses the phenomena of rural development and environmental sustainability; it focuses on important patterns, as generational change, computerization, innovation and associationism (Grillotti Di Giacomo *et al.*, 2021). The 2020 edition it was characterized by several novelties, some of which were implemented during the sudden and unexpected outbreak of the Covid-19 pandemic. In this research trend of data collection and its working methods will be analysed at regional and provincial level, throughout the period of the survey.

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<sup>1</sup> The paper is the result of the common work of the authors. In particular, paragraph 1 is attributed to Rosalia Coniglio, 1.1 is attributed to Barbara Boninfante, 1.2. to Domenico Tucci, paragraphs 2 - 2.1 to Lorella Sicuro, paragraph 2.2 to Sabrina Angiona and paragraph 3 to Lucia Mongelli. Roberto Antonello Palumbo developed tables, graphs and cartograms.

<sup>2</sup> During and after pandemic Istat had carried out some surveys: "SARS-CoV-2 seroprevalence survey", "Situation and prospects of companies after the Covid-19 health emergency", "The holiday prospects of Italians in the Covid era", "Diary of the day and activities at the time of the coronavirus", "Survey on secondary school students - Children and the pandemic: daily life "at a distance".

### 1.1. Innovations

The 2020 edition, initially scheduled for October 2020, has been postponed due to the health emergency (FAO, 2020a). It took place from 7 January to 30 July 2021. The information collected referred to the 2019-2020 agricultural year, i.e. the period from 1st November 2019 to 31st October 2020.

It was the last decennial data collection involving all Italian farms (about 1,700,000) as the traditional methodology, but it was also characterized by some innovations in view of the transition to permanent census - conforming to the other censuses (Population and Housing, Companies, Non-Profit Institutions and Public Institutions) - and to adapt the activities planned with the ongoing pandemic (Eurostat, 2021). The introduced innovation has contributed to create new opportunities to modernize and optimize the data collection process and the working methods:

- use of IT processing systems (called Sistema di Gestione Indagine - SGI) to support the data acquisition and monitoring (FAO, 2020b). This was a fundamental tool developed before Covid-19 and useful when the health emergency isolated the Country reducing intra-territorial mobility;
- the questionnaire was available exclusively in digital format;
- involvement of Centres for Agricultural Assistance (CAA) in the survey network. The timely acquisition of quality data was allowed, thanks to the CAA's widespread presence on the territory and their specific knowledge and familiarity with the companies in the agricultural sector;
- organization of distance learning for all the people involved in various ways in the survey.

Regarding the questionnaire in digital format, it was possible to choose among three different interview techniques:

- CAWI (Computer-Aided Web Interviewing), the online self-compilation by the respondent who was able to connect to Istat site dedicated to the Agricultural Census through the credentials received in the information letter;
- CATI (Computer-Assisted Telephone Interviewing), the telephone interview, a technique that has been implemented in progress during the sudden and unexpected Covid-19 pandemic. This kind of interview could be carried out in two ways: Inbound, the respondent contacted Istat toll-free number during the survey period and requested an interview; Outbound, the respondent was contacted by an operator to do the interview by telephone; moreover, video-interviews by Skype were done in order to avoid personal contact with the respondents;
- CAPI (Computer-Assisted Personal Interviewing), the face-to-face interview with CAA operators: the assignment of farms to CAA was made

on the basis of territorial proximity and/or the presence of the company Dossier.

The Covid-19 health emergency led to adoption of a new training model course for Census' operators: on one hand, by the use of online Moodle platform, with slides in e-learning mode, audio contents, tutorials, manuals, guides and test; on the other, training in virtual classroom on Microsoft Teams, with the objective to resume the more complex concepts of the survey, provided an overview of the survey tools (SGI, questionnaire) through exercises, guaranteeing collaboration and communication in real time (Castano, 2020). Approximately 6,500 CAA's operators were involved in about 150 training days.

### *1.2. The census list and the organization*

The survey unit of the Agricultural Census is the farm, in particular it is identified by all technical economic units with unitary management and that carry out agricultural and/or livestock activities. The Italian regional distribution of farms of the census list is visible in Table 1.

A unit is defined as eligible if it reaches at least one of the following thresholds:

- 20 ares (2,000 m<sup>2</sup>) of Utilized Agricultural Area;
- 10 ares (1,000 m<sup>2</sup>) planted with vines;
- 10 ares (1,000 m<sup>2</sup>) of greenhouses;
- 10 ares (1,000 m<sup>2</sup>) of mushrooms;
- the presence of at least one animal for reproduction or slaughter (not intended for self-consumption) of the following species: cattle, buffaloes, horses, sheep and goats, pigs, poultry, rabbits;
- the presence of at least 3 hives.

Regarding the organization of the Census, the network was composed by Istat at a national level that deal with the methodological, organizational and technical aspects (through the General Census Plan). In each territorial office, through the Territorial Supervisors, Istat has carried out support, training, and supervision tasks. Besides, the Ministry of Agricultural, Food and Forestry Policies (MIPAAF) provided strategic support. In particular, with respect to the organizational model, it made available to Istat the data from administrative sources useful for census purposes. The Agency for disbursements in agriculture (AGEA) has carried out support activities for Istat in relations with the survey network and has made data from administrative sources available.

The Regions have prepared the Regional Census Plans. In some cases they have established the Regional Technical Commission (CTR) and have monitored the survey, carrying out macro checks on reports, considering particular domains agreed between Istat and Regions (basic models, and high participation).

As previously mentioned, CAA collected basic data by contacting the survey unit and carrying out the interviews. An external company managed the telephone interviews and provided support for the compilation through the toll-free number.

## 2. Trend of data collection

The census list consisted of 1,699,942 farms (Table 1).

**Table 1** – *Italian regional distributions of total, multi-localized and relevant farms in the list of 7th General Census of Agriculture - absolute values – Year 2020.*

Region	Number of farms in the census list	of which multi-localized	of which relevant
Piemonte	78,492	5,970	778
Valle d'Aosta/Vallée d'Aoste	4,265	116	62
Lombardia	75,205	7,031	1,122
Trentino-Alto Adige/Südtirol	46,724	1,048	699
<i>Bolzano</i>	27,350	564	410
<i>Trento</i>	19,374	484	289
Veneto	112,562	7,899	1,689
Friuli-Venezia Giulia	27,050	1,457	404
Liguria	23,765	1,297	349
Emilia-Romagna	78,642	3,753	1,171
Toscana	81,350	3,713	1,216
Umbria	41,897	1,433	624
Marche	51,219	2,006	770
Lazio	117,963	4,789	1,767
Abruzzo	66,212	1,494	991
Molise	28,600	1,095	429
Campania	134,413	6,121	2,015
Puglia	266,195	13,353	3,990
Basilicata	49,766	1,522	744
Calabria	132,553	2,384	1,981
Sicilia	211,179	10,306	3,165
Sardegna	71,890	2,987	1,077
<b>Italia</b>	<b>1,699,942</b>	<b>79,774</b>	<b>25,043</b>

Source: Istat.

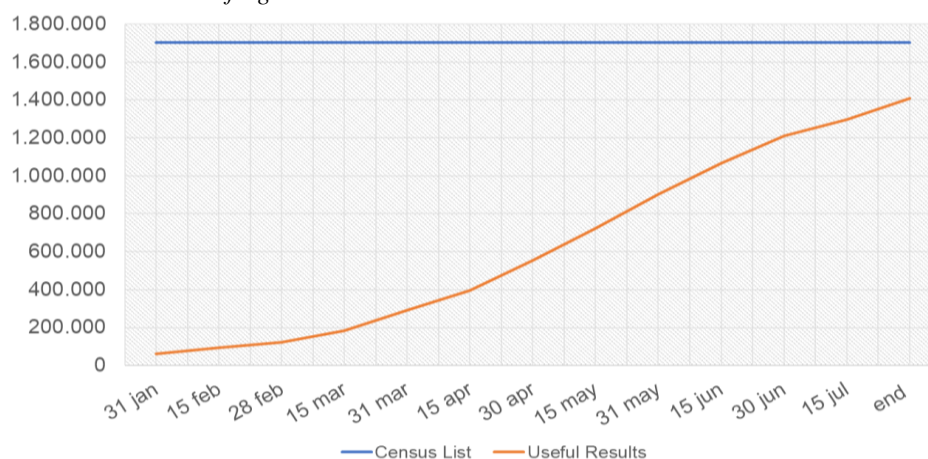
### 2.1. Useful results and complete interviews

At the end of survey, the 91.5% of the most important agricultural farms in terms of agricultural area and livestock was measured. In addition, 82.6% of final useful



outcomes - referred to completed interviews (59%), out of target (19.5%), discontinued company (3.2%) and temporarily inactive farm (0.9%) - were recorded. The cumulative frequency of useful results<sup>3</sup> from January to the end of the survey is visible in Figure 1.

**Figure 1** – Cumulative frequency of useful results from January to the end of 7th General Census of Agriculture - absolute values – Year 2021.



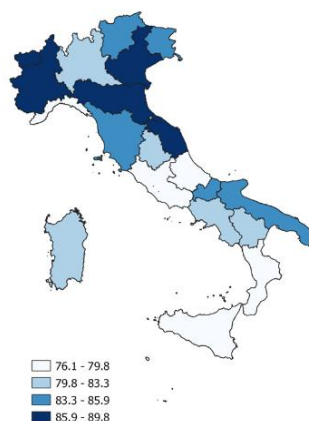
Source: Istat.

In particular, at regional level (Figure 2), geographical gradient from North to South of Italy was observed. The Italian average was equal to 82.3%: the North-West and North-East were above the national value (respectively 84.1% and 87.7%), the Centre was in line (82.8%), while the South and Islands were below the national average (80.4%). Specifically, the highest values were found in Veneto (89.8%), Emilia Romagna (87.9%) and Marche (86.9%), while the lowest ones were in Liguria (78.3%), Sicilia (77.6%) and Calabria (76.1%).

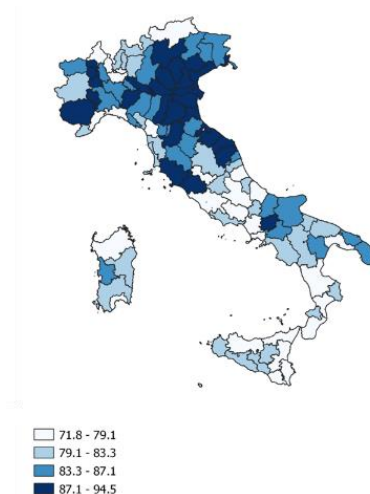
At the provincial level (Figure 3), the 56.1% of the Italian provinces recorded a percentage of useful results on the census list higher than the national average value (82.3%): the 78.3% of these were provinces of the North and Centre. The highest values were reported in five provinces of the North-East: Ferrara (94.5%), Trento (91.9%), Rovigo (91.7%), Venezia (91.6%) and Padova (91.5%). At the other extreme were the provinces of Napoli (71.8%), Cosenza (71.9%), Messina (72.1%), Genoa (72.8%) and Catanzaro (74.2%).

<sup>3</sup> The useful results are completed interviews and companies that are off target, shut down and temporarily inactive.

**Figure 2** – Useful results of census list, percentage values, by region. Year 2021.

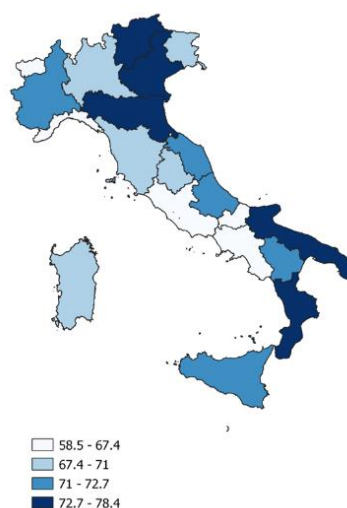


**Figure 3** – Useful results of census list, percentage values, by province. Year 2021.



The national percentage of complete interviews on the total useful outcomes was equal to 71.4%. The average of these interviews in the South and Islands (71.9%) exceeded that of the North-West (69.6%) and the Centre of Italy (67.3%). In particular, the highest values were recorded in Trentino - Alto Adige (78.4%), Veneto (77.5%) and Calabria (74.8%). On the contrary, Valle d'Aosta (64.8%), Lazio (62.9%) and Liguria (58.5%) were the regions with the lowest values. (Figure 4).

**Figure 4** – Complete interviews on the total useful outcomes, percentage values, by region. Year 2021.



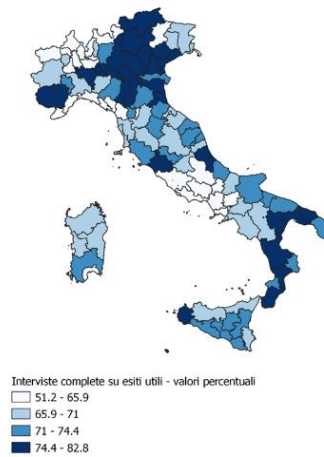
At the provincial level (Figure 5), there were fifty-one (47.7%) Italian provinces that presented a percentage of complete interviews on the total useful results which is higher than the national average value (71.4%) and were concentrated, above all, in the North-West, in the South and in the Islands.

## 2.2. The multichannel data collection technique

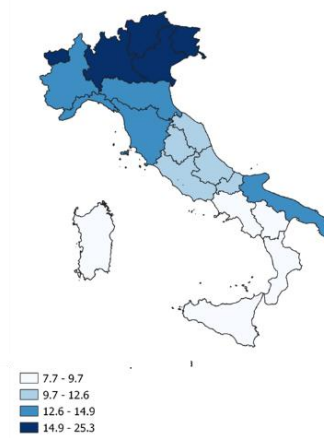
The questionnaire was in digital format and the CAWI response mode (Figure 6) showed a North-South geographical gradient. The highest values were recorded in Trentino-Alto Adige (25.3%), Friuli-Venezia Giulia (17.4%) and Lombardia (17.3%), the lowest ones in Sardegna, Campania (both 8.1%) and Calabria (7.7%).

For the CAPI technique (Figure 7) high values in the South and in the Islands were observed. Furthermore, higher percentages were found in Campania (62.1%), Molise (61.7%) and Basilicata (61.5%), while the lowest ones in Trentino-Alto Adige (49.1%), Liguria (47.6%) and Lombardia (47.2%).

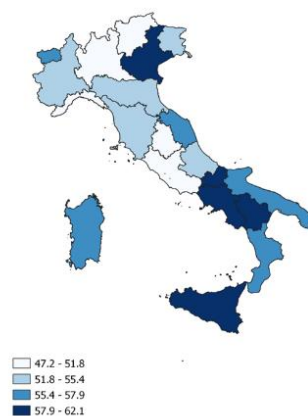
**Figure 5** – Complete interviews on the total useful outcomes, percentage values by province. Year 2021.



**Figure 6** – CAWI (Computer Assisted Web Interviewing) response rate, percentage values, by region. Year 2021.

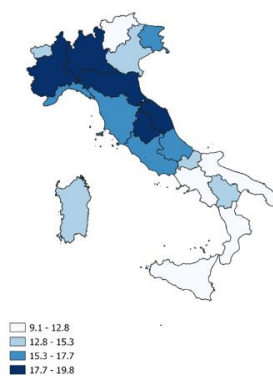


**Figure 7** – CAPI (Computer Assisted Personal Interviewing) response rate, percentage values by region. Year 2021.



The CATI technique (Figure 8) was mostly used in the North-West and in the Centre of Italy. The highest values were registered in Piemonte (19.8%), Marche (18.9%) and Umbria (18.7%), while the lowest ones in Puglia (11.5%), Sicilia (10.7%) and Trentino-Alto Adige (9.1%).

**Figure 8** – CATI (Computer Assisted Telephone Interviewing) response rate, percentage values, by region. Year 2021.



### 3. Conclusion

The aim of this work is to analyse the innovation aspects of the techniques adopted in the implemented processes. Besides, we have also examined the progress of the 7th General Census of Agriculture in Italy at territorial level, considering the

new national organization of the survey and the contribution provided by the territorial network in the management of activities. The data show the full success of the strategy implemented by ISTAT whose main innovations are: three different survey techniques, the use of the administrative data, the online acquisition system for multi-channel management, a specific and adequately trained detection network, monitoring through a web application (Castano, 2020). In addition, the online acquisition of data has allowed the use of an immediate control system of formal correctness through hard and soft rules.

The analysis of the territorial trend of data collection highlights some interesting geographical characteristics. For example, the Italian Northern regions and a part of Centre regions register the highest percentage of useful results on the census list. At the contrary, no geographical gradient emerges as regards the values of the complete interviews on the useful results. In fact, at the regional level both North and South record high values of complete interviews, at the provincial level, apart from the particularly virtuous behaviour of the Northeast, greater homogeneity between North and South and different trends within the same region are observed.

Concerning to the survey techniques, Italy is clearly divided into two parts: on the one hand the CAWI technique, relating to the online self-compilation of the questionnaire, on the other the CAPI technique, the face-to-face interview with the operator. In fact, higher frequency of CAWI in the North and CAPI in the South of Italy is observed. This evidence highlights the problem of lower digital literacy of the farmers in the South.

For the first time the CATI technique, by telephone, was introduced with the purpose to stimulate the respondent who was unable to complete the questionnaire independently or for the interviewer who did not want the CAPI interview - given the ongoing Covid-19 pandemic. Although the use of this interview method was lower than expected, it is nevertheless interesting that the regions of the North and the Centre of Italy record the highest values.

To assess the quality of the data collected, ISTAT conducted a "Coverage and Measurement Control Survey" from January to April 2022.

It is a sample survey which estimates, for the whole national territory, the number of farms existing at the reference date of the 7th Census of Agriculture and its coverage rate, defined as the ratio between the number of farms recorded in the Census and the number of farms existing.

The purpose of the Control Survey, conducted on a random sample of farms (about 135,000), was also the estimation of the measurement error for the main aggregates observed as the macro types of crops for the Utilized Agricultural Area (UAA) and livestock consistency. (Bernardini *et al.*, 2012).

In conclusion, despite the Covid-19 pandemic, data collection of 7th General Census of Agriculture was a real success thanks to the innovations adopted. Some

innovations were established a priori, such as the use of the electronic questionnaire, the adoption of registers and administrative archives and the involvement of the CAA. Other innovations were adopted in itinere to face the sudden challenge imposed by the pandemic from Covid-19, such as the CATI survey technique and virtual classroom training.

Italy is one of the European Country that has adapted to the difficulties imposed by the pandemic and has proven capable of adhering to new challenges and adoption of good practices. These new opportunities have allowed to accelerate the pace of innovation and modernize the data collection process (Eurostat, 2021). Therefore, the success achieved by the 7th General Census of Agriculture in Italy represents a promising starting point for the transition to the future Permanent Census of Agriculture.

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## SUMMARY

The economic censuses give a complete picture of the size and characteristics of the national economic system. In particular, the General Census of Agriculture provides a detailed reading of agricultural and livestock farms at national, regional and local level. The 2020 edition was the last decennial data collection involving all Italian farms (about 1,700,000), as the traditional methodology. Therefore, although traditional, it led innovation and has been characterized by several novelties, some of which were implemented during the sudden and unexpected outbreak of the Covid-19 pandemic. In fact, despite the obvious criticalities, it has been possible to adapt the activities planned with the ongoing pandemic, creating new opportunities to modernize and optimize the data collection process and the working methods. The questionnaire was available exclusively in digital format: it was possible to choose among three different interview techniques (CAWI - Computer- Assisted Web Interviewing, CATI - Computer-Assisted Telephone Interviewing and CAPI - Computer-Assisted Personal Interviewing).

