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LABORATORI tematici

Urban non-urban agglomeration divide: is there a gap in productivity and wages ?

Eleonora Bartoloni, Andrea Marino, Maurizio Baussola, Davide Romaniello

28-29
APRILE
2022

#IstatWebinar

Indice della presentazione

- Theoretical background, motivation and research questions
- Data and some descriptive statistics
- Empirical specifications
- Endogeneity issues
- OLS and IV results
- Further results
- Summary and conclusions

Theoretical background, motivation and research questions (1)

- Theoretical considerations suggest that agglomeration economies linked to urban agglomerations may positively affect productivity. Urban characteristics, i.e., population density, may reflect the Marshallian agglomeration economies related to the sharing of productive infrastructure, learning mechanisms and matching opportunities between firms and employer-employees (Duranton and Puga, 2005).

- Empirical studies provide evidence of a clear productivity gain as long as urban density increases (Henderson, 2003; Martin et al. 2011; Baldwin et al., 2008; Anderson and Loof, 2011).

- Di Giacinto et al. (JEG, 2014, "*Mapping local productivity advantages in Italy: Industrial districts, cities or both* ?") find that in the 1995-2006 period both urban areas and industrial districts enjoy a productivity premium compared to other areas, the gain being significant larger for producers located in cities.

- Buzzacchi et al. (QEF Banca d'Italia, 2021, "*Agglomeration and the Italian North-South Divide*"): analyzing the 1995-2015 period in a sample of manufacturing plants, they find that "…*the TFP-density nexus contributes to explaining a large share of the substantial productivity gap between*" North and South."

Theoretical background, motivation and research questions (2)

- A thorough evaluation of the impact of urban locations has to take into account overall firm performance, thus not only productivity but also negative externalities and costs.

- Besides positive agglomeration externalities, congestion costs negatively affect firm performance (Henderson, 1974). Traffic jams, crime, high housing or land rents and other negative externalities may reduce profitability (Sweet, 2014, Baert and Reynaerts, 2018, Bartoloni and Baussola, 2021).

- Wages are an important determinant of production costs. Wages competition among firms for the skilled workforce in the densest areas, may lead to higher production costs and further upward pressure on wages (Combes and Duranton, 2006).

- Ahrend et. al. (2014) underline the crucial role of urban areas - and more specifically high–density populated metropolitan areas in 5 OECD countries – in affecting wages and, according to their reasoning, productivity.

- Kampelmann et al. (2018), using Belgium data, they estimate "*how regions affect the productivity, the wage and cost competitiveness (i.e. the productivity-wage gap) of firms*" conditional on industry/workers characteristics and information about the wage setting mechanism.

Theoretical background, motivation and research questions (3)

- 1) Do agglomeration economies play a significant role in affecting productivity and wages differentials at the local level?
- 2) Does the impact of urbanization on the productivity-wage gap significantly differ across sectors according to their technological characteristics ?
- 3) Do firm-specific factors, particularly job-related characteristics, have a distinctive role in shaping the performance at the establishment level?

- We provide a first answer to these question by considering plant level data from a single region, Lombardy (industrial and financial heartland of Italy, GDP = around 85% of Belgium economy)

Data

- SBS FRAME Territoriale (2015): integrates establishment data by using: (i) The Structural Business Statistics (SBS) and (ii) the Statistical Archive of Active Firms (ASIA-UL), the statistical register of business establishments.
- Information on job quality stems from the ASIA Employment Archive, a matched employer-employee data set from which we derive additional variables on the demographic and job-related characteristics of employment at the firm level.
- The data set covers all industry and services activities (Nace Rev.2), excluding the financial sector as well as some personal and household services.
- N = around 255.000 units (around 55.000 in manufacturing)
- The localization is defined at the municipality level, whose degree of urbanization is detected using the DegUrba classification (Eurostat).
- The extent of agglomeration externalities may be related to sectoral knowledge characteristics ➔ we adopt a sector aggregation based upon technology and knowledge intensity (Htech classification, Eurostat)

Measuring the Degree of Urbanization: the Degurba index

- Firm-level data are referred to municipalities
- Many empirical papers measure urbanization through population density only
- *Degurba* classification increasingly popular; it takes into account both population density and size
- A preliminary classification of regular 1 km^2 grid cells according to population and density thresholds (along with information on contiguity) allows to classify municipalities into one of the three following categories:

1) *High-density areas*

2) *Intermediate density areas*

3) *Rural (thinly populated) areas*

➔ We use this information to build dummy variables to be included into the econometric specification

Eurostat Htech Sector Aggregation (based upon NACE Rev.2)

MANUFACTURING INDUSTRIES

1) HIGH TECHNOLOGY

(«**HT**»; computer, optical products,..; n=2478)

2) MEDIUM-HIGH TECHNOLOGY

(«**MHT**»; chemicals, machinery,...; n= 14562)

3) MEDIUM-LOW TECHNOLOGY

(«**MLT**»; coke, rubber and plastic;..; n=17873)