The Centres for Agricultural Assistance (CAA), the Regions, the Autonomous Provinces and the Agency for Agricultural Disbursements (AGEA) had the opportunity to be involved in the survey network with the ISTAT. They collaborated according to different levels of participation. Another novelty of the Census was the organization of distance learning for all the people involved in the survey. The information collected referred to the 2019-2020 agricultural year, i.e. the period from 1st November 2019 to 31st October 2020. The multichannel data collection technique and the many actors involved had been very important for the success of the survey.

They allowed to produce detailed statistical information on numerous agricultural, rural development and environmental sustainability phenomena, that will have an important impact on the planning and evaluation of European, national, regional and local agricultural policies.

In this research the trend of data collection and its working methods will be analyzed at regional and provincial level, throughout the period of the survey.

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## **OVER-EDUCATION AND THE GREAT RECESSION. THE CASE OF ITALIAN PH.D GRADUATES**

Barbara Ermini, Luca Papi, Francesca Scaturro

### **1. Introduction**

The emergence and consolidation of the so-called knowledge economy has strengthened the importance of high levels of education. Accordingly, we observed a growing interest toward the role and function of Ph.D programs in providing high skilled human capital (EUA, 2005), available also to fulfill job requirements and carry on occupations outside academia.

Notwithstanding, it become clear that over-education may be an issue also at the level of Ph.D holders (Bender and Heywood, 2011; Di Paolo and Manè, 2016). The topic has received attention also in Italy where several papers analyzed which factors can influence the qualification and skill mismatch among Ph.D holders and the possible impact of the mismatch in terms of wages and job satisfaction (Gaeta, 2015; Ermini *et al.*, 2017; Ghosh and Grassi, 2020; Gaeta *et al.*, 2022; Cintio, 2022). At the same time, while a growing number of scholars studied the relationship between over-education and cyclical economic fluctuations (Croce and Ghignoni, 2012; Cockx and Ghirelli, 2016; Liu *et al.*, 2016; Altonji *et al.*, 2016). However, such a strand of literature has not yet focused on Ph.D graduates. Indeed, given the polarization and strategic and opportunistic upskilling and under-employment induced by downturns (Modestino *et al.*, 2016, 2020; Beaudry *et al.*, 2016; Hershbein and Kahn, 2018), the crisis may have affected the professional outcomes of both low and high-educated individuals.

Within this context, this paper adds to the existing literature by assessing the effect of the recent structural financial and economic crisis on overeducation in the labour market of the most skilled workers, i.e. Ph.D graduates. We adopt three different proxies to take the recession effect into account and, as a novelty, we examine the nexus between over-education and regional resilience. Finally, we contribute to improve evidence on the situation of Italian Ph.D graduates by using data on four cohorts of Italian Ph.D recipients surveyed from 2004 to 2010 by the Italian National Institute of Statistics (hereafter ISTAT).

Our main results show that the Great Recession increased the risk of over-skilling. Working in R&D based occupations, both within academia or other sectors of the

economy, reduces the detrimental effect of the economic crisis on over-education in general. The remainder of the paper proceeds as follows. Section 2 presents data and the econometric approach. Section 3 discusses the results of the empirical analysis as to the impact of the Great Recession on over-education. Concluding remarks are made in Section 4.

## 2. Empirical strategy

### 2.1. Data and over-education measure

Data for the present study come from two cross-sectional surveys on the professional outcomes of Italian Ph.D graduates carried out by ISTAT in 2009 – that surveyed those who obtained a doctoral degree in Italy in 2004 and 2006 (12964 respondents out of 18568 graduates) – and 2014 – directed to graduates awarded the doctoral title in 2008 and 2010 (16322 respondents out of 22469). The surveys collected information on four main issues: personal details and education; job and job search; mobility; family-related characteristics.

Following Ermini *et al.* (2017), we adopted a subjective approach based on Ph.D graduates' self-assessment to measure over-education in terms of *over-skilling*; this variable is used as dependent variables in the empirical analysis. It is defined as a dummy variable equals to one when respondents reported that the skills and competences acquired during the Ph.D were not useful to carry out the job, and equals to zero otherwise. In our ISTAT sample, only slightly above 50% of Ph.Ds (13633 out of 27189 valid responses) declared to be not over-skilled showing that in Italy over-skilling is a crucial concern also for the most educated workers. Interestingly, over-skilling is less relevant for those holding academia positions or R&D jobs (i.e., about 13500 individuals in our sample) as these workers declare to be mismatched with percentages equal, respectively, to 10% and 15.7%.

### 2.2. Econometric approach

To investigate the relationship between over-education (OE) and the Great Recession (GR), we estimated the following model:

$$OS = \alpha + \beta GR + X\gamma + \varepsilon \quad (1)$$

where the dependent variable OS, a  $N \times 1$  vector, is over-skilling for each respondent  $i = 1 \dots N$  and it is a dummy variable equals to one when workers reported to be over-skilled, and zero otherwise, as described in section 2.1.  $GR$  is a  $N \times 1$  vector collecting proxy for the Great Recession computed for each respondent  $i$ ; it is measured using three different indicators, denoted as *crisis*, *varVA* and *resilience*, that are punctually outlined in section 2.3.  $X$  is the  $N \times K$  matrix of  $K$  control variables, which includes potential determinants of OS, for any  $i$ . In this analysis, we included three different

categories of control variables in the main equation: socio-demographic information, Ph.D features and job attributes. The parameters  $\beta$  (a scalar) and  $\gamma$  (vector  $K \times 1$ ) are the estimated coefficients of GR and  $K$  control variables, respectively. Finally,  $\varepsilon$  is the usual  $N \times 1$  vector of individual error term. All the dependent and independent variables introduced above are briefly defined in Table 2, which also reports the relevant summary statistics.

Since the dependent variable has a binary outcome  $OS_i \in (0,1)$  for each respondent  $i$ , i.e. it is equals to one when workers are over-educated and zero otherwise, equation (1) can be estimated by a probit model<sup>1</sup>. Given a set of regressors<sup>2</sup>  $w_i$ , our goal is to describe  $Pr(OS_i = 1|w_i)$  through a function of the form  $Pr(OS_i = 1|w_i) = F(w_i'\delta)$ , where  $F(\cdot)$  is assumed to be normal. Indeed, as a binary outcome model, we give the probit model a latent variable interpretation, by assuming that the variable  $OS_i$  is linked to an unobserved variable  $OS_i^*$  according to the following equations:

$$OS_i^* = (w_i'\delta) + e_i \text{ where } e_i \sim F(\cdot) \quad (2)$$

$$OS_i = \{1 \text{ if } OS_i^* > 0 \text{ 0 otherwise} \quad (3)$$

Moreover, as the probability of being over-educated was assessed only for those respondents employed at the time of the survey, our sample represents a non-random selection of potential observations. Ignoring this selection into the labour market by using a simple probit model could produce biased estimates of the determinants of the risk of over-education that can be corrected by estimating a probit model with sample selection (Heckman, 1979). Accordingly, assuming that the dependent variable is observed if (and only if)  $OS_i^{select} = 1$  and it is unobserved otherwise, we have the selection equation specifying the probability for the respondent to be employed as a function of some covariates  $z_i$ :

$$OS_i^{select} = z_i'\lambda + u_i > 0 \quad (4)$$

This approach yielded consistent, asymptotically efficient estimates for all parameters in the model when the correlation through the error terms of the main probit equation of determinants of over-education and the probit selection equation of the probability of being employed, i.e.,  $e_i$  and  $u_i$ , was other than zero, making results from the standard probit techniques of Equation (3) biased.

As regards the selection equation adopted to correct for potential sample selection, we follow Ermini *et al.* (2017) in the choice of valid excluded instruments

<sup>1</sup> See Gaeta (2015) and Ermini *et al.* (2017) for applications in a similar context.

<sup>2</sup> For simplicity of notation, we indicate a unique matrix  $W$  of variables; it includes our key variable  $GR$  and all the other controls included in  $X$  as illustrated in equation (1).

to perform probit with selection, i.e. marital status (*married*) and children (*children*), both interacted with the variable *female*.<sup>3</sup> Additionally, socio-demographic information, Ph.D-related features and the variable on the area of residence were included among the regressors of the employment status in the selection equation (see Table 2 for descriptive statistics).

### 2.3. Great Recession measures

The main purpose of our analysis is to assess the impact of the Great Recession on the risk of over-skilling among Ph.D recipients. It may well happen that downturns have a more painful impact on middle-skilled workers, who also suffer from the competition of those high-skilled workers who take middle- and low-skilled jobs – an occurrence usually denoted as ‘upskilling’. As a consequence, over-skilling among high- skilled workers may easily emerge in a slack (polarized) labour market. Indeed, as shown in Table 1, our data indicate that the incidence of over-skilling has increased substantially during the crisis.

As to measurement issues, as a main proxy for the Great Recession we generated *crisis*, a dummy variable that assumes value one if Ph.D graduates were awarded their degree during the economic crisis, i.e. from 2008 onwards, and zero otherwise. This variable captures global discontinuity in the economic system due to adverse fluctuations and the related economic contraction. According to our sample, this cut-off distinguishes respondents to the first ISTAT survey (graduated in 2004 and 2006) from respondents to the second one (graduated in 2008 and 2010).

**Table 1** – *Over-education before and after the crisis (%)*.

		Before the crisis	After the crisis	Total
Over-skilling	No	54.7	46.5	50.1
	Yes	45.3	53.5	49.9
	Total	100.0	100.0	100.0

*Authors' elaboration ISTAT 2009, 2014*

Moreover, under the assumption that the crisis resulted in a general slowdown of growth and a decline in the values of the main economic indicators, we elaborated two further indicators to depict the behavior of a worsening local labour market that, before and after the economic crisis, operated in significantly different economic conditions and with different opportunities for the newcomer Ph.D holders.<sup>4</sup> Accordingly, as a second indicator of the Great Recession, we approximated the crisis of labour market prospects by computing the variation of the value added

<sup>3</sup>See Ermini *et al.* (2017) for more details and a richer set of literature references.

<sup>4</sup>The mean values of the two variables computed before and after the crisis signal a deterioration of the labor market's performance in the post-recession period. Indeed, tests of the difference between the two periods' means returned to being statistically significant. Results are available on request.

(*varVA*) registered in the provincial job area of a worker who entered the labour market as a Ph.D holder before and after the crisis, as follows:

$$varVA_{k,p} = \frac{VA_{k,t(k)}^p - VA_{k,t(k)-1}^p}{VA_{k,t(k)-1}^p} \quad (5)$$

Where *VA* indicates Value Added,  $k = 2004, 2006, 2008, 2010$ , i.e. the cohort of graduates,  $p = 1, 2 \dots 110$ , i.e. the Italian province where the job is located and  $t(k)$  the relevant year to compute the variation across two points of time as a function of  $k$  such that

$t(k) = \{2007 \text{ if } k = 2004, 2006 \text{ 2011 if } k = 2008, 2010\}$ .<sup>5</sup> Higher values of *varVA* denote a lower exposure to the economic crisis pointing out the growth of value added across the two points of time.

**Table 2 – Variables and summary statistics.**

Variable (label)	Description	Obs	Mean	Std. Dev.
<b>DEPENDENT VARIABLES</b>				
Over-skilling (oversk)	dummy=1 if over-skilled	27189	0.499	0.500
Employment (employm)	dummy=1 if employed	29286	0.928	0.258
<b>KEY REGRESSORS</b>				
Great Recession (crisis)	dummy=1 if awarded during Great Recession	29286	0.557	0.497
Value Added variation ( <i>varVA</i> )	Provincial variation of Value Added	24446	0.029	0.022
Provincial Economic Resilience (resilience)	Provincial labour market economic resilience	24264	-	2.669
<b>SOCIO-DEMOGRAPHIC VARIABLES</b>				
Gender (female)	dummy=1 if female	29286	0.521	0.500
Citizenship (ita citizenship)	dummy=1 if Italian	29286	0.984	0.126
Marital status (married)	dummy=1 if married or living together	29286	0.523	0.499
Children (children)	dummy=1 if having at least one child	29286	0.377	0.485
Parents' educational level (parents education)	1: junior high school diploma or lower*	29286	0.253	0.435
	2: high school or post-high school diploma	29286	0.378	0.485
	3: degree or post-graduate	29286	0.369	0.483

<sup>5</sup> Great recession hit Italy mainly during 2008. Thus, we assumed that those who attained the title in 2004 and 2006 have been exposed to pre-crisis labour market scenario that ended in  $t(k)=2007$ ; on the contrary, cohorts who get the Ph.D title in 2008 and 2010 faced a post crisis labour market setting that endured (at least) until  $t(k)=2011$ . This reasoning has been applied for computing variations of value added and resilience indicators (see Equation 5 and 6, respectively).

**Table 2** – Variables and summary statistics (continue).

Variable (label)	Description	Obs	Mean	Std. Dev.
Parents class (parents class i)	Parents' highest social class:	29286	0.301	0.459
	1: bourgeoisie*	29286	0.4	0.490
	2: middle class	29286	0.17	0.376
	3: petite bourgeoisie	29286	0.101	0.301
	4: working class	29286	0.027	0.164
Province of residence before University	5: other	29286	0.027	0.164
Ph.D-RELATED VARIABLES	categorical variable, province of residence	29286	n.a.	n.a.
Recent cohort(s) (recent cohort)	dummy=1 if most recent cohort of graduates	29286	0.536	0.499
Age at graduation (Ph.D age)	dummy=1 if 29 (or younger)	29286	0.284	0.451
Visiting abroad (visiting abroad)	dummy=1 if visiting abroad for at least 1 month	29286	0.35	0.477
Ph.D Study field (study field)	- Hard Sciences	29286	0.257	0.437
	- Medicine	29286	0.143	0.350
	- Agriculture and Veterinary Sciences	29286	0.067	0.250
	- Technical Sciences	29286	0.191	0.393
	- Economics and Statistics*	29286	0.059	0.236
	- Law	29286	0.072	0.259
	- Socio-political Sciences and Humanities	29286	0.21	0.407
Province of Ph.D University	categorical variable, Ph.D University province	29286	n.a.	n.a.
JOB-RELATED VARIABLES				
Self-employment (selfemployed)	dummy=1 if self-employed	27189	0.138	0.345
Informal access (informal access)	dummy=1 if informal channels to find job	27189	0.078	0.267
Academic (academic)	dummy=1 if academic sector	27189	0.342	0.474
R&D (R&D)	dummy=1 if R&D prevalent in job	27189	0.431	0.495
Part time (part time i)	0: Full-time*	27189	0.895	0.306
	1:Part-time, no full-time opportunities	27189	0.063	0.244
	2: Part-time, voluntary	27189	0.041	0.199
	0: No job started before Ph.D completion*	27189	0.317	0.465
Job experience- numbers (jobexp i)	1: One job started after Ph.D completion	27189	0.299	0.458
	2: More than one job after Ph.D completion	27189	0.384	0.486
Sector (sector i)	Sector: 1: Industry*	27189	0.084	0.278
	2: Service	27189	0.897	0.303
	3: Agriculture	27189	0.018	0.134

\* denotes the reference category in the estimation

Finally, according to Martin (2012), differences in the region's sensitivity to economic fluctuations can be observed because of its economic resilience. We built on the concept of resilience to elaborate a measure of regional difference in employment opportunities. We basically compared employment's variation in a

territorial region relative to the national one, before and after the crisis. By so doing, we were able to assess if the crisis had worsened the capacity of the labour market to give workers an occupation. For the post-recession, this measure corresponds to the economic resilience described by Martin (2012). In fact, the impact of the crisis depends on the real exposure of the local labor market to the fluctuation and on its capacity to restructure economically in response to a crisis. To our knowledge, the nexus between territorial economic resilience in the broad sense and over-education has not yet received attention. Actually, labour markets more resilient to crisis can offer more opportunities for skill-job matching because they are better able to drive transformation of a given geographical area, to retain manufacturing, and to innovate a high-tech economy. Accordingly, we used *resilience* as an additional proxy of the intensity of the crisis. Thus, we computed:

$$resilience_{k,p} = \frac{\frac{\Delta E^p}{E^p} - \frac{\Delta E^N}{E^N}}{\left| \frac{\Delta E^N}{E^N} \right|} \quad (6)$$

where E stands for employment,  $\frac{\Delta E}{E}$  is the employment variation;  $\frac{\Delta E^p}{E^p} = \frac{E_{k,t(k)}^p - E_{k,t(k)-2}^p}{E_{k,t(k)-2}^p}$ ;  $k = 2004, 2006, 2008, 2010$ ;  $t(k) = \{2007 \text{ if } k = 2004, 2006, 2011 \text{ if } k = 2008, 2010\}$ ;  $p = 1, 2, \dots, 110$  is the province of job location and  $N=Italy$ .<sup>6</sup> Values of resilience above zero indicate the greater resistance of the province to economic shocks compared to the nation. In contrast, values less than zero indicate a decreased ability to cope with a recessionary period compared to the national average.

### 3. Results and discussion

This section presents the empirical results of our econometric analysis. As the coefficients of the selection term were statistically different from zero, we relied on the estimates of the probit models with sample selection. Accordingly, Table 3 reports the results of the main model of determinants of over-skilling (columns (1), (3) and (5)) and the results of the employment selection equation (columns (2), (4) and (6)). For the sake of space, we only show results for the proxies for the Great Recession (*crisis*, *varVA* and *resilience*) and those of the excluding instruments.<sup>7</sup>

<sup>6</sup> When using employment as a measure to evaluate the state of the local labour market, we adopted a temporal lag larger than the one assumed to evaluate changes in value added, given that the employment level reacts slowly to variations in local economic conditions: that is, employment effects are more persistent.

<sup>7</sup> Full estimates are available upon request.

The variables chosen as instruments in the selection equation are significant and show the expected sign: having children and being married increase the probability of getting a job, denoting a relatively higher urgency to provide family sustenance. However, when also the gender variable is taken into account, a disadvantage for women emerges: being a woman with children or being a married woman reduces the probability of being employed, confirming our theoretical predictions. Notably, the coefficient of the dummy crisis shows a negative and significant sign confirming our expectation that during a recession the opportunities to find a job are relatively scarce and being unemployed is more likely. Overall, the results of the whole selection model appear to be fairly stable across all the estimated specifications.

**Table 3 – Over-skilling before and after the crisis.**

	(1)	(2)	(3)	(4)	(5)	(6)
	oversk	empl_sel	oversk	empl_sel	oversk	empl_sel
Key regressors:						
Crisis	0.113*** [0.018]	-0.118*** [0.026]		-0.168*** [0.024]		-0.183*** [0.024]
varVA			-1.410*** [0.414]			
Resilience					-0.006* [0.003]	
Excluding instruments:						
Children		0.202*** [0.052]		0.219*** [0.053]		0.218*** [0.053]
female*children		-0.373*** [0.061]		-0.375*** [0.062]		-0.373*** [0.061]
Married		0.281*** [0.045]		0.276*** [0.046]		0.273*** [0.046]
female*married		-0.260*** [0.056]		-0.237*** [0.056]		-0.229*** [0.056]
Observations	27189	29286	24446	29286	24264	29286
				26.42		18.12
Wald test rho=0 (p-value)		43.35 (0.000)		(0.000)		(0.000)

Rob. std. errors in brackets. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  All estimates include: constant, socio-demographic variables, Ph.D related variables and job related variables (see Table 4).

Focusing on the main model of over-skilling determinants, it emerges that the coefficient of *crisis*, which is the main proxy for the Great Recession, is positive and significant. This result suggests that the Great Recession has reduced the probability of Ph.D-holders to find the job most appropriate for their skills. The risk of over-skilling is more likely during a downturn. In column (3) we report the estimated coefficient of *varVA*. The correlation between this variable and over-skilling is negative, suggesting that as the index grows - signalling that the area is less hit by the crisis - over-skilling is less likely. This reinforces the belief that recessions do not offer opportunities for adequate job matching. We then assess the predictive power of the variable *resilience* in column (5). As the coefficient is negative and



statistically, even if weakly, significant, we can conclude that Ph.D-holders working in areas with a higher level of market potential were at less risk of over-skilling. Overall, the above evidence validates the hypothesis that the Great Recession brought about a deterioration of professional outcomes also in terms of over-skilling determining a waste of human capital as a possible outcome.

In an attempt to account for the heterogeneous impact of the crisis across job characteristics of our sample of Ph.D-holders, we extended the empirical model in the columns (1)-(3)-(5). Hence, we interacted the *crisis* dummy with *academic* and *R&D*: that is, those variables that best capture the worker's taste for science, which corresponds to the primary vocational attitude of academically-trained Ph.D students. We expected that being occupied in such sectors could protect the workers from the negative effect of the economic fluctuation because these high-skilled jobs are at less risk of downskilling. Moreover, the highly qualified human capital holding such jobs can be a key factor in relieving an economic crisis. Economic resilience of a region hinges on the capacity to maintain and to booster the territorial competitiveness by branching into related or entirely new paths of development (Martin and Sunley, 2015). It entails restructuring and reorienting human and capital resources, a task that high human capital employed in knowledge and technology-led sectors can more easily perform. We report the estimates of interest of the main model of over-skilling in Table 4. The results are in line with our expectations of negative coefficients of the interaction terms. For those who worked in academia or in R&D based occupations the Ph.D title proves to be worthy to avoid over-skilling also in risky economic conditions such those related to downturns.

**Table 4** – *Over-skilling and the Great Recession in R&D-based occupation.*

Dependent Variable: Over-skilling	Coeff	Std. error
crisis	0.323***	[0.026]
academic	-0.852***	[0.031]
Crisis•academic	-0.324***	[0.043]
R&D	-0.930***	[0.028]
crisis•R&D	-0.342***	[0.038]
Observations	27189	

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  Estimates include: constant, socio-demographic variables, Ph.D related variables and job related variables (see Table 4) and an employment selection equation; the operator • denotes the interaction term between crisis with the variables academic and R&D.

As regards other drivers of over-education not reported in the table, socio-demographic variables do not seem to affect significantly the probability of being over-educated. Surprisingly, the family of origin of doctoral graduates does not influence over-education. International exposure emerges as a key aspect of a Ph.D course, because spending a study period abroad proves to be the characteristic that most affects a successful job matching. Moreover, the risk of over-education is not

equally distributed across fields of study since Ph.D graduates in Humanities are more likely to be mismatched than peers graduated in Economics or Science and Technology. Overall, a strong result of this paper, is that job characteristics are the main drivers of the risk of mis-match among Ph.D-holders. Besides a prominent protective effect induced by working in a university or a R&D-based center, we point out that self-employers or workers in the manufacturing sector are at a greater risk of over-education.

#### **4. Concluding comments**

In this paper we have sought to shed light on the impact of the Great Recession on over-education. We have focused on Italian Ph.D-holders, graduated from 2004 to 2010, using surveys carried out by ISTAT (2009, 2014). Our estimates revealed a striking impact of the Great Recession. This effect emerged when the incidence of the crisis was measured both by using a crude dummy and when we adopted more refined indicators that explicitly took account of economic performance at provincial level, such as value added growth, and the local labour market's resilience. As expected, our findings show that the impact of the crisis is less pronounced when labour markets are more resilient. Moreover, the effect of downturns on over-skilling is less marked among Ph.Ds working in academia or R&D activities. These findings prompt several considerations.

First, closer attention should be paid by economic studies to the phenomenon of over-skilling which, although it is becoming increasingly widespread, costly, and persistent - and even more so during downturns - is still overlooked. Second, indicators of the state of the labour market should also include the important dimension of over-education in order to avoid underestimating its real costs, especially during recessions. Third, the sensitivity of over-skilling to economic fluctuations calls for economic policies designed not only to promote employment but also to favor job matching and to integrate Ph.D-holders into the process of producing and distributing goods and services. Indeed, human capital is a key factor in developing regional resilience, which is itself an effective strategy to deal with economic fluctuations and to cope with cyclical variations. Finally, our evidence seems to confirm that the Italian Ph.D is still based on a research-oriented educational pattern, since working in academia or in research-based sectors provides the most successful matching. In this regard, our evidence highlights the need for more incisive policy actions promoting a more applicable type of knowledge which might be more valuable outside the pure research sectors and academia. Hopefully, this should produce successful outcomes also among self-employed workers, who, according to our results, appear to be at a disadvantage.

### Acknowledgements

We thank participants to LVIII Sieds Conference held at LUMSA (Palermo) for helpful comments. The authors alone are responsible for the views expressed in this paper and the publication does not constitute an endorsement by the institutions with which the authors are affiliated of the opinions expressed in it.

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### SUMMARY

The paper evaluates the impact of the Great Recession on Ph.D over-skilling using data drawn from four annual cohorts of Ph.D graduates surveyed by the Italian National Institute of Statistics. The results show that over-skilling is positively associated with the Great Recession. However, it has an heterogeneous impact across job characteristics, as being occupied within academia or R&D-related sectors protect the workers from the negative effects of the economic fluctuation.

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## **THE ECONOMIC IMPACT OF SOCIAL ENTREPRENEURSHIP: AN EXPLORATORY ANALYSIS OF THE LINKAGE BETWEEN SOCIAL COOPERATION AND LOCAL GROWTH IN ITALY**

Giuseppe Terzo

### **1. Introduction**

Social entrepreneurship is a phenomenon that is attracting increasing interest within the field of economics. It refers, in general terms, to all those entrepreneurial ventures that are not oriented toward individual profit maximization but rather the pursuit of public benefit purposes that enable the generation of social value (Huybrechts and Nicholls 2012). As recently pointed out by the OECD (2022), social enterprises have strong potential and can provide a crucial contribution to promoting more inclusive and sustainable growth. These firms have grown in importance over the past decade by expanding their reach within the European Union, contributing to important policy objectives, such as job creation, inclusiveness, equal opportunities, sustainability, and civic participation (European Commission 2020).

Considering these premises, with this article I aim to assess the economic impact of this emerging phenomenon. Focusing on the Italian context, I specifically analyze the contribution of social cooperatives — which are the most important expression of social entrepreneurship in Italy (Picciotti *et al.* 2014) — to the economic growth of provinces (NUTS-3) through the lens of relational capital. I choose Italy because it represents a fascinating case study in light of its important cooperative tradition that has allowed it to be one of the pioneering countries of social entrepreneurship (Terzo 2021a).

I investigate the Italian case using a panel data set of 106 NUTS-3 regions spanning the period from 2012 to 2019. Specifically, I apply a linear within-estimator technique with fixed effects to the so-called Barro regression ( $\beta$ -convergence model) addressing the well-known econometric issues of reverse causality and estimation bias resulting from unobserved province-specific influences.

I structure this analysis to test the hypothesis that social cooperatives may, through the creation of relational networks based on the principle of unconditional reciprocity that fosters the spread of generalized trust, stimulate the economic growth of Italian provinces. The results of the econometric investigation confirm the presence of a positive linkage between the local diffusion of social cooperation and

economic growth, providing novel evidence on an issue still partially unexplored by empirical studies.

The remainder of the paper is structured as follows. Section 2 describes the theoretical framework. Section 3 illustrates the empirical strategy, while Section 4 comments on the results of the econometric analysis. Finally, Section 5 offers some concluding remarks.

## 2. Theoretical background

As argued above, this study focuses on social cooperatives, which constitute a universe — the social cooperation — that has become pivotal in the expansion of the social economy in Italy (Terzo, 2021b). They are playing an increasingly important role in the economies of high-income countries that seek to maintain high welfare standards while meeting increasingly tight budget constraints (Pesenti, 2014).

The social cooperative firm, to which Italian law recognizes by right the legal status of social enterprise, produces goods and services to pursue, unlike traditional cooperatives, the general interest of the community in which it operates. It has an innovative nature, through the goods or services it offers, and through the organization or production methods it resorts to, contributing to social cohesion, employment, and the reduction of inequalities (Becchetti and Pisani, 2015).

This organization, as a non-profit institution, can be considered a relational good, since it facilitates, through the implementation of activities aimed at pursuing the general interest, the development of trust relationships based on the principle of reciprocity (Terzo *et al.*, 2022). Following Poledrini (2015), it is possible to highlight how social cooperatives base their activities on the principle of unconditional reciprocity, defined by Bruni (2008) as the propensity to cooperate because of intrinsic motivations — for example, in a spirit of solidarity — and not to get a material benefit in exchange.

The orientation toward unconditional forms of reciprocity is what distinguishes a social cooperative from a traditional cooperative or capitalist firm. A traditional cooperative, indeed, is characterized by the pursuit of members' interests, while a capitalist firm is by that of shareholders, giving rise to cooperative actions that, in different ways, can generate particularist forms of trust. Social cooperatives, on the other hand, can foster, through the adoption of cooperative behaviour based on the principle of unconditional reciprocity, the spread of generalized trust.

As shown in a large empirical literature (e.g., Beugelsdijk *et al.*, 2004; Bjørnskov, 2012; Dincer and Uslaner, 2012; Zak and Knack, 2001), generalized trust is a key factor in the economic growth of territories. Repeated interactions between members of a collective promote the dissemination of information and the relevance of

reputation. The higher opportunity cost associated with opportunistic actions makes agent behaviour more predictable, resulting in an overall reduction in uncertainty. For these motivations, an increase in trust-based relations may reduce the average cost of transactions, just as an increase in physical capital reduces the average cost of production (Sabatini, 2008).

Considering that social cooperation represents, in the light of its features as a relational good, a source of generalized trust, I thus empirically test the hypothesis that a greater local diffusion of social cooperatives corresponds to the higher economic performance of territories.

### 3. Econometric approach

#### 3.1. Data

The data set is a strongly balanced panel for 106 Italian provinces (NUTS-3) over the period from 2012 to 2019. A detailed list of the variables included in the model is provided in Table 1 together with some descriptive statistics and the correlation matrix of explanatory variables.

As a dependent variable, I consider the annual growth rate of value added per capita, measured as the logarithmic difference in value added per capita between years  $t$  and  $t-1$ :

$$\Delta VA_{pc_{it}} = \ln VA_{pc_t} - \ln VA_{pc_{t-1}} \quad (1)$$

The variable of interest is the local diffusion of social cooperatives, which is expressed as follows:

$$SOC\_COOP_{it} = (\text{social cooperatives}/\text{total firms}) * 10,000 \quad (2)$$

It represents, therefore, the number of social cooperatives per 10,000 total firms, expressing the weight of social cooperation within local entrepreneurial systems. Considering that social cooperatives represent the majority of social enterprises operating in Italy (Borzaga and Musella 2020), this indicator can be considered a reliable proxy of the degree of social entrepreneurship in a territory.

I also include in the analysis a set of variables useful for controlling some socio-economic characteristics of local contexts. To control the  $\beta$  convergence hypothesis (e.g., Barro, 1991, Barro *et al.*, 1991; Barro and Sala-i-Martin, 1992a, 1992b), I include the initial level of value added per capita ( $VA_{pc}$ ). To control the endowment of human capital, I consider a proxy indicating the percentage of people aged 25-39 with a tertiary level of education (ISCED 5,6,7 and 8) ( $HUM\_CAP$ ). I also control for the sectoral composition of the local economy, including the percentage of value-

added represented by the manufacturing sector (*MANUFACT*), and the agglomeration effects through a variable expressing the population density (number of inhabitants per square kilometres) (*POP\_DENS*). Finally, to control the level of trustworthiness I include a variable indicating the number of reported crimes per 10,000 inhabitants (*CRIME*).

The dependent variable is measured for the period 2013-2019, while the explanatory variables are for the period 2012-2018. This lagging of explanatory variables allows us to mitigate the reverse causality bias.

### 3.2 Empirical strategy

I use regression analysis to estimate the determinants of local economic growth. Two conventional approaches for estimating panel data are the fixed-effects and random-effects procedures. However, whether the individual province fixed-effects are correlated with other exogenous variables, the random-effects estimation procedure yields inconsistent estimates. A Hausman test shows that the fixed province-effects are correlated with the other exogenous variables, suggesting that the fixed-effects estimation procedure is the more appropriate choice. On a theoretical basis, a fixed-effects technique is more appropriate because the data are not a sampling of provinces. Hence, for both theoretical and empirical reasons, I adopt the fixed-effects procedure, estimating the following equation:

$$\Delta VA_{pcit} = \beta_0 + \beta_1 VA_{pc_{i,t-1}} + \beta_2 SOC\_COOP_{i,t-1} + \beta_3 X_{i,t-1} + \Phi_i + u_i \quad (3)$$

Where, as described above,  $\Delta VA_{pc}$  is the annual growth rate of value added per capita,  $VA_{pc}$  the initial level of value added per capita,  $SOC\_COOP$  the number of social cooperatives per 10,000 total firms,  $X$  a vector of control variables,  $\Phi$  the province fixed effects and  $u$  the error term. Given the panel nature of the data, I also address the potential for serial correlation. A Durbin-Watson test indicates that autocorrelation is a concern; therefore, all standard errors are clustered at the province level.

Considering how there would be a problem of reverse causality, which can only be mitigated by lagging the explanatory variables, I also estimate a regression model with instrumental variables. In this model, the variable *SOC\_COOP* is treated as endogenous and instrumented with two variables. Following widespread literature, I consider two instruments that should be strongly correlated with the variable of interest and should not have a direct impact on economic growth. Since social capital can be a determinant of the creation of social cooperatives, I include in the analysis a proxy of civicness; that is, the percentage of separate waste collection of municipalities (*SEP\_WASTE*) (employed, for instance, in Terzo 2021a and Caporale *et al.*, 2016). As shown by Kim and Kim (2015), a determinant of the spread of non-



profit organizations — such as social cooperatives — can be the heterogeneity of the population; that is, the size of the registered foreign population as a percentage of the total population (*POP\_HET*), which I employ as a further instrument.

**Table 1** – Summary statistics (panel A) and correlation matrix of explanatory variable (panel B).

PANEL A					
Variable	Source	Mean	SD	Min	Max
<i>AVA_pc</i>	Centro studi G. Tagliacarne	0.0134	0.0229	-0.1983	0.1920
<i>VA_pc</i>	Centro studi G. Tagliacarne	22736	6157	12992	48666
<i>SOC_COOP</i>	Unioncamere	3.80	1.94	0.98	9.70
<i>POP_DENS</i>	Istat	269.4	376.5	37.09	2614
<i>HUM_CAP</i>	Istat	23.06	5.43	10.80	43.80
<i>MANUFACT</i>	Centro studi G. Tagliacarne	16.16	7.98	4.07	37.04
<i>CRIME</i>	Istat	193.5	84.84	23.00	548.7
<i>SEP_WASTE</i>	Istat	48.76	18.91	4.80	87.90
<i>POP_HET</i>	Istat	7.45	3.38	1.36	16.93

PANEL B							
		1	2	3	4	5	6
1	<i>VA_pc</i>	1.0					
2	<i>SOC_COOP</i>	-0.6	1.0				
3	<i>POP_DENS</i>	0.3	-0.2	1.0			
4	<i>HUM_CAP</i>	0.6	-0.3	0.2	1.0		
5	<i>MANUFACT</i>	0.5	-0.5	0.4	0.3	1.0	
6	<i>CRIME</i>	0.5	-0.6	0.1	0.2	0.1	1.0

### 3.3 Results

Table 2 shows the results of some specifications of the baseline model. Column 1 indicates a specification in which I include only the initial level of value added per capita to test the hypothesis of convergence, which is confirmed since the coefficient is negative and statistically significant. Next, I include the variable of interest (Column 2), which shows a positive and statistically significant coefficient. This coefficient does not change in sign and significance following the subsequent introduction of the control variables (Column 3). These results, which at this stage I interpret as robust correlation, represent initial evidence confirming the work's hypothesis.

**Table 2** – Estimation results I (N = 742).

Dependent variable	Ordinary Least Squares (OLS) regressions		
	(1)	(2)	(3)
$\Delta VA_{pc}$			
<i>VA<sub>pc</sub></i>	- 0.0695** (0.0284)	-0.1042*** (0.0274)	-0.1838*** (0.0338)
<i>SOC_COOP</i>		0.0819*** (0.0104)	0.0468*** (0.0099)
<i>POP_DENS</i>			-0.0087*** (0.0021)
<i>HUM_CAP</i>			0.0274*** (0.0082)
<i>MANUFACT</i>			-0.0719*** (0.0254)
<i>CRIME</i>			-0.0180** (0.0078)

Note. All estimates include a constant term and the provincial fixed-effects (not shown). All explanatory variables are log-transformed. Clustered robust standard errors are shown in brackets. \*\*\*p<1%; \*\*p<5%; \* p<10%.

With regard to the control variables, the positive sign of the *HUM\_CAP* variable is consistent with the well-established literature that highlights the crucial role of human capital in economic growth processes (e.g., Barro, 2001; Gennaioli *et al.*, 2013; Lucas, 2015). Contrary to expectations, I find a negative sign for the *POP\_DENS* and *MANUFACT* variables. These results, which should be interpreted as simple correlation, can be explained by taking into account how the most industrialized and urbanized areas are those that probably suffered most from the effects of the Great Recession, having the most difficulty in the recovery path. The result on population density is congruent with what Muringani (2022) recently found. Finally, the negative sign of the *CRIME* variable is consistent with some empirical studies that have found how crime negatively impacts the value added of Italian provinces (e.g., Carboni and Detotto 2016; Mauro and Carmeci 2007).

Table 3 shows the estimates of IV regressions using a Two-stage least squares (2SLS) estimator. In Columns (1) and (2) I estimate the model separately including the two instruments, while in Column (3) they are jointly included. Looking at the tests of the first two specifications, where the instruments are included individually, it is possible to see how the under-identification tests reject the null hypothesis in both cases. Moreover, the weak identification tests indicate values of the F statistic that are well above the Staiger and Stock (1997) rule of thumb value of 10. The same results are obtained in the third specification (Column 3), where the instruments are

both included. In this case, we can also verify the over-identification test, which does not reject the null hypothesis that the instruments are uncorrelated with the error term. Hence, the instruments are exogenous and not weak. The results of these estimates confirm the existence of a positive linkage between the local diffusion of social cooperation and the economic performance of Italian provinces, which is therefore robust to reverse causality issue. The control variables all confirm the same signs. However, unlike previous estimates, only *VA\_pc* and *HUM\_CAP* retain statistical significance.

**Table 3** – Estimation results II (*N*=742).

Dependent variable	IV-2SLS regressions		
	(1)	(2)	(3)
<i>ΔVA_pc</i>			
<i>VA_pc</i>	-0.1914*** (0.0443)	-0.1921*** (0.0450)	-0.1916*** (0.0446)
<i>SOC_COOP</i>	0.1716*** (0.0461)	0.1826*** (0.0541)	0.1743*** (0.0445)
<i>POP_DENS</i>	-0.0100 (0.0106)	-0.0101 (0.0106)	-0.0100 (0.0106)
<i>HUM_CAP</i>	0.0203** (0.0086)	0.0196** (0.0088)	0.0201** (0.0086)
<i>MANUFACT</i>	0.0184 (0.0442)	0.0264 (0.0483)	0.0203 (0.0403)
<i>CRIME</i>	-0.0107 (0.0085)	-0.0100 (0.0090)	-0.0105 (0.0086)
Instrumental variables	<i>pop_het</i>	<i>sep_waste</i>	<i>pop_het</i> <i>sep_waste</i>
Underidentification test – p-value (Kleibergen-Paap rk LM statistic)	0.0000	0.0000	0.0000
Weak identification test (Kleibergen-Paap rk Wald F statistic)	69.614	56.248	40.715
Overidentification test – p-value Hansen J statistic	—	—	0.7945

Note. All estimates include a constant term and provincial fixed effects (not shown). All explanatory variables are log-transformed. Clustered robust standard errors are shown in brackets. \*\*\*p<1%; \*\*p<5%; \*p<10%. First-stage estimates are not reported (they are available upon request).

#### 4. Concluding remarks

This article aimed to provide some evidence of the impact that social cooperation has on the economic performance of territories, focusing on the Italian context. The features of this sector — which constitutes a virtuous example of social entrepreneurship — mean that it can be characterized as a pivotal component of a territory's endowment of social capital, contributing to the generation of a virtuous process of economic growth.

To test the hypothesis that social cooperation, by its being a relational good, can be a determinant of local economic growth, I structured an econometric analysis on a sample of 106 Italian provinces (NUTS-3) for the period 2012-2019. The results of this analysis confirm the potential virtuous role of social cooperation in local economic growth processes, indicating that a greater diffusion of social cooperatives within local entrepreneurial systems corresponds to higher levels of economic performance.

Although this evidence represents only a first attempt to delineate a possible causal link between social cooperation and economic growth, it appears promising and could be useful in directing future research towards a better understanding of how social-oriented business models can promote more equitable and sustainable growth models that can reduce the regional disparities that characterize countries like Italy.

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### SUMMARY

With this article I aim to investigate the linkage between social entrepreneurship and local economic growth through the lens of relational capital. Focusing on the Italian context, I consider the role of social cooperation — which constitutes a fundamental expression of social entrepreneurship in Italy — in stimulating the economic growth of provinces (NUTS-3). Specifically, I conjecture that social cooperative can contribute to local economic growth through the development of relational networks based on the principle of unconditional reciprocity that enable the spread of generalized trust, which, as reported in a large body of literature, is a key factor in the advancement of market economies. A panel analysis covering the period 2012-2019 shows results that confirm the hypothesis that social cooperation may be a determinant of local growth.

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## THE UNINTENDED EFFECTS OF INCREASING FIXED-TERM EMPLOYMENT ON HEALTH

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### 1. Introduction

Over the last decades, numerous European countries have introduced other forms of employment, leading to a significant increase in the number of temporary workers, in order to promote a greater flexibility of the labour market, employment and productivity growth (Geronikolaou *et al.*, 2016; Parello, 2011). With regard to Western Europe, there has been a considerable increase of fixed term labour contracts from the '80s, whereas in the middle of the '90s temporary works increased quickly even in Southern Europe<sup>1</sup>. The subsequent decrease in permanent jobs in favour of temporary works better responded to the changes and fluctuations of the labour market and reflected the higher competition between companies since they had to adapt quickly to the varying supply and demand conditions of the labour market. The liberalised use of temporary forms of employment created a new category of temporary workers in the middle between unemployed and permanent employed, with lower rights and social protection, and consequently less costly. Some authors evidenced that the regulations of temporary work in Europe aimed also to reduce the high unemployment rate especially among the young workers (Barbieri *et al.*, 2009), although it may translate into a feeling of economic uncertainty for individuals (Schmitt, 2012).

Since 1997, Italy undertook steps towards flexibility with reforms which liberalized the use of flexible or temporary employment leaving unchanged the discipline and employment protection for standard regular workers. Starting with the Treu Package (Law 196/1997), which introduced apprenticeship, part-time employment and temporary contracts, at the turn of the new century, two labour market reforms increased job flexibility by introducing new atypical and temporary contracts and by relaxing the restrictions on their use. Based on an EU directive, the Italian Law 368/2001 relieved employers of being obliged to define the specific reasons for using fixed-term contracts and eliminated mandatory limits to their

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<sup>1</sup> The highest percentages have been recorded in Spain, staying above 30% since 1990 (Dolado *et al.*, 2002).

renewal. This reform generally revised employment protection legislation at the margin, mostly providing more flexible types of contracts for new hirings (atypical contracts), without modifying rules for workers who already had permanent (open-end) contracts. The new institutional changes in the fixed-term contracts became effective from 2005 onwards, when a large part of manufacture sectors renewed the collective agreement. The labour market reform greatly contributed to the spread of temporary employment in Italy, registering the steepest increase of temporary contracts among young people with respect to other European countries. In Italy, youth temporary employment for workers between 15 and 24 age years raised from 26.5% in 2000 to 36.9 in 2005, joining 46.8% in 2010 (Cappellari *et al.*, 2012). The empirical evidence suggests that precarious employment is an important determinant of adverse health outcomes since temporary workers are more likely to suffer from income instability and lower wages, stressful working conditions, hazards at the workplace (Becker and Engel, 2018). The decentralisation of the bargaining process over wages and working hours and the lack of regulation and protection that support the standard employment relationship reduced the rights and power of precarious workers, all factors resulting in a difficult psychological environment in the workplace (Robone *et al.*, 2011). In particular, job insecurity is associated with lower self-perceived health, and even lower physical health, as well as higher probability to have depressive symptoms (Rugules *et al.*, 2008; Waenerlund *et al.* 2011).

Our paper aims to address the effects of the increasing role of fixed-term employment on workers' health status in Italy. We use self-rated health (SRH) as a health outcome indicator, although its appropriateness has been often put to question, because the evaluation could be downward biased for pessimistic individuals or could change across cultures (Prinja *et al.*, 2012). These potential limitations impose to be careful in case of cross-population comparisons. However, other studies have established that self-rated health is closely linked to objective health conditions (Egidi and Spizzichino, 2006), physical and emotional well-being, and it is a valid predictor of mortality (Idler and Benyamini, 1997). Overall, it allows for a global, complete and reliable evaluation of the general individual health status and well-being: respondents, when assessing their condition, are able to account simultaneously for the different dimensions of health.

Data were drawn from the IT-SILC dataset, which includes the question on SRH, over the period 2004-2009. Based on simple correlations, some studies have investigated the association between employment status (unemployment, atypical contracts, part-time contracts) and health effects in Italy (Minelli *et al.*, 2014; Pirani and Salvini, 2015) or Europe (Ronchetti and Terriau, 2019). Our approach is different from previous studies since our aim is to identify changes in SRH from an exogenous variation determined by the application after 2005 of the new rules concerning the fixed-term contracts in Italy and estimate the causal effect of their



extension of applicability in the labour market. We show that the new labour market regime explains the increase of a negative perceived health of about 17-19%, irrespective of the control group or the functional form used. Our results are robust when we extend the analysis performing an ordered *logit* model.

## 2. Econometric model

Consider a dataset composed by a series of independent cross-sections, such that observations on  $N$  individuals are available in each period. We denote each subject  $i$  ( $i = 1, \dots, n$ ) that we follow for one year and observe the pooled data for  $t$  ( $t = 1, \dots, T$ ) time points.  $Y$  is the outcome of interest. We indicate as  $S$  our dichotomous treatment variable, recording 1 when the individual is involved in the labour market regime with a fixed-term contract and zero otherwise, and  $X$  is a column vector of covariates. The vector  $X$  includes the confounders, namely they may simultaneously affect both  $S$  and  $Y$ . We specify a model for the relationship between the potential outcome  $Y^{(s)}$  and the treatment indicators  $S_+$ . As a benchmark, a linear probability model is shown in the equation below:

$$E(Y^{(s)}) = \beta_0 + \beta_1 S_+ + X' \beta_2 \quad (1)$$

where  $S_+$  is a scalar summarising the treatment post reform (i.e., workers with a new legislation of fixed-term contracts). While  $\beta_0$  estimates the potential outcome mean (i.e., the expected self-rated health without the reform of fixed-term contracts), in order to estimate the parameters of interest  $\beta_1$ , and interpret the estimate as a change due causally to the reform of employment on perceived health, we include the identification assumption that the new fixed-term contracts was conditional upon renewal of collective agreement. Following D'Agostino *et al.* (2018), we consider that the sectors of Textiles, Wood Products, Chemicals, Construction, Transportation, Retail Trade, Food Products and Telecommunication renewed collective agreements, mostly in 2005 and 2006. Other important sectors of the economy such as Metal Manufacturing and Banking renewed the collective agreements in that period but decided to postpone the implementation of the 'new' fixed-term contract to a successive agreement<sup>2</sup>.

Thus, we identify the effects on perceived health based on the timing of their introduction which has not involved homogeneously all the employees. Our empirical strategy compares what happened in terms of self-perceived health in a

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<sup>2</sup> Later, Law 247/2007 introduced changes in maximum duration (i.e., three years) for fixed-term contracts stipulated with each employer. However, the new reform of fixed-term contracts was only applicable from September 1, 2009.

treatment group of workers with fixed-term contracts with respect to a potential control group. A fundamental challenge to this approach is to determine counter-factual outcomes. When perceived health in the group of workers with fixed-term contracts is observed, after the opportunity for firms to increase the use of temporary job, the impact of the law should be assessed in relation to the potential outcomes in the absence of labour flexibility inflows.

The counter-factual outcome is approximated by observed perceived health in: i) workers of sectors that did not apply early (2005 or 2006) the new rules on the fixed-term contracts; workers with permanent contracts, who are not affected by the Italian labour market reform. In the first case, the control group accounts for the application differences among sectors of the fixed-term contracts, which should not differ with respect to individual characteristics of workers ( $CG_1$ ). In the second case, the control group ( $CG_2$ ), also includes a large sample of workers with permanent contract, which irrespective of the sectoral application of the fixed-term contracts, represents a benchmark for self-rated health. In particular, in this case, to reduce the detrimental effects of confounders in estimating the causal effect of the introduction of the new fixed-term contracts on perceived health, we use an inverse probability weight (IPW) method estimated by a standard logistic regression.

### 3. Data

The dataset IT-SILC used in this paper is drawn from the cross-sectional survey of the European Statistics on Income and Living Conditions (EU-SILC) in the period 2004-2009. This survey is designed to be representative of each European country which analyses the living conditions of private households and includes variables for our interest of labour conditions, socio-demographic characteristics and perceived health. The choice of using the cross-sectional survey, instead of the longitudinal counterpart, depends from a greater disaggregation of several variables at the sectoral level, which is required for a correct identification of the causal estimation of the increasing fixed-term employment on health. Although this sectoral disaggregation is publicly unavailable, we obtained from Italian Institute of Statistics (IIS) an *ad hoc* data processing by ADELE service<sup>3</sup>. In particular, the dataset was extended by including the *three digit* European statistical classification of economic activities (NACE), which allows us to identify the sub-sectors that applied the new job legislation.

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<sup>3</sup> The analyses have been carried out by the authors at the ISTAT's Laboratorio per l'Analisi dei Dati Elementari (ADELE).

Our baseline analysis is carried out on the birth cohorts of employees aged 15-64. As a partial limitation to the use of the dataset, workers employed by the public sector were excluded from this analysis. In addition, we excluded self-employed workers because many laws were passed during the analysed period specifically for them, complicating identification of the labour market reforms in which we were interested. We removed from the dataset workers on leasing contracts, because detailed information on them was not available and seasonal workers due to missing data. The number of observations we obtain for the baseline estimation is about 5,000 when the *CG1* sample is accounted for and about 47,000 when we use the sample *CG2*.

SRH is used as an outcome of the labour market reform impact which allowed of using fixed-term job contracts more easily. The question "how is your health in general" administered to individuals in the dataset distinguishes five modalities (very good, good, fair, bad, very bad). In the empirical analysis, we maintain the ordered framework along with a dichotomous variable which code individual answers with 0 for a "positive" health perception (good, very good), and 1 for "poorer" health perception (fair, bad, very bad).

**Figure 1-** Cohort and age patterns of poor health.

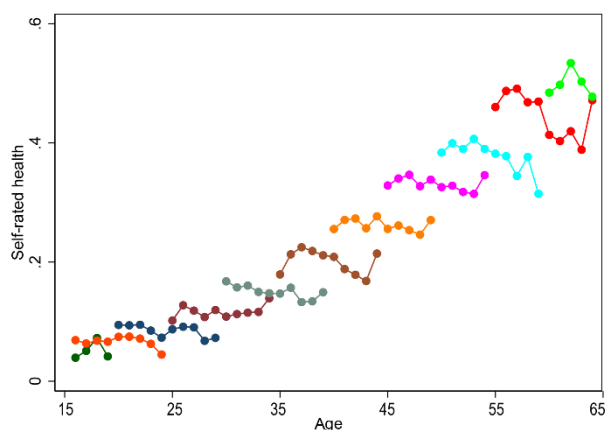


Figure 1 shows an upward trend in the poor health pattern by age and cohorts, meaning that health problems increase by age. Table 1 compares the health status between workers with fixed-term contracts in the new labour market regime (Treatment Group, *TG*) and control groups (*CG1* and *CG2*). Workers with a new fixed-term contract report worse health (2-3 percentage points) than their counterparts.

From the same source IT-SILC, we collected several control variables. The first block of control variables include the mostly common used individual characteristics

such as gender, marital status, age and cohort classes, household size and the highest degree of education, where the latter variable is categorised as no education, primary, pre-secondary, secondary and tertiary education. We also distinguish between Italian and immigrant workers, for whom we consider the region of origin (EU and extra-EU countries). The second block of controls consider the residence home areas of the worker according to the degree of urbanisation (if he or her lives in small, medium or large cities) and their perception of crime or violence in his residential home area. The last block characterise the firm by controlling for the size of the firm, the number of worked hours of the individual and by the fact that the worker attended at an official training course in the past. Descriptive statistics are listed in the Lanari *et al.* (2022).

**Table 1-** Descriptive statistics of self-rated health for workers.

Outcome	Modalities	CG1	CG2	TG
Self-rated health	Good/very Good	0.808	0.792	0.778
	Poor	0.192	0.208	0.222
	Very good	0.194	0.179	0.173
	Good	0.614	0.613	0.605
	Discrete	0.170	0.195	0.197
	Bad/Very Bad	0.023	0.013	0.025

*Notes:* The sample size is composed by 5,328 observations when we include workers with a fixed-term contract who were not affected by the reform (CG1) and by 47,835 observations when we also consider workers with a permanent contract (CG2). TG. Treatment Group.

#### 4. Results

In this section, we present the estimates of the effect of the introduction of the new fixed term contracts on health of workers. We offer estimations using the SRH indicator in the dichotomous scale to compare those who had a positive perception of health to those who reported poor health. Then, we display results using the SRH indicator in the ordered scale.

Before presenting the main results of the analysis, Figure 2 shows the balanced graph of the propensity scores used (inversely) as weights for SRH. We do not present the balanced graph of the ordered perceived health variable for each health state, since they are really close to the highlighted graphs. The patterns suggest that the treated and control samples are well balanced and that the mass of propensity scores at 1 and 0 is small. This confirms that the used control variables are useful to remove the selection bias in our sample.

**Figure 2 -** Balanced graphs of the self-rated health.

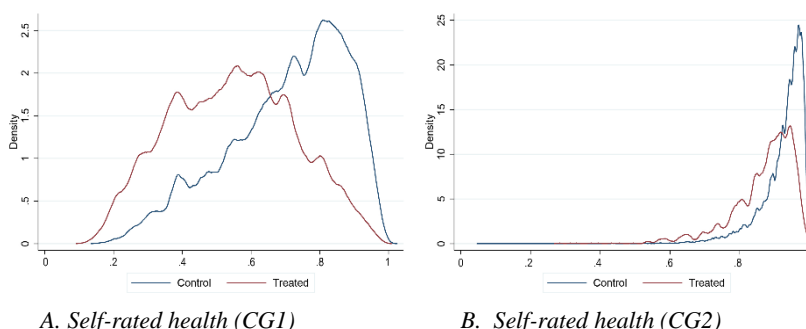


Table 2 reports the main estimation results. The first two columns compare estimates from the weighted linear probability model (LPM) by the inverse of the propensity scores of the covariates using CG1 as control group. The potential outcome parameter  $\beta_0$  measures the percentage of workers who perceived a poor health status and were not affected by the new labour market regime ("Potential outcome means"). On the other hand, the introduction of the new fixed-term contracts increases of 3.2 percentage points the probability to move to a poor health status ( $\beta_1$ , "average treatment effect"), corresponding to a variation of about 16.3%  $(0.032/0.196)^4$ . The magnitude is larger using the CG2 control group.

**Table 2 -** Estimates of the reform of fixed term contract on (poor) self-rated health.

Parameters	Linear probability model (LPM)				Logit model			
	CG1		CG2		CG1		CG2	
$\beta_1$	0.032	***	0.043	***	0.032	***	0.037	***
	(0.009)		(0.011)		(0.012)		(0.012)	
$\beta_0$	0.196	***	0.216	***	0.195	***	0.216	***
	(0.006)		(0.001)		(0.006)		(0.001)	
Observations	5,328		47,835		5,302		47,661	

Notes: Robust standard errors are reported in brackets; \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . CG1 includes workers who were not affected by the reform; CG2 also considers workers with a permanent contract.

The inclusion of open-ended contracts in this control group highlights a significant impact on workers involved in the new fixed-term contracts, who experienced a worsening in health, estimated around 20% (i.e., 0.043/0.216). These results are close to the *logit* propensity score estimates in columns 3 and 4, which list the estimated parameters of equation (1) in terms of marginal effects, irrespective of the

<sup>4</sup> The effect of the fixed-term contract reform is estimated in percentage as:  $(1 \cdot 100) / 0$ .

control group used. Table 3 lists the parameter estimates of the ordered *logit* model. Since we had few observations of workers in "very bad" health status, we have included them in that of "bad" health. Using *CG1* control group, the estimated  $\beta_1$ 's parameters suggest that the effect to extend the fixed-term contracts by the Italian Law 368/2001 reform is not uniform across these modalities. The application of these new rules increased "fair" health perception of workers involved in the fixed term contracts by 2.9 percentage points, whereas decreased workers with "good" health perception by 2.7 percentage points. Estimates using *CG2* show similar results. Thus, the ordered estimation suggests that the effects in health perception of workers involved in the new rules of fixed-term contracts depend largely on changes in the worker responses to be in good of fair health status.

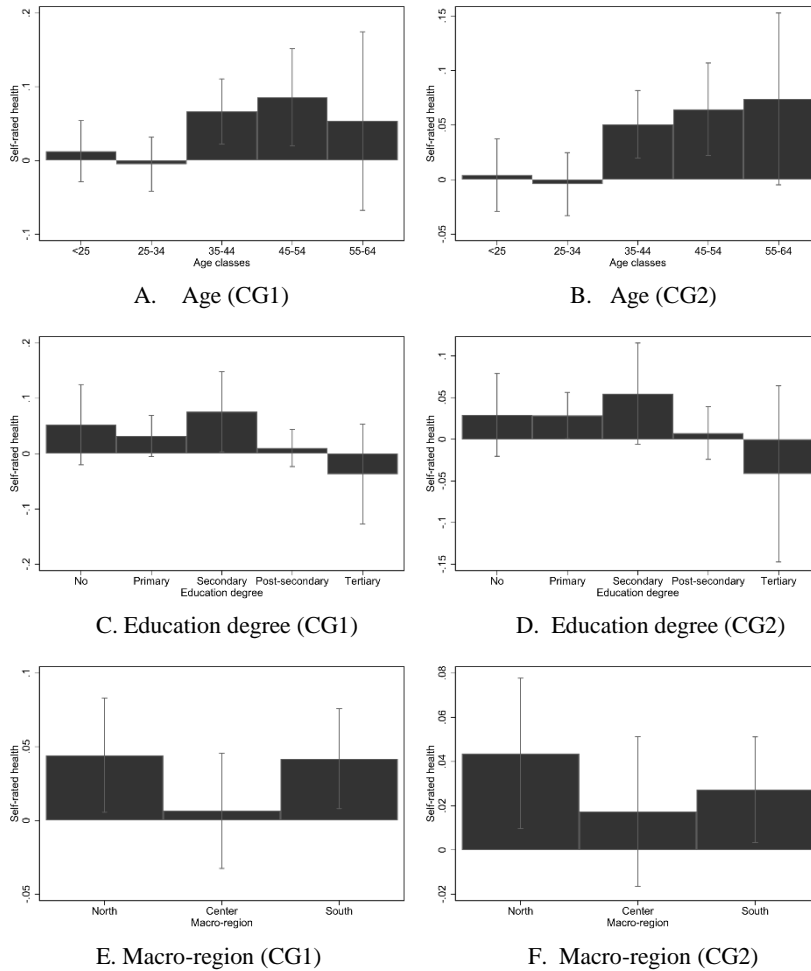
**Table 3 - Estimation results: the reform of fixed term contract on (poor) self-rated health.**

Control Group	Self-rated health	Very good	Good	Fair	Bad
CG1	$\beta_1$	-0.004 (0.012)	-0.027 * (0.016)	0.029 ** (0.011)	0.003 (0.005)
	$\beta_0$	0.184 *** (0.006)	0.618 *** (0.008)	0.172 *** (0.006)	0.024 *** (0.000)
	Observations	5,328	5,328	5,328	5,328
CG2	$\beta_1$	-0.007 (0.011)	-0.034 *** (0.015)	0.037 *** (0.011)	0.004 (0.004)
	$\beta_0$	0.169 *** (0.001)	0.614 *** (0.002)	0.193 *** (0.001)	0.022 *** (0.000)
	Observations	47,835	47,835	47,835	47,835

Notes: Robust standard errors are reported in brackets; \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . *CG1* includes workers who were not affected by the reform; *CG2* also considers workers with a permanent contract.

To complete the analysis, Figures 3 shows the marginal effects on the binary variable SRH, when we consider a heterogeneous effect linked to age, education and region of residence. The choice of the heterogeneous groups is quite in line with the existing literature of health behaviours and is still consistent with the heterogeneous effects of the Biagi reform found by D'Agostino *et al.* (2018). We find that the introduction of the new fixed term contract had a significant impact on workers in the age class 35-55, with primary or secondary education degrees (significant level, 10%) and either on workers living in south or north regions.

**Figure 3 - Marginal effects, Self-rated health.**



**5. Conclusions**

The present study exploited data of an extended classification of economic activities by ISTAT to estimate the effect of the increasing flexibility of fixed-term contracts on self-rated health of workers in the first decade of this century. Comparison of the SRH profiles of various working contract types pointed out where the differences lie: workers with a new fixed-term contract performed worse on the

SRH compared with the workers with the same type of working contract applied before the new Italian reform on fixed-term contract. Our study also examined the effect of the Italian labour market reform on health compared to almost all labour market contracts, as a control group. Clearly, the evaluation of the causal effect of the changes in relieving employers of being obliged to define the specific reasons for using fixed-term contracts and in eliminating mandatory limits to their renewal is complex because linked to many confounding factors, such as gender, educational level, and social status, while the reasons for accepting this new contracts range from economic needs, experience for next contracts and reduction of periods out of work. The availability of data on several risk factors at the baseline allowed us to perform multivariate adjustment for potential confounding factors, including chronic conditions. Our findings support the contention that fixed-term contracts generally deteriorated perceived health.

Which plausible explanation could be underlying the relationship between fixed-term contracts and perceived health? The literature discussed in Introduction suggests as a potential mechanism on explaining negative impact, the increase of job instability and wage volatility (i.e., economic uncertainty). Having not unlimited employment generates fears and anxiety that might have negative consequences for individuals' quality of life and subjective well-being, although some advantages of temporary contracts has been stressed in literature, as the increase job chances for active workers who would otherwise be cut out of the labour market or job satisfaction for highly skilled workers (Guest *et al.*, 2006). However, the magnitude of these recognized channels depends on how the new labour market regimes are linked with the country institutional setting. For example, in the Nordic countries the welfare system assists largely workers losing job or women in pregnancy time, favouring a speed return to employment also through an efficient system of employment offices. In this case, job instability from fixed-term contracts is not expected to increase (or makes less significant) economic uncertainty. On the other hand, countries with a weak institutional setting associated to the extensive use of fixed-term contracts for employed workers (or women searching job after maternity), generated less and penalized opportunities in job, with a reduction of contract duration and a likely greater persistence in temporary contracts. D'Agostino *et al.* (2018) confirmed that the new regimes of contracts in Italy generated the persistence of temporary employment, which allows us to maintain confidence with the underlying explanation of fixed term contract-health nexus in this study.



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### SUMMARY

This paper estimates the effect of the increasing role of fixed-term employment on workers' health status in Italy. We use data from IT-SILC dataset, which includes workers' responses in self-rated health over the period 2004-2009. We identify changes in self-rated health from the application after 2005 of the new rules concerning the fixed-term contracts and estimate the causal effect of their extension of applicability in the labour market. We show that the new fixed term regime explains the increase in poor health of workers, irrespective of the control group or the econometric model used.

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## **TOTAL FACTOR PRODUCTIVITY IN ITALIAN MANUFACTURING: DOES LOCATION MATTER?**

Sheila A. Chapman, Vito Pipitone

### **1. Introduction**

In 2013 a well-known article dubbed Italy “the sleeping beauty of Europe - a country rich in talent and history, but suffering from a long-lasting stagnation”. At the root of stagnation lay the “great unlearning” – the process whereby the productivity in manufacturing, after having largely outpaced that of other countries (Germany in the first place) throughout the ‘70s and ‘80s, from the mid-’90 on turned sluggish and then fell, never to recover ever since (Hassan Ottaviano, 2013).

While there is general consensus around the main causes of Italy’s productivity slowdown - failure to adopt the ITC revolution, bad market regulation, low R&D expenditure, low investment - less attention has been devoted to the spatial aspects of the problem. In fact, although the disparity between an efficient North and a lagging South, with the Centre lying somewhere in-between, is largely acknowledged, not enough studies address the problem from a spatial point of view.

This paper aims at deepening these studies. Starting from firm-level data, it estimates total factor productivity (henceforth TFP) for over 190,000 Italian manufacturing firms during 2008-20. The estimated TFP is then aggregated with reference to a rather fine territorial breakdown, that of NUTS-3 provinces, and to sectors’ technology content, according to the Ateco classification. Estimates are used to analyse spatial interdependence, spillovers and networks and to investigate the presence of clusters among administrative units and/or manufacturing sectors. The analysis is directed at assessing whether provinces’ TFP performance differs significantly across units, if it is possible to trace common patterns moving towards TFP convergence, and what is the role, if any, of geographic location vis à vis sectoral specialization. The results seemingly point to a relatively strong influence of location in determining the level and performance of provincial TFP.

The paper is organized as follows: Section 2 presents a brief survey of the literature on Italian regional disparities; Section 3 describes the data and methodology. The results of the analysis are reported in Sections 4, where spatial correlation and TFP convergence is tested, and 5, that addresses the role of specialization. Some concluding remarks follow (Section 6).

## 2. Literature review

Economic and social dualism is a long-standing feature in Italy's history. Since the country's unification (1861) it has been the object of vast debate. The literature has often focused on the relevance of economic variables, of initial conditions and of local features. Economic growth and spatial convergence are viewed as the result of a process of capital accumulation, often strengthened by a parallel accumulation of human and social capital.

Within this framework, economic policy and public investment are viewed as key elements to create the best conditions for growth. The latest significant episode of North-South convergence (1951-73) was led by a strong cycle of public investment in infrastructure and heavy industry which brought the South to register a higher average rate of capital accumulation than the North. The situation changed radically in the '70s, when the average net rate of capital accumulation in the South progressively declined (Iuzzolino et al., 2011).

A recent strand of the literature focuses on the role of social and institutional factors (see Asso, 2021, for a review). The basic idea is that local features – including institutions – determine the incentives for investments and are essential for creating innovative entrepreneurial systems. Many socio-economic indicators measure the impact of social disparities on capital accumulation and on the quality of institutions (Felice, 2011; Lasagni et al., 2015; Pipitone Seta, 2017). Moreover, in the South transaction costs are higher also due to illegality: "in the historically slow growing regions of Southern Europe, poor quality government, historically pervasive corruption, collusion and lack of trust are more of a barrier for development than a shortage of assets" (Charron et al., 2015).

While a big array of new data-sets is available, there is growing consensus on the fact that no unique variable can account for the lack of convergence between the North and the South of Italy. On the contrary, the persistence of disparities appears to be linked to a number of interconnected factors (Daniele et al., 2018; Viesti, 2021). Southern regions appear to be blocked in a typical "intermediate development trap" featuring premature de-industrialization, demographic shocks (Pipitone et al., 2022), an inefficient public sector, low productivity and hence low competitiveness at the firm level (Giordano et al., 2015).

One of the most recent strands of the literature discards the notion of a uniformly under-developed South trapped in unchanged economic performance<sup>1</sup>. This idea is applied also to study local TFP (Aiello Scoppa, 2000, Byrne et al., 2009); in this

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<sup>1</sup> "No mistake could be bigger than to think that the long-standing issue of the Mezzogiorno simply means that nothing has ever changed in Italian regional disparities" (translated from Iuzzolino et al., 2011). See also Asso et al., 2021.

respect, research aims at identifying the micro-foundations of the social processes and of the changes that lead to innovation and growth for firms in under-developed, constrained areas (Asso Trigilia, 2010, 2013; Asso Pipitone, 2013).

From the point of view of TFP, one of the key issues is that of analysing, alongside to firms' individual features (size, sector of activity, R&D), also the role of variables that are external to the firm but are linked to the territorial dimension in which it operates (the availability of infrastructure, the quality of public institutions and of services) in an attempt to evaluate each one separately (Aiello et al. 2014).

### 3. Data and methodology

Data cover the period 2008-20 and are taken from Bureau van Dijk - AIDA database that reports information from Italian firms' unconsolidated balance sheets. For each firm we retrieve value added, the wage bill (as a proxy for the number of workers), materials (as a proxy for intermediate inputs) and the book value of total tangible fixed assets<sup>2</sup>. The data is then deflated by the annual average of ISTAT's monthly 4-digit Industrial Production Price Indexes for sectors from 11 to 33 (at the 2-digit level) in the ATECO classification. Wages are deflated by the annual average of ISTAT's monthly sectoral deflators defined on the basis of collective wage agreements. Outliers are removed by eliminating the 1st and the 99th percentile from each deflated variable. This leaves a sample of 194.821 firm-year observations.

TFP is estimated by means of the semi-parametric, two-step estimation procedure introduced by Olley Pakes, 1996, that explicitly accounts for firms' entry (exit) decisions. This method is preferred over traditional estimation methods (pooled OLS, fixed effect estimation) that notoriously give rise to biased coefficients due to endogeneity and selection problems<sup>3</sup>.

Convergence is estimated with reference to the non-linear time-varying factor model defined by Phillips Sul, 2007, 2009. By tracking the convergence path of each unit, the model allows to identify convergence clubs, or clusters, endogenously, each moving to a specific steady-state position. Moreover, this method does not relate uniquely to growth theories and can thus be successfully used to study the convergence of variables other than output<sup>4</sup>.

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<sup>2</sup> We also retrieve the depreciation of tangible fixed assets (as a proxy for investment), the date of firm creation (to derive age), the number of workers (to derive specialization) and other codes to identify location, sectors and so on.

<sup>3</sup> A full discussion of the features and methodological issues that arise when estimating TFP is beyond the scope of the present paper. References can be found, among others, in Van Briesebroeck, 2008.

<sup>4</sup> For a description and discussions of the Phillips Sul model, see Apergis et al., 2018.

#### 4. Clubs and spatial correlation

As a first step, Fig. 1 shows the evolution of the average TFP (in logs) over 2008-20 for Italy's four NUTS-1 macro-regions: North-West, North-East, Centre and South (including the two islands of Sicily and Sardinia)<sup>5</sup>. A number of observations are immediately evident: first, as expected, the two northern areas show higher, and faster growing, average TFP with respect to the Centre and the South; second, TFP performance in the North-West and the North-East are strongly correlated<sup>6</sup>, to the extent that henceforth they will be grouped together in North. Third, while the Centre appears to follow the performance of the North fairly closely, the South shows a somewhat a differing behaviour, especially in the crises of 2008-9 and 2019-20. Finally, the gap between the highest and the lowest TFP is smaller in 2008 than it is in 2018<sup>7</sup>. This can be taken as a *prima facie* indication of growing divergence in TFP levels across Italian macro-regions, at least after the Great Recession and until 2019.

The hypothesis is tested more rigorously at the provincial level by applying, as already mentioned, the econometric method of Phillips Sul (2007, 2009). We first calculate the log-t test to analyse overall convergence in mean TFP across provinces, the null hypothesis being that provinces converge to a common, long-run TFP (absolute convergence). Results reported in Tab. 1 reject the null, suggesting absolute divergence in TFP across provinces.

We then test for the presence of local convergence clubs. Tab. 2 shows that the null hypothesis of local convergence is not rejected at the 5%. It is thus possible to identify four convergence clubs: with the exception of the diverging province of Fermo, Italy's remaining 106 provinces all converge towards multiple local TFP levels, conditional on each's initial economic structure and features. The two largest clubs (club 1 and club 3) show transitional, or temporary divergence (negative, but significant coefficients). The two smaller ones (club 2 and 4) present conditional convergence, i.e. convergence in TFP growth (positive and significant coefficients).

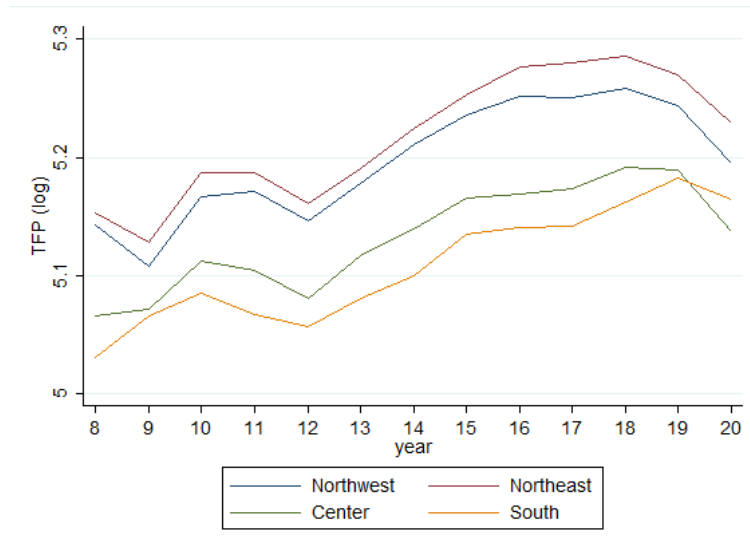
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<sup>5</sup> North-West includes the (NUTS-2) regions of Piemonte, Valle d'Aosta, Liguria and Lombardia, for a total of 25 NUTS-3 provinces; North-East groups the two autonomous provinces of Trieste and Bolzano, and the regions of Veneto, Friuli-Venezia-Giulia and Emilia-Romagna (22 provinces); Centre counts Toscana, Umbria, Marche and Lazio (22 provinces); finally, South and Isles count Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna (36 provinces). Over time provinces have been considerably re-organized; a number of new ones has been introduced and, in some cases, later abolished. This paper refers to the classification in force in 2020, for a total of 107 provinces.

<sup>6</sup> Pearson's correlation coefficient is positive and high (0,994).

<sup>7</sup> And also, notably, in crisis period 2009-13. According to Ciani et al., 2018, this resulted from a two-fold effect: a selection bias eliminating the most inefficient firms and a competitive stimulus, according to which surviving firms are obliged to improve TFP.

**Figure 1** – Mean TFP (in logs), by macro regions (2008-20).



**Table 1** – Log-t convergence test.

	Coeff	SE	T-stat
log(t)	-0.9499	0.0096	-99.3462

**Table 2** – Converge clubs.

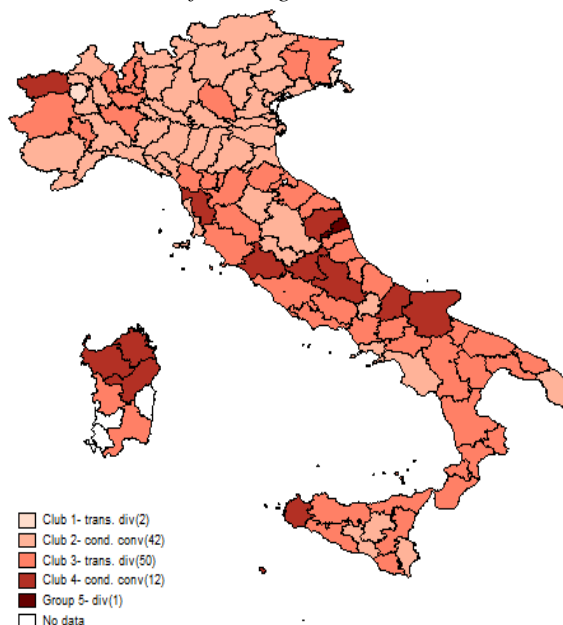
	Club 1	Club 2	Club 3	Club 4
Coeff	-2.939	0.049	-0.032	0.410
T-stat	-1.155	0.695	-0.492	5.710

All clubs are shown in Fig. 2, that also reports the number of provinces in each club.

Fig. 2 points to an evident North-South divide in TFP levels and dynamics. This is further investigated by means of Moran’s I statistic that tests for the presence of global spatial autocorrelation. As expected, the statistic is positive and significant, ruling out the hypothesis of a random distribution of TFP and pointing rather to positive correlation. Over 2008-18 spatial effects generally strengthen – the statistic goes from 0,173 in 2008 to 0,220 in 2018 (the highest value in 2008-20) - but falls in 2019-20. In general, it tends to grow in good years and weaken in bad ones (Moran’s I = 0,050 in 2020). The scatterplot in Fig.3 (derived from 2018 data) shows a positive slope and confirms a global clustering pattern. This points to high TFP

provinces tending to border high TFP neighbours (high-high), and low TFP provinces generally having low TFP neighbours (low-low).

**Figure 2** – *The spatial distribution of convergence clubs.*



Mapping Moran's I quadrants shows – as expected - a neat divide between northern provinces, mostly high-high, and southern ones, mostly low-low (see Fig. 4). Even if not all the provinces located in the high-high or low-low quadrants are statistically significant, local spatial autocorrelation points to a far lower presence of territorial links across southern provinces throughout the period. Moreover, a breakdown by NUTS-1 macro-regions reports positive and significant autocorrelation among provinces in the North and Centre, in sharp contrast with the negative, non significant one for the South, suggesting a random distribution<sup>8</sup>. This points to far weaker spatial ties (spillovers, networks, positive externalities, linkages etc.) for southern provinces. However, what Fig. 4 shows is that in the North and in the Centre provinces, both high-high and low-low, tend to cluster together. In the South, instead, high performing areas appear to be randomly distributed.

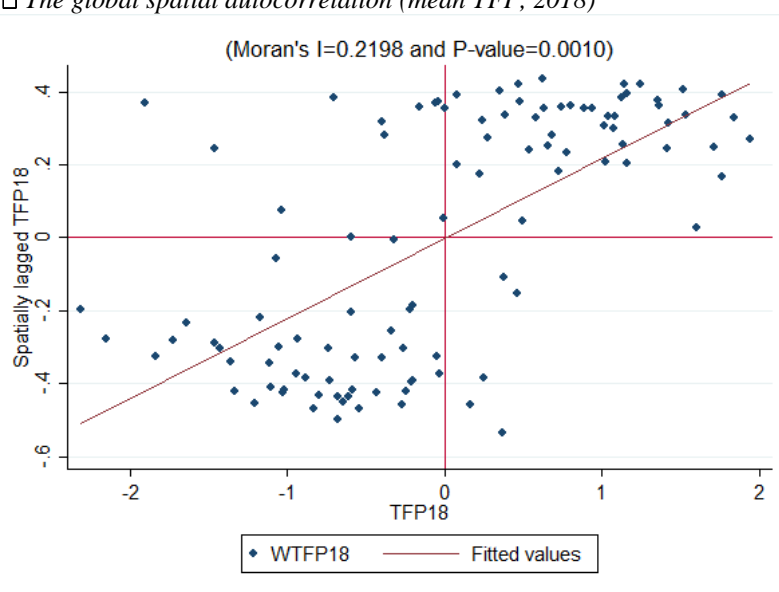
<sup>8</sup> This holds true even when the two major islands – which could reasonably have weaker spatial links with provinces in the mainland - are not included in the sample.



## 5. The role of specialization

The results reported in paragraph 3 point to a seemingly strong pattern of spatial distribution of TFP between northern and southern provinces. TFP, however, could be linked to factors differing from geographic location. Among these, sectoral specialization could play a prominent role. We thus investigate the impact – if any – of specialization in explaining the territorial pattern of TFP across Italy's provinces.

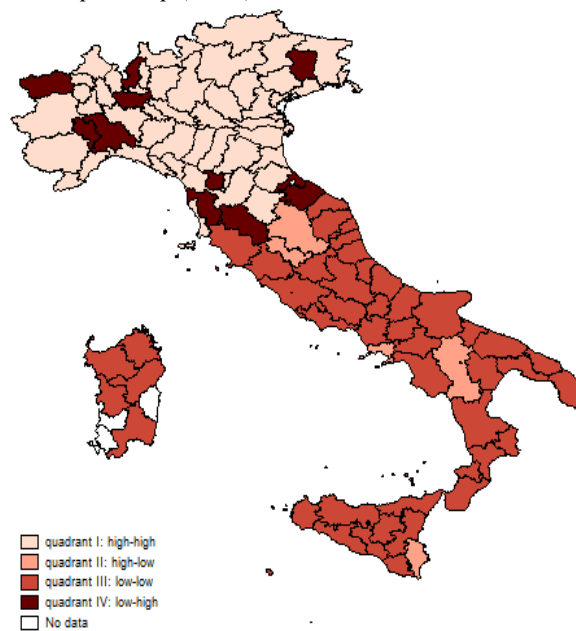
**Figure 3** □ *The global spatial autocorrelation (mean TFP, 2018)*



To this end, we refer to the classification provided by Eurostat that groups Ateco/Nace manufacturing sectors on the basis of their technology content<sup>9</sup>. This allows to distinguish among high-tech sectors (HIT); medium-high tech (MHT); medium-low tech (MLT) and low-tech (LOT) ones. We then calculate a modified Krugman specialization index that compares the ratio between the employees in the sector over the employees in all sectors in the province to the same ratio calculated for Italy<sup>10</sup>. We classify a province as specialized in a macro-sector when the index is >1. Note that provinces may specialize in more than one macro-sector.

<sup>9</sup> For details, see <https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:High-tech>

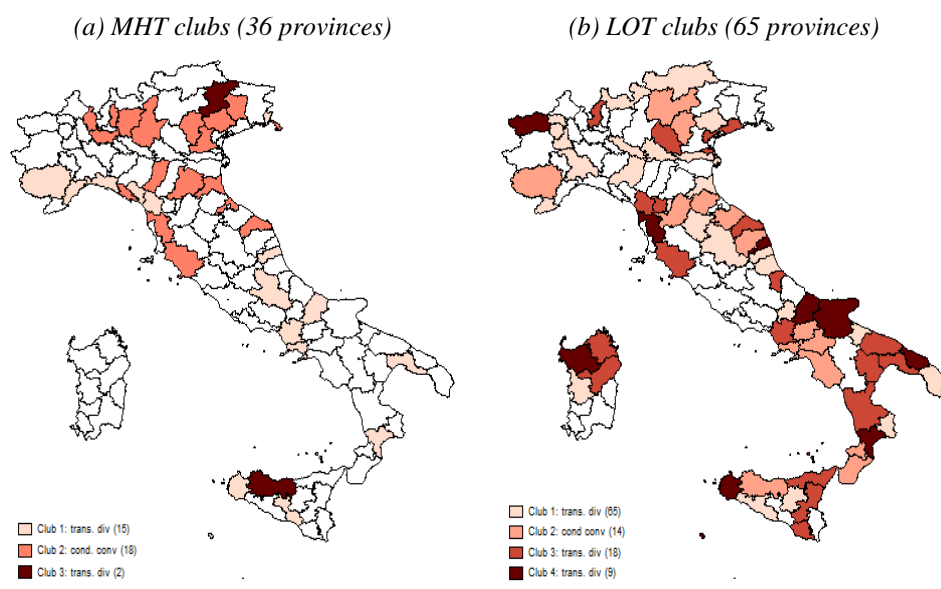
<sup>10</sup> By contrast, the well-known Krugman index is calculated as the sum of the absolute differences between the two ratios over all sectors in the location (region, province, city). For details, see Palan, 2010.

**Figure 4** – Moran scatterplot map (2018).

We run again the Phillips Sul model to check for the presence of clubs among the provinces that specialize in a given macro-sector. We refer to the results obtained for 2018<sup>11</sup>; in general, however, these hold for the entire period. All macro-sectors diverge, but all contain a number of converging, or temporarily diverging, clubs. After running the post-estimation merging procedure the number of clubs ranges between 3 (MHT and MLT) and 4 (HIT and LOT)<sup>12</sup>. As expected, specialization leads HIT and MHT clubs to mostly group provinces from the North. In addition, in these sectors clubs are: (i) very stable over time in terms of membership; and (ii) show higher convergence (or lower transitional divergence) speed than in other sectors. The clubs that group provinces specialized in MLT and LOT sectors, instead, include many territories of the Centre and the South. In general, (i) membership is less stable over time than in the other macro-sectors, i.e. there is high intra-club mobility; (ii) clubs show far lower convergence speed, implying weaker convergence. In addition, many clubs record transitional divergence (i.e. negative, but significant, convergence coefficients).

<sup>11</sup> We select 2018 as our reference year inasmuch as it is the time-period in which spatial correlation is at its highest, as shown in Fig. 1 and confirmed by Moran's *I*.

<sup>12</sup> For HIT no merge was possible. Throughout the period a diverging group with only two members (two southern provinces, Aquila and Catania) was present in the sector as well.

**Figure 5** – Convergence clubs in selected macro-sectors (2018).

The picture, however, is more articulate than that. In fact, MLT and LOT clusters include also provinces from the North, especially from the North-East; in turn, MHT and also HIT clubs feature some Centre-South members. Yet, HIT and MHT provinces in the South do not join northern convergence clubs. Rather, they form small groups that follow separate paths; moreover, they do not show any territorial link. This contrasts with Northern provinces, which tend to cluster in large groups across neighbouring regions, showing strong territorial links in all macro-sectors. This may be verified by comparing the two maps in Fig. 5 that shows club membership respectively for medium-high technology (MHT) and low technology (LOT) provinces in 2018<sup>13</sup>.

## 6. Conclusion

Our results point to what appears to be a significantly different behaviour of firms' TFP across Italy's provinces and is essentially linked to a territorial dimension. Thus, northern areas (and central-northern ones, to some extent) show strong geographical patterns which pointing to the presence of spillovers, linkages and networks, with positive outcomes in terms of TFP performance. Southern (and

<sup>13</sup> We show the spatial distribution of MHT provinces instead of that for HIT ones, given the relatively small number of provinces specialized in the latter macro-sector (only 27 in 2018).

central-southern) provinces instead form clubs that follow idiosyncratic paths, especially in high and medium-high technology sectors, implying that good practices do not spread to neighbouring areas. MLT and LOT clubs do show some evidence of territorial links also for southern members, but these occur mainly within NUTS-2 regions (this may be traced for provinces in Campania, Sicily and Sardinia) and do not extend across regions.

Moreover, when it comes to determining an area's performance in terms of TFP, geographic location appears to be more important than sectoral specialization. Put differently, it could be claimed that location does matter.

### Acknowledgments

A preliminary version of the paper was presented at the LVIII Annual Conference SIEDS held in Palermo (26-7 May 2022). The authors thank all the participants in the presentation for their useful comments and suggestions.

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### SUMMARY

This paper investigates the sluggish, or falling, productivity of Italian manufacturing firms which began in the mid-90s and carried on well into the Two Thousands, to recover slowly only in 2013-19. While there is general consensus on the main determinants of Italian firms' sluggish performance -- failure to adopt the ITC revolution, rigidities -- less attention has been devoted to the spatial aspects of the problem.

Starting from firm-level data, the paper estimates total factor productivity (henceforth TFP) for over 190,000 Italian manufacturing firms during 2008-20. TFP is estimated with reference to the method suggested by Olley Pakes (1996). The estimated TFP is then aggregated with reference to Italy's NUTS-3 provinces, and to the Ateco manufacturing breakdown. The presence of clubs is identified by means of the dynamic, nonlinear factor model developed by Philips Sul (2007, 2009) that allows to identify groupings endogenously. Finally, the relative strength of sectoral specialization against that of geographic location is tested with respect to the creation of clusters.

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## **COVID-19: THE EFFECTS OF THE ITALIAN RED ZONES ON MORTALITY**

Marco Biagetti, Valentina Ferri

### **Introduction**

Italy and Spain were the first two European countries hardly hit by the Wuhan strain of SARS COV-2. The 2020 Covid-19 first wave was particularly deadly in the Italian region of Lombardy. The region is the most populated in Italy accounting for roughly 17-18% of the total population of the country. Yet, during the first Covid-19 wave (March through early May 2020) official figures show 16,632 deaths in Lombardy (47.7% of the Italian total) a ratio which is significantly higher with respect to what happened in the second and third wave combined (Chirico et al. 2021)<sup>1</sup>.

Within Lombardy, Fior and Mpampatsikos (2021) show that the difference of daily deaths that occurred between 2020 (i.e. the period of the first two Covid-19 waves) and the average of the previous five years (i.e., the so-called ‘excess deaths’ by Covid-19), is positive for most of the 622 municipalities they analyze. Only a few municipalities in Como, Varese, and Mantua provinces have a negative balance. The peaks (with a number of deaths greater than 125) are found in the provincial capitals (characterized by a greater number of inhabitants) and between Val Brembana and Val Seriana districts. Then, in the East-West axis (along the A4 highway) that intercept the Franciacorta area, Brescia and the Garda Riviera plains, and the plain between Crema and Cremona. Others are in the East Milanese area and between the municipalities of Bergamo and Brescia's lowlands, where the municipalities of Caravaggio, Treviglio (lower Bergamo Province), and Orzinuovi (Brescia Province) stand out. This is a highly urbanized and very productive territory; from the Bergamo valleys to Brescia's hills. The greatest increase in deaths was found in Bergamo, Lodi, and Cremona Provinces, and the Western part of the Brescia Province, while a sort of vertical axis of contagion running from the Lodi area's southern edges until the city of Bergamo and its entire province could be highlighted.

Most remarkably, some municipalities have seen a 26 times higher increase of deaths compared to the average daily deaths, such as Valbondione, Aprica and Breme. Also Torrazza Coste (Pavia Province), Senna Lodigiana (Lodi Province), Verolavecchia, Corte Franca and Torbole Casaglia (Brescia Province), San Giovanni

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<sup>1</sup> In the latter waves, deaths in Lombardy were 15,515 (18.9% of all deaths in Italy).

Bianco and Nembro, Alzano Lombardo, Selvino, Pradalunga (Bergamo Province) stand out.

Overall, those authors show an increase in death toll circumscribed at parts of the above mentioned provinces, particularly in some municipalities and in the first wave. Building on this findings, in what follows this article wants to shed light on the following: a) the increase in daily mortality between February and March 2020 in the municipalities first involved in the first Covid-19 pandemic; b) an increase similar in the Lodi, Bergamo and Cremona provinces; c) a reduction of cases and Covid-19 related excess deaths due to the institutions of the so called Red Zones where strict Chinese-like lockdowns were implemented.

The paper is organized as follows: chapter two reviews literature on Non-Pharmaceutical Interventions (NPI) carried out to tame and tackle Covid-19 outbreaks. Chapter three exhibits the data used and the methodology (difference-in-difference) chosen. Chapter four highlights the introduction of Red Zones. Chapter five shows econometric results, while the last chapter concludes.

## 2. Literature: NPI interventions on covid-19 outbreaks

Mendez-Brito et al. (2021) have performed a systematic review of published and unpublished empirical studies, and found that early implementation of school or working place closings were associated with a higher effectiveness in reducing COVID-19 cases and deaths, while general stringency of the NPIs was not.

Similar results have been found by Brauner et al. (2020) through the use of a Bayesian hierarchical model. In particular closing schools and universities was highly effective, together with banning gatherings. Closing most other business was had instead limited benefit; that many countries may have been able to reduce  $R$  below 1 without issuing a stay-at-home order.

Sharma et al. (2021) evaluate the effects of 17 NPIs on second wave of Covid-19 in Europe again using a hierarchical Bayesian transmission model. Once again, business, school closures, gathering bans reduced transmission but less than they did in the first wave. This difference is likely due to organizational safety measures and individual protective behaviors—such as distancing—which made various areas of public life safer and thereby reduced the effect of closing them.

Liu et al. (2021) evaluated the effectiveness of 13 NPIs for 130 countries and territories using panel regression techniques and hierarchical cluster analyses from January to June 2020. The evidence found was strong for an association between school closures and internal movement restrictions with an  $R_t$  reduction. Other NPI like workplace closure had strong evidence of effectiveness on reducing transmission only when the level of intensity was ignored, while the gathering cancellations was effective only when the evaluation was carried out considering maximum capacity (e.g. restrictions on 1000+ people gathering were not effective,



restrictions on < 10 people gathering were). Evidence about the effectiveness of the remaining NPIs (stay-at-home requirements, public information campaigns, public transport closure, international travel controls, testing, contact tracing) was inconsistent and inconclusive. The authors found temporal clustering between many of the NPIs. Effect sizes varied depending on whether or not we included data after peak NPI intensity.

Yacong Bo et al. (2021) collected evidence on 4 NPIs (face masks, isolation or quarantine, social distancing, traffic restrictions) for 190 countries between January 23rd and April 13th 2020. Results showed that face masks reduced  $R_t$  by 15%, quarantine by 11%, social distancing by 43%, traffic restrictions by 9%. Distancing and the simultaneous implementation of two or more types of NPIs seemed to be associated with a greater decrease in the  $R_t$  of COVID-19.

On the other hand Seung-Hun Hong et al. (2021) using a linear regression over 108 countries found that school closures are effective in containing COVID-19 only when they are implemented along with complete contact tracing. Furthermore, the authors suggested that governments should consider implementing prudently designed full contact tracing and school closure policies, among others to contain COVID-19 effectively and minimize the risk of human rights abuses

Along the same lines, Haug et al. (2020) analyzed the issue using a comprehensive, hierarchically coded dataset of 6,068 NPIs implemented in March–April 2020 in 79 territories, through a multi-method approach consisting of (1) a case-control analysis (CC), (2) a step function approach to LASSO time-series regression (LASSO), (3) random forests (RF) and (4) transformers (TF). They found that a suitable combination of NPIs is necessary to curb the spread of the virus. Less disruptive and costly NPIs can be as effective as more intrusive, drastic, ones. Haug also shows that their effectiveness of NPIs depends of course on timing of adoption. Early adoption is always more beneficial: in other words, the earlier the better in terms of curbing spreads of rapidly propagating viruses.

### 3. Descriptive statistics, data and methodology

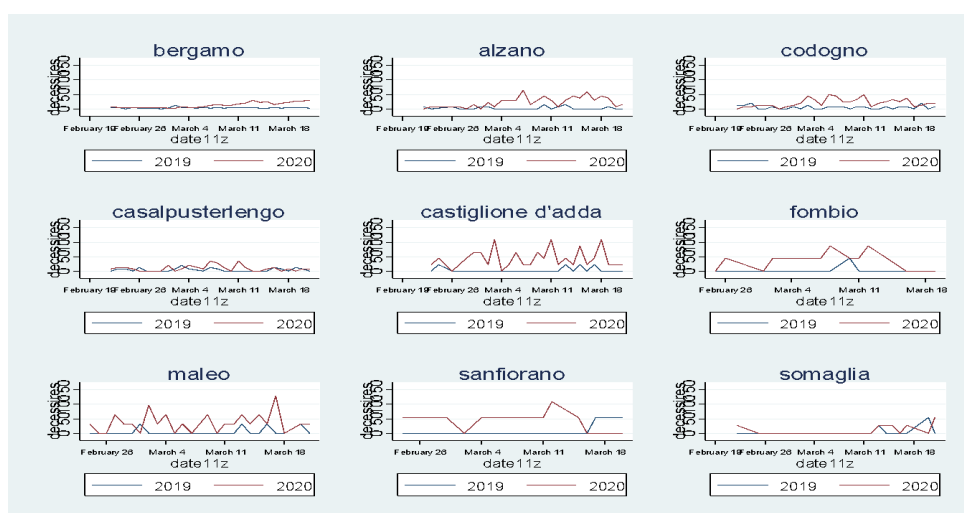
Before introducing the data and methodology used, a word of caution needs to be said. Covid-19 related deaths<sup>2</sup> are not available at a municipal level. Nonetheless, were they hypothetically available, their reliability would be questioned. The reason for this unreliability is that when the first European Covid-19 outbreaks appeared, the discrepancy between deaths due to Covid and deaths of people due to other reasons whose tests were found positive (the so called deaths with Covid) was absolutely thin. To circumvent this limitation, we have decided to use data on all-cause daily mortality under the hypothesis that municipalities included in the first

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<sup>2</sup> The deaths for which Covid-19 can be considered the main or one of the main causes.

Red Zone established between February 22<sup>nd</sup> and March 8<sup>th</sup> 2020 have seen a statistically significant reduction in deaths in the time lapse immediately subsequent to the reopening of the same Red Zone. Even if some may think that this reduction in mortality could have been even higher in the following months, due to the abolition of the same Zone, only the period up to March 23<sup>rd</sup> can be analyzed. This time limit is mandatory even because after the first delimited Red Zone, another wider Red Zone was established throughout the whole of Lombardy. This would undoubtedly bias our results. In Figure 1 the difference in the deaths count between 2019 and 2020 can be seen for nine municipalities among which Bergamo.

**Figure 1** – Differences between 2019-2020 in some municipalities.



Source: Authors' elaborations on ISTAT data.

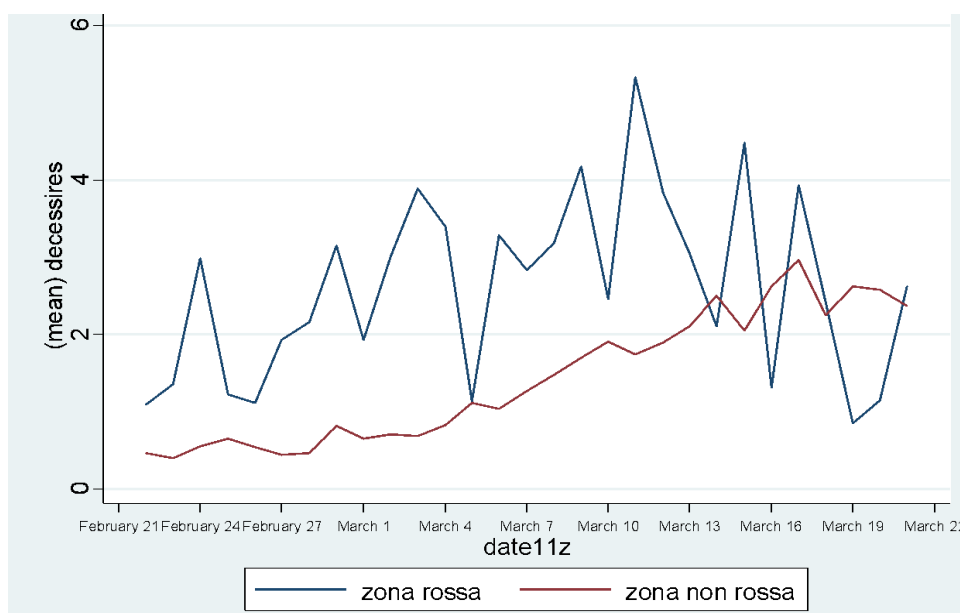
Our analysis concerns municipalities located in the the Lodi, Bergamo, Cremona provinces: in particular we use data on overall mortality from February 22<sup>nd</sup> until March 20<sup>th</sup> 2020, not those on Covid-19 related deaths for the reasons explained above, i.e. to dodge the well-known diatribe between deaths due to Covid-19 and deaths with Covid-19.

Furthermore, it has to be made crystal clear that that some of those towns were included in the Red Zone while others were not. Mortality in municipalities included in the Red Zone has been found lower with respect to that in municipalities in the same or bordering provinces which were not included in the Red Zone, i.e. where a decision to curb contagions and deaths was not quickly taken.

We start off from a common trend hypothesis between means in overall deaths (per 10,000 inhabitants) in the Red Zone municipalities and in the adjacent towns belonging to the Bergamo, Lodi, Cremona provinces for which daily availability is warranted.

Figure 2 shows a parallel trend with an inversion for the Red Zone starting from March 12<sup>th</sup> 2020. For this reason, in our chosen technique we have decided a cut off date of March 8<sup>th</sup> between the time before and after the intervention. Nevertheless, we try to use also March 12<sup>th</sup> as a threshold date. As can be seen from figure 2, the latter date seems the one from when the trend starts reversing. This is not surprising as Covid-19 related deaths are usually quite persistent in time and only slowly decay. In other words, lockdowns are likely to have quite immediate reducing effects on contagions but not on deaths.

**Figure 2** – Deaths in the delimited red zone and outside the red zone.



Source: Authors' elaborations on ISTAT data.

By exploiting the time lag in municipalities included in the Red Zone since February 21<sup>st</sup>, we are able to verify that after March 12<sup>th</sup><sup>3</sup> mortality in the so called “treated” municipalities (included in the circumscribed Red Zone) and “controls” (those which were not treated i.e. not included in the same Red Zone) is absolutely different.

To gauge this, we make use of diff-in-diff methodology used to estimate the treatment effect (the introduction of the delimited Red Zone) on the treated group. In our case the treated group is composed by the following ten municipalities (with population at the right): Codogno 15,422; Castiglione d'Adda 4,612;

<sup>3</sup> The end of the circumscribed Red Zone was decided on March 8<sup>th</sup> but some days are need to record fatalities.

Casalpusterlengo 15,118; Fombio 2,307; Maleo 3,037; Somaglia 3,827; Bertónico 1,071; Terranova dei Passerini 903; Castelgerundo 1,476; San Fiorano 1,848.

The Difference-in-difference method allows estimating causal effects based on external policy changes. This method captures the significant differences in outcomes across the treatment and control groups, which occur before and after an intervention. There are two reasons for including covariates in a difference in differences regression: to identify the treatment effect and to reduce the error variance (i.e. increase power of statistical tests). The number of families could affect the dependent variable but would not affect the policy effect on the dependent variable.

In the equation the dependent variable is deaths/residents, the treatment variable is red zone/no red zone, the covariate is the number of families. In other words the approach we have chosen takes the following form:

$$d_{it} = R_{it} + f_{it} + \varepsilon_{it} \quad (1)$$

Where  $d$  is the number of deaths over resident inhabitants in the  $i$ -th municipality,  $R$  is the red zone /no red zone dummy,  $f$  is the number of families in the same municipality,  $\varepsilon$  is the error term,  $t$  is the time-subscript. This variable is a signal of a “same-dwelling density” which could worsen early spread of a disease and thus increase correlated hospitalizations and deaths. Afterwards, we augment (1) with other covariates as a robustness check so that it becomes:

$$d_{it} = R_{it} + X_{it} + \varepsilon_{it} \quad (2)$$

In the  $X$  vector in (2) we include the number of people attending Academic courses by municipality of residence and the mean income of that municipality to capture the effects of education and income on engagement towards public health. Data for these covariates are obtained from the Atlas of Italian Municipalities and refer to the latest available year (2017) for people attending higher education courses, and to December 2019 (i.e. two months before the pandemic outbreak) for the other<sup>4</sup>.

#### 4. Results

Table 1 shows that the establishment of the circumscribed Red Zone has determined a reduction in mortality of 0.96 people per 10,000 inhabitants from March 8<sup>th</sup> through March 22<sup>nd</sup> 2020 (about 128 fewer deaths at the March 8<sup>th</sup> cut off). Thus, in the very short term, the institution of this containment zone has been useful

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<sup>4</sup> We also used another variable to account for the older mean age computed by municipality in Lombardy at the end of 2019. This variable could help a researcher account for the effect of the spread of a respiratory diseases among the an older population.

to avoid an uncontrolled spread of the most dangerous strain of Covid with a very likely, connected increase in deaths.

**Table 1 – Diff in diff estimation results with March 8<sup>th</sup> cut off.**

Number of observations in the DIFF-IN-DIFF: 3859

	Before	After	
Control:	1710	1999	3709
Treated:	73	77	150
	1783	2076	

Bootstrapped Standard Errors

Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	0.712			
Treated	2.422			
Diff (T-C)	1.710	0.305	5.61	0.000***
After				
Control	2.215			
Treated	2.966			
Diff (T-C)	0.751	0.354	2.12	0.034**
Diff-in-Diff	-0.959	0.481	1.99	0.046**

R-square: 0.13  
 \* Means and Standard Errors are estimated by linear regression  
 \*\*Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Source: our calculations from ISTAT data.

Secondly we insert the number of households resident in those municipalities among the covariates. As can be seen, estimates do not exhibit virtually any change (a reduction of 0.95 deaths per 10,000 inhabitants) with the usual March 8<sup>th</sup> cut off.

**Table 2 – Diff in diff estimation results with March 8<sup>th</sup> cut off controlling for the number of households.**

Number of observations in the DIFF-IN-DIFF: 3859

	Before	After	
Control:	1710	1999	3709
Treated:	73	77	150
	1783	2076	

Bootstrapped Standard Errors

Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	0.807			
Treated	2.489			
Diff (T-C)	1.681	0.304	5.53	0.000***
After				
Control	2.301			
Treated	3.030			
Diff (T-C)	0.729	0.293	2.48	0.013**
Diff-in-Diff	-0.952	0.417	2.28	0.022**

R-square: 0.13  
 \* Means and Standard Errors are estimated by linear regression  
 \*\*Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Source: our calculations from ISTAT data.

Table 3 shows that reduction in overall deaths is about 1.5 per 10,000 inhabitants when the other cut off date (March 12<sup>th</sup>) is chosen.

**Table 3 – Diff in diff estimation results with March 12<sup>th</sup> cut off.**

Number of observations in the DIFF-IN-DIFF: 3859

	Before	After		
Control:	2248	1461	3709	
Treated:	95	55	150	
	2343	1516		

Bootstrapped Standard Errors

Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	0.951			
Treated	2.722			
Diff (T-C)	1.771	0.264	6.72	0.000***
After				
Control	2.400			
Treated	2.664			
Diff (T-C)	0.264	0.419	0.63	0.529
Diff-in-Diff	-1.507	0.491	3.07	0.002***

R-square: 0.11  
 \* Means and Standard Errors are estimated by linear regression  
 \*\*Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Source: our calculations from ISTAT data.

Table 4 shows that the results do not vary when the first covariate (number of families) is included.

**Table 4 - Diff in diff estimation results with March 12<sup>th</sup> cut off controlling for the number of households.**

Number of observations in the DIFF-IN-DIFF: 3859

	Before	After		
Control:	2248	1461	3709	
Treated:	95	55	150	
	2343	1516		

Bootstrapped Standard Errors

Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	1.046			
Treated	2.790			
Diff (T-C)	1.743	0.249	6.99	0.000***
After				
Control	2.486			
Treated	2.729			
Diff (T-C)	0.243	0.415	0.59	0.558
Diff-in-Diff	-1.500	0.496	3.02	0.003***

R-square: 0.12  
 \* Means and Standard Errors are estimated by linear regression  
 \*\*Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Source: our calculations from ISTAT data.

#### 4.1 Robustness check: more than one covariate

Table 5 below shows that the inclusion of two other covariates (education and income) for the March 8<sup>th</sup> threshold does not change our results: the reduction in deaths of 0.96 per 10,000 resident people is confirmed in the very short run.

**Table 5 – Diff in diff estimation results with March 8<sup>th</sup> cut off controlling for the number of households, education being attended, income.**

Number of observations in the DIFF-IN-DIFF: 3859				
	Before	After		
Control:	1710	1999	3709	
Treated:	73	77	150	
	1783	2076		
Bootstrapped Standard Errors				
Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	1.417			
Treated	3.057			
Diff (T-C)	1.640	0.273	6.01	0.000***
After				
Control	2.906			
Treated	3.590			
Diff (T-C)	0.684	0.359	1.91	0.057*
Diff-in-Diff	-0.956	0.425	2.25	0.025**
R-square: 0.15				
* Means and Standard Errors are estimated by linear regression				
**Inference: *** p<0.01; ** p<0.05; * p<0.1				

Source: our calculations from ISTAT data.

The same applies when the threshold is shifted to March 12<sup>th</sup> as can be seen in table 6: the reduction in deaths is always -1.5 per 10,000 inhabitants.

**Table 6 – Diff in diff estimation results with March 12<sup>th</sup> cut off controlling for the number of households, education being attended, income.**

Number of observations in the DIFF-IN-DIFF: 3859				
	Before	After		
Control:	2248	1461	3709	
Treated:	95	55	150	
	2343	1516		
Bootstrapped Standard Errors				
Outcome var.	deces~s	S. Err.	t	P> t
Before				
Control	1.649			
Treated	3.351			
Diff (T-C)	1.702	0.274	6.21	0.000***
After				
Control	3.085			
Treated	3.282			
Diff (T-C)	0.198	0.425	0.46	0.642
Diff-in-Diff	-1.505	0.495	3.04	0.002***
R-square: 0.13				
* Means and Standard Errors are estimated by linear regression				
**Inference: *** p<0.01; ** p<0.05; * p<0.1				

Source: our calculations from ISTAT data.

Finally, results for the municipal mean age are not statistically significant<sup>5</sup>. This is a sign that at the onset of the pandemic in Northern Italy, the differences among mean ages in Lombardy's municipalities were too small to help account for the change in the relative number of deaths.

## Conclusions

Our results explain that establishing a Red Zone has been effective in reducing deaths in the very short term as it helped reducing pressures on health facilities which were not used to cope with this type of disease during the first “Wuhan” wave. On the other hand, municipalities bordering those included in the Red Zone have experienced a higher number of average deaths per number of residents. This result is confirmed when one or more covariates (number of households, education, income) are included, while the mean age is not statistically significant, suggesting that the differences among mean ages between municipalities were (and still are) too small to account for the change in the relative number of deaths. This can Of course, we are very well aware that early lockdowns (or Red Zones) are much more effective than hard lockdowns (see for example Plümper and Neumayer, 2022)

Even though, results suggest that delimited lockdowns can be effective in reducing spreads of dangerous diseases, these are kind of interventions which cannot be kept indefinitely of course. Furthermore, in the longer term, less restrictive and more voluntary measures could even be more effective due to individual self-learning and more responsible behavior (see Bendavid et al., 2021).

To put it more clearly, struggles against highly transmissible airborne viruses are not 100 meter races but rather marathons: effective short-term measures which clearly lower deaths should be coupled with longer-term decisions where individual choices have to be led and respected at the same time.

The debate between preserving individual choices from one hand and safeguarding minimal, sufficient conditions in public health is thorny to say the least. While our paper is focused only on evaluating the effectiveness of short-term measures (the only ones virtually available almost all over Europe in February and March 2020) in terms of reducing deaths, we are well aware that the longer the time passed the higher will be the relevance of preserving individual, ever more informed choices compared to public health needs.

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<sup>5</sup> They are available upon request.



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### SUMMARY

The analysis based on diff in diff method concerns municipalities of the Lodi, Bergamo, Cremona provinces: in particular, we use data on overall mortality, not those on Covid-19 related deaths.

We start off from a common trend hypothesis between means in overall deaths (per 10,000 inhabitants) in the Red Zone municipalities and in the adjacent towns belonging to the Bergamo, Lodi, Cremona provinces for which daily availability is warranted.

Our results explain that establishing a Red Zone has been effective in reducing deaths in the very short term as it helped reducing pressures on health facilities which were not used to cope with this type of disease during the first “Wuhan” wave.

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## **OECD PMR INDICATORS FOR PROFESSIONAL SERVICES. CIVIL LAW NOTARIES AS “PUBLIC GOOD”: EFFICIENCY AND LEGAL PROTECTION NEED HIGER REGULATION**

Antonio Cappiello

### **1. Introduction**

The OECD regularly measures, through the Product Market Regulation (PMR) indicators, barriers to competition related to the national regulations of OECD and some other non-OECD countries. Since 1998, OECD also measures the regulation level of some professional services (lawyers, accountants, civil engineers, architects) that are deemed to play a key role (as intermediate input) in the productivity and the growth of a country. The intent of evaluating the regulation of the professional services is to find the right balance between effective beneficial competition and the correction of the possible market failure connected to the provision of these services. OECD would like to assess how well the markets for professional services are working and how the PMR variables are linked to specific regulatory features of these markets.

### **2. PMR Methodology, market failure and public goods**

The aim of PMR is to ensure the smooth functioning of the market through the competition mechanism. The main idea is to avoid barriers to entry in the market and to ensure fair competition. Then higher scores are assigned to professional services with a higher level of regulations that are deemed to be connected with lower quality services and higher costs. The PMR score ranges from 0 (lowest level of regulation) to 6 (highest level of regulation). However, in the case of the public goods, competition does not always ensure that markets work well (e.g., market failure), and that the health and safety of consumers are protected<sup>1</sup>. The provision of a service that is part of the administration of justice (public good) may therefore need screening criteria that are different from the ones used for measuring retail or other kinds of professional services. In the case of an institutional service of justice, output per capita, investment and employment may not be strictly connected to pure

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<sup>1</sup> The PMR for professional services takes into consideration criteria connected to the entry barriers and conduct regulation (among others: exclusive rights, years of education, compulsory training and examinations, deontological rules, advertising and fixed fees)

competition mechanisms and deserve attentive regulation in order to meet the social demand and avoid discrimination.

### 3. Is deregulation in notarial services correlated with lower costs and better performances?

If we compare the level of the notarial regulation (as expressed by the PMR) with the Registering Property indicators of World Bank, we can observe an interesting aspect: “low level of regulation” does not seem to be more correlated with better quality and lower costs, while a “higher level of regulation” is more often associated with better performances in terms of quality, costs, and speediness of the procedures.

First of all, to correctly assess the impact of the PMR on measuring the level of regulation in the countries adopting notaries, we should consider that the civil law notary system may be very different from the system adopted in some countries analysed by the PMR, such as USA, Sweden, Korea and Israel. In fact, in some of these countries, notaries do not necessarily need a university education in law, and they are not mandatory required in the real estate (RE) transfers and other important legal transactions; moreover, they are not compulsory required to check the legal content of the document. The following table (Table 1) shows countries adopting civil law notaries (members of the International Union of Notaries) who are involved in real estate transactions according the analysis of the Doing Business report of the World Bank<sup>2</sup>.

**Table 1** – *Countries (analysed by PMR) adopting civil law notaries (UINL members) who are involved in the real estate transactions.*

<b>Argentina</b>	Chile	<b>Croatia</b>	Greece	Italy	Luxembourg	Poland	Slovak Rep.
Austria	<b>Bulgaria</b>	Czech Rep.	France	Japan	Mexico	Portugal	Slovenia
Belgium	Colombia	Estonia	Hungary	Latvia	Netherlands	<b>Romania</b>	Turkey
<b>Brazil</b>	Costa Rica	Germany	<b>Indonesia</b>	Lithuania	Spain	<b>Russia*</b>	

\* Following the political events of February 2022, Russia was suspended by UINL (however this does not affect the analysis aiming at assessing the characteristics of the legal systems and the notaries' functions)

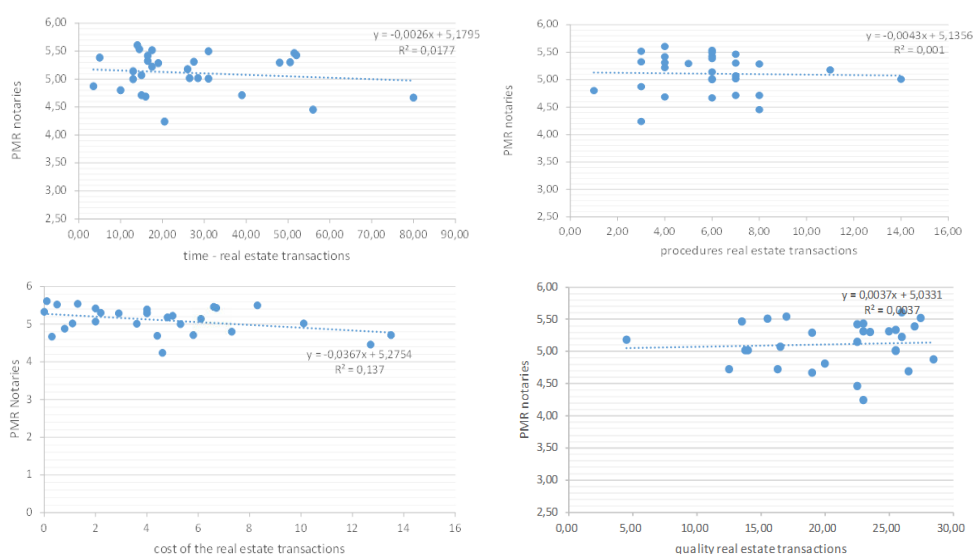
Source: World Bank DB report 2018 (countries in bold are non-OECD countries)

Therefore, taking into consideration the more homogeneous cluster indicated in Table1, we verify if a lower score of PMR corresponds to lower costs and higher performances as it concerns quality, lower number of procedures and faster processing. As indicators of performance of the notarial services, we could use the World Bank DB report indicator (*Registering Property RP*<sup>3</sup>) for the real estate transactions (core sector of the notarial activities).

<sup>2</sup> The table only indicates the sub-group of civil law notary countries that were analysed by the PMR indicator.

<sup>3</sup> RP indicators on costs, procedures, time and quality.

**Figure 1** – Comparison of notaries' PMR score and RP indicators in countries adopting notaries in the RE transfers.

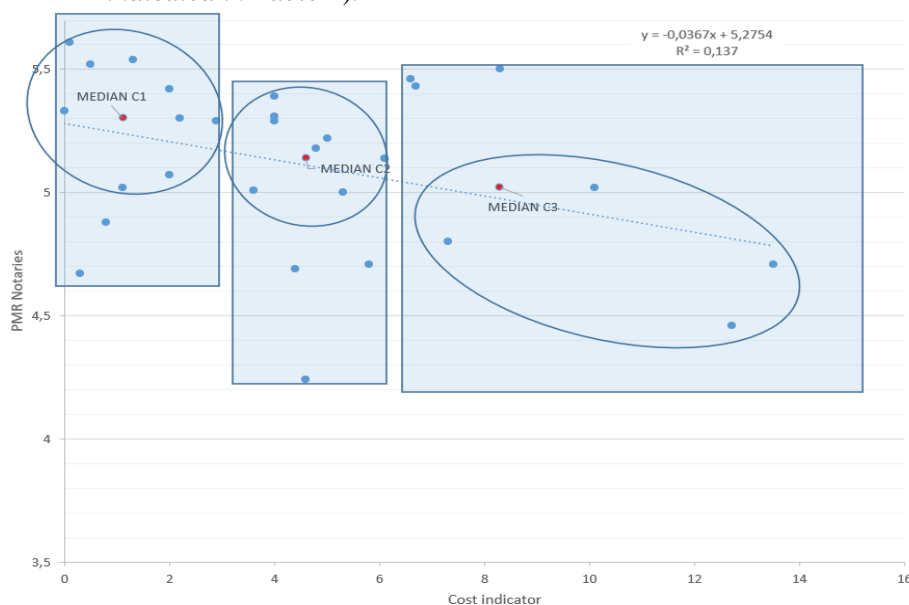


Source: elaboration of the author on World Bank and OECD PMR data (2018).

The third frame of Figure 1 (enlarged and divided in clusters in Figure 2) shows a tendency underlying an inverse correlation between the level of regulations (PMR) and cost supported by the consumer for the real estate transfer. In other words, highly regulated notarial systems produce a lower final cost for the consumers. Moreover, in Figure 1 we can also observe<sup>4</sup> a general tendency of (slight) inverse correlation between “PMR score and procedures” and “PMR score and time” (this means that “countries with notaries” adopting less procedures and completing them in less time have some kind of tendency to adopt a more regulated notarial system), and some sort of tendency to a positive correlation between “PMR score and quality”. The inverse correlation (analysed in more detail below in Figure 2) between the regulation of notarial services and cost of the real estate transactions, it seems to be slightly higher.

<sup>4</sup> Figure 1, 2 and 4 show slight relations that are anyway important indication of the tendency expressed by the data.

**Figure 2** – Countries adopting civil law notaries in the RE transfers. Comparison of PMR score and RP Cost score (the frames represent the clusters indicated in Table 2).



Source: elaboration of the author on World Bank and OECD PMR data (2018).

**Table 2** – Countries (analysed by PMR and adopting notaries in RE transactions) divided into clusters according to the RP Cost indicator of the DB report.

		CO Cost RP	PMR notaries (level of regulation)
<b>Cluster 1</b>	MEDIAN C1	1,10	5,30
<b>C1</b>	AVERAGE C1	1,20	5,24
	ST.D C1	0,96	0,30
<b>Cluster 2</b>	MEDIAN C2	4,60	5,14
<b>C2</b>	AVERAGE C2	4,69	5,02
	SD C2	0,75	0,36
<b>Cluster 3</b>	MEDIAN C3	8,30	5,02
<b>C3</b>	AVERAGE C3	9,31	5,05
	ST.D C3	2,85	0,42

Source: World Bank and PMR indicator 2018 (2 outliers are not considered in this table).

The above clusters show a tendency underling an inverse correlation between level of regulations (PMR) and cost supported by the consumer for the real estate transfer (highly regulated notarial systems produce a lower final cost for the consumers).

#### 4. What about countries that do not use the notary system in real estate transactions?

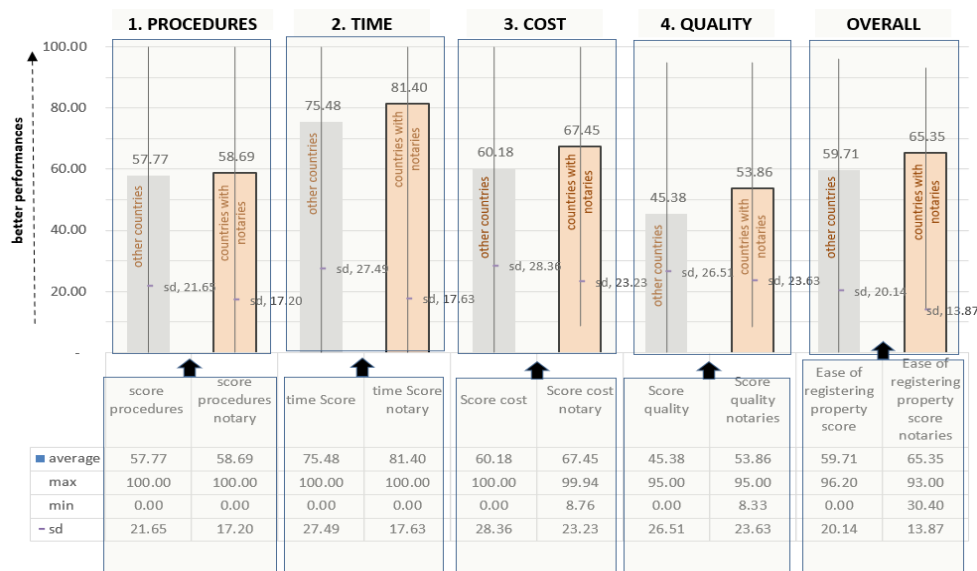
A comprehensive study (Doing Business Report and Real Estate Transfers: Far Better with Legal Controls and Notarial Guarantee. Working Papers 20/079, EXCAS) focused the analysis on the main sub-indicators of the Registering property (namely, number of procedures, time, cost and quality the real estate registration infrastructure) in order to assess the average impact of civil law notaries. The aggregate assessment on the 190<sup>5</sup> countries analysed by the DB shows better average results by countries adopting civil law notaries in real estate transfers. In Figure 3, representing the average performance on the Registering Property indicator, we can notice the better performances of the UINL countries adopting notaries in all sub-indicators. Moreover, the standard deviation has significant lower value in the UINL clusters. This means that inside the group of countries adopting notaries, the distribution of the scores is more uniform. The lower gap between maximum and minimum value (overall indicator as well as cost and quality sub-indicators) for the UINL cluster is a further confirmation of the greater uniformity of performances inside this group. Considering the analysis of the previous paragraphs on the level of PMR and the notarial performances, Figure 3 can provide an indication on the impact of regulation on professionals involved in the real estate transactions in systems that do not adopt notaries (scores are standardized on a scale from 1 to 100, where 100 = best performance).

The data (see Figure 3) also shows the greatest gap between the 2 analysed clusters (countries using notaries vs. other countries) in the quality indicator (8.47) and, surprisingly against all stereotypes, also in the cost indicator (7.26). This means that the quality of the transfer is much higher and less expensive if on civil law notary control. Another consideration can be made on the gap between the procedures and time indicators, with the most evident gap being on time. This surely means that the transfer is faster in the civil law notary countries' cluster. If we consider that the indicator on the procedures presents a less evident gap, this means that, on average, each procedure is completed quickly. Moreover, considering the possible distortion coming from the implication of the methodology on the calculation of time and procedures (see Cappiello 2014), a more faithful representation of the reality by these indicators would probably enhance further, the important legal control made by highly qualified legal experts (notaries) completing many checks (procedures) faster than systems that do not adopt civil law notaries.

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<sup>5</sup> The irregularities detected by the World Bank audit, concerns mainly China (other minor errors were detected in the data of Azerbaijan, Saudi Arabia and United Arab Emirates). These countries do not adopt civil law notaries for real estate transfers, so the aggregate results of the analysis on 190 countries are therefore not affected.

**Figure 3** – Performances of UINL countries requiring notaries in property transfers (comparison with countries that do not use the notary system).



Note: The line inside each histogram shows the minimum and maximum value of each considered distribution, as well as the standard deviation indicated by a spot with the acronym sd.

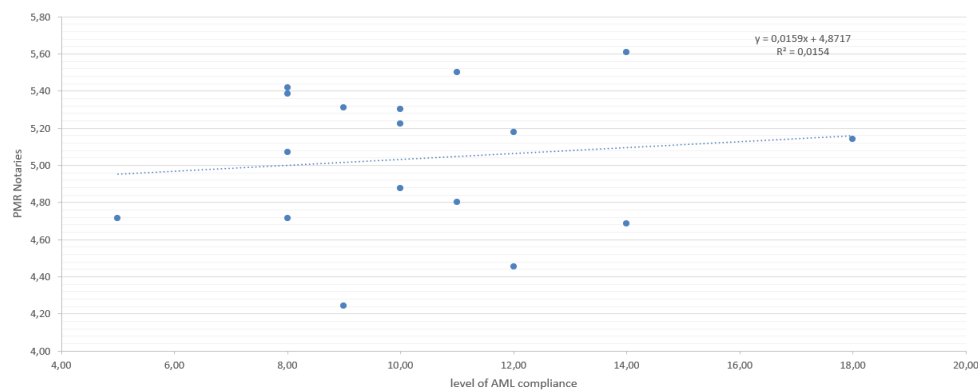
Source: World Bank Doing Business Report 2020, Registering property indicator 2020

## 5. Compliance with the FATF (IO and R) and notarial services

Another important aspect of professional services is the compliance with the FATF anti-money laundering (AML) recommendations, especially as concerns the DNFBS criteria (features adopted also as guidelines for the EU legislation and OECD policies on AML). In Figure 4, note a positive trend as it concerns the correlation between the PMR score for the notarial professions and FATF compliance as it concerns AML (as a proxy we considered IO3-7, R10-11 and R22 of the FATF standards, which are more correlated with the nature of the service provided by notaries). Therefore, more regulated notarial systems tend to have a higher level of compliance with FATF standards. Figure 4 concerns the available FATF data on UINL countries (analysed by the PMR) adopting notaries for the RE transfers.



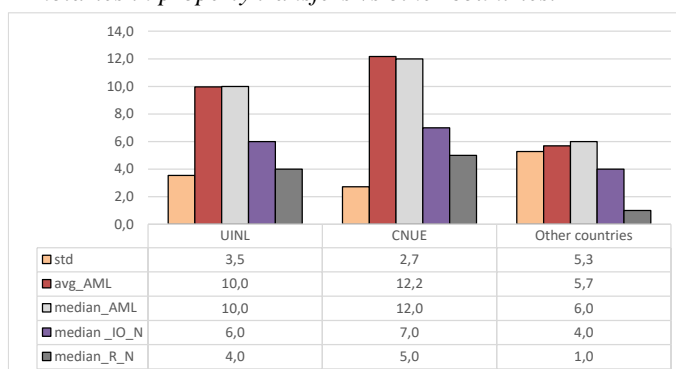
**Figure 4** – UINL countries requiring notaries in property transfers. Compliance with AML standards and PMR scores as they concern the notarial profession



Source: elaboration on MER-FUR data FATF 2018-2019.

In Figure 5, note better compliance by CNUE (European countries adopting notaries) and UINL (world countries adopting notaries) compared to countries adopting a different system for Real Estate Transfers (the aggregated results are based on the before mentioned FATF criteria).

**Figure 5** – Compliance with AML standards: UINL and CNUE countries requiring notaries in property transfers vs other countries.



Source: elaboration on MER-FUR data FATF 2018-2019.

## 6. Final considerations and future perspectives

If we accept the paternalistic choice of the legislator to protect the consumer (through the *ex-ante* notarial control) and we agree on the high standards with respect to education and selection of the public officers guaranteeing the credibility of the

entire property transfer process, we should reconsider the PMR scheme. If we think that professional standards are needed and are proportional to the objective, the open issue is the quantification of a fair compensation of the services provided by the notaries and which criteria have to be used. In other words, if we agree on setting high standards and these are deemed proportional to our objective, the criteria of selection and conduct (high education, continuous education, selection through a competitive examination, avoiding misleading advertising, etc.) have to be considered as “a protection for the consumer” instead of an “entry barrier” or a “conduct regulation” limiting free competition. Moreover, the fact that the overall PMR indicator is highly aggregated, as it incorporates in a single figure over 1000 data points, could be an obstacle rather than an advantage for the policymakers. This aggregation could hide the subsector score and therefore, the policymakers - missing the detail of each particular aggregated feature - may fail to individuate the right aspect where to intervene. Protection of the consumer is often based on competition, nevertheless the analysis of the consumer biases (for example switching costs or misrepresentation of the offer) and of the nature of supply market should guide the assessment of possible distortions and defend the consumer, ensuring transparency and clarity on costs, services and products (taking into account the final burden for the consumer and the simplification and clearness of the supplied services and products). The simplification and supervision of some relevant financing, intermediation and collateral services (offered to the companies and the individuals) may boost the productivity of all sectors connected to them. These intermediate inputs may have a greater impact on the cost, quality and productivity of all their connected trades and services. The analysis in paragraphs 3 and 4 show that the final effect of the regulation in many cases produces lower costs and better quality of the notarial services (better results than other system). Likewise, the assessment on the FATF requirement for AML (see par. 5) shows that a more regulated system of professionals guarantees better compliance with the anti-money laundering policies, and therefore, useful externalities for the consumer and the whole country system. As long as costs are fair, and services are guaranteed with high quality standards, we may need to reconsider the assessment scheme of the PMR<sup>6</sup>. The PMR scheme applied to the notarial category may risk to distort the evaluation made by the institutional users of these data (e.g. EU Commission and National Governments) and could produce deregulations risking to complicate the proper improvement of the supplied service. Since, as stated in the OECD brochure “the World Bank considers the PMR indicators a very useful diagnostic tool which complements their own *Ease of Doing Business indicator*”, attention should also be paid to assess the

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<sup>6</sup> Notaries, as underlined by the EU legislation (see introductory paragraphs), can be seen as ex-ante judges as concerns the nature of their services that must necessarily be highly regulated in order to ensure the correct administration of the Justice. Therefore, the PMR assessment scheme may have less adaptability to professions who are part of the administration of the justice.

consistency of PMR and the World Bank data with the final policy aims. The State involvement may not always induce distortion, and each market should be evaluated separately with detailed assessments of all their features. Few months ago, the World Bank has just decided to discontinue the Doing Business (DB) report<sup>7</sup> that supported deregulations without proper assessment of features connected to the security of the business environment (a new World Bank methodology, called BEE<sup>8</sup>, will be adopted also considering more qualitative aspects). Therefore this methodology change (BEE) it is a sign that the same World Bank experts recognised that the DB criteria often pushed country governments to compete for improvement in the DB rankings without always obtaining a real enhancement of their socio-economic environment. Nevertheless, the BEE already announced that, besides integrating some of the PMR criteria, it will also assess “*whether the involvement of third-party professionals is optional (e.g., lawyers, accountants, notaries) for business registration*”. It seems instead reasonable that the impact of a third-party professional should only be evaluated in terms of the general efficiency for the whole process. Also the methodology for calculating time and procedures should take into account the “actual time” and the advantages for the consumer without penalising a one-stop-shop that, within the same range of time and with higher guarantee, provides its output with more simultaneous controls (procedures)<sup>9</sup>.

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<sup>7</sup> World Bank press communication (Washington, September 16, 2021)

<sup>8</sup> Business Enabling Environment (World Bank, *Business Enabling Environment (BEE)*, Pre-Concept Note, Washington, February 4, 2022).

<sup>9</sup> Cappiello A. 2014, *World Bank Doing Business Project and the Statistical Methods based on Ranks: the Paradox of the Time Indicator*, Rivista Italiana di Economia, Demografia e Statistica, Volume LXVIII n. 1.

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### SUMMARY

This article analyses the application of the OECD PMR criteria to the civil law notaries. Since the notarial service is offering a “public good” (administration of the justice), many criteria defined by the PMR indicator are, in this case, to be considered as a protection of the consumer rather than an obstacle to the proper functioning of the market. The level of regulation - because of the nature of the notarial public function - should forcibly be higher than the other PMR analysed professions. Therefore, if we apply the PMR to the notarial profession, we highly risk depriving the community and citizens of the *ex ante* legal security (removing the protection especially to the vulnerable parties). These reflections are supported by the empirical analysis on the correlation level of the notarial regulation (as expressed by the PMR) with some World Bank indicators. We can observe that “lower levels of regulation” do not seem to be more correlated with better quality and lower costs, while a “higher levels of regulation” are more often associated with better performances in terms of quality, costs, and speediness of the procedures. Moreover, also the anti-money laundering compliance with FATF standards (an important requirement for legal professionals) shows a positive trend of correlation with higher level of notarial regulation.



**SOCIETÀ E RIVISTA ADERENTI AL SISTEMA ISDS**  
**ISSN ASSEGNATO: 0035-6832**

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*Direttore Responsabile:* CHIARA GIGLIARANO

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Iscrizione della Rivista al Tribunale di Roma del 5 dicembre 1950 N. 1864

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Associazione all'Unione Stampa Periodica Italiana

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TRIMESTRALE

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*La copertina è stata ideata e realizzata da Pardini, Apostoli, Maggi p.a.m. @tin.it – Roma*

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