4) LOW-TECHNOLOGY

(«**LT**»; food textile, wood…; n =19578)

SERVICES SECTORS

1) HIGH-TECHNOLOGY SERVICES

(«**HITS**»; telecommunications, R&S; n=12236)

2) KNOWLEDGE INTENSIVE MARKET SERVICES

(«**KNWMS**»; legal, engineering;…n= 44604)

3) OTHER SERVICES

(«**Other**»; wholesale/retail trade…; n=113133)

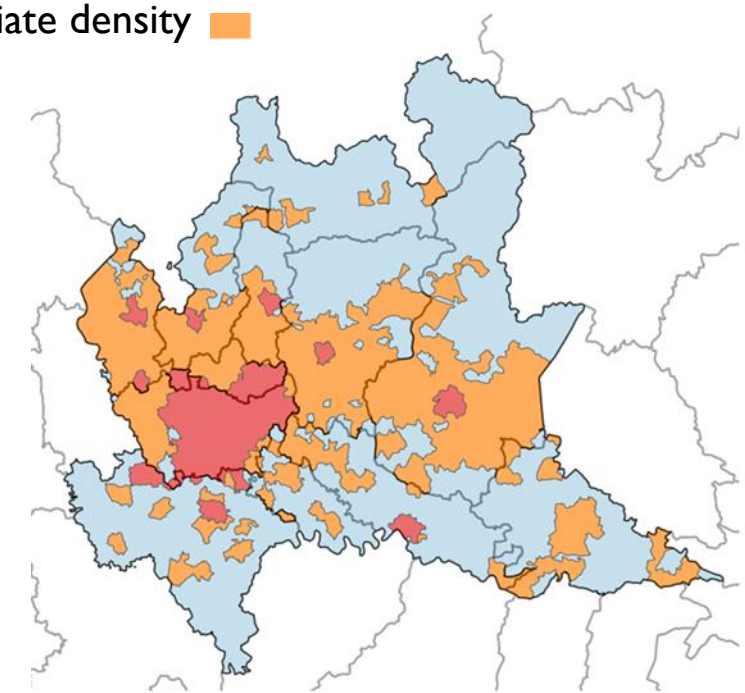
4) HOUSEHOLD SERVICES

(«**House**»; education, health…; n=30225)

Urbanization and Economic Activity in the Lombardy Region

Map

High density
Intermediate density
Rural



Some Statistics

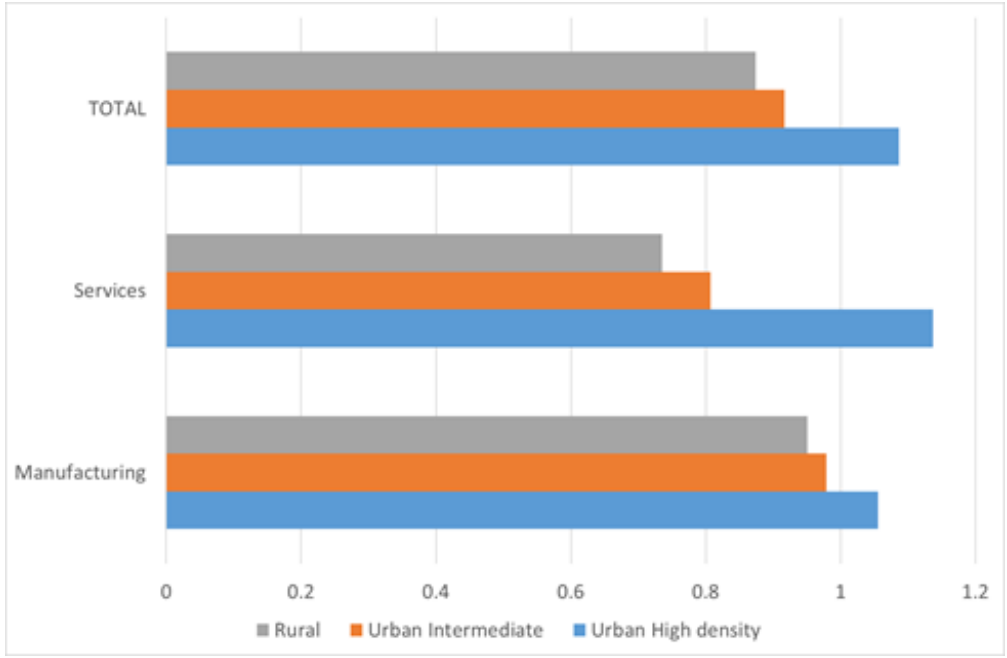
	Municipalities	Population (thousand)[a]	Surface (Km2)	Firms' local units	Value added (billions)
Lombardy Region	1,527	10,019	23,864	854,144	181
Urban High-density	8.2	40.4	7.8	48.7	55.5
Intermediate	47.1	47.8	34.2	42.3	37.7
Rural	44.7	11.8	58.0	9.0	6.8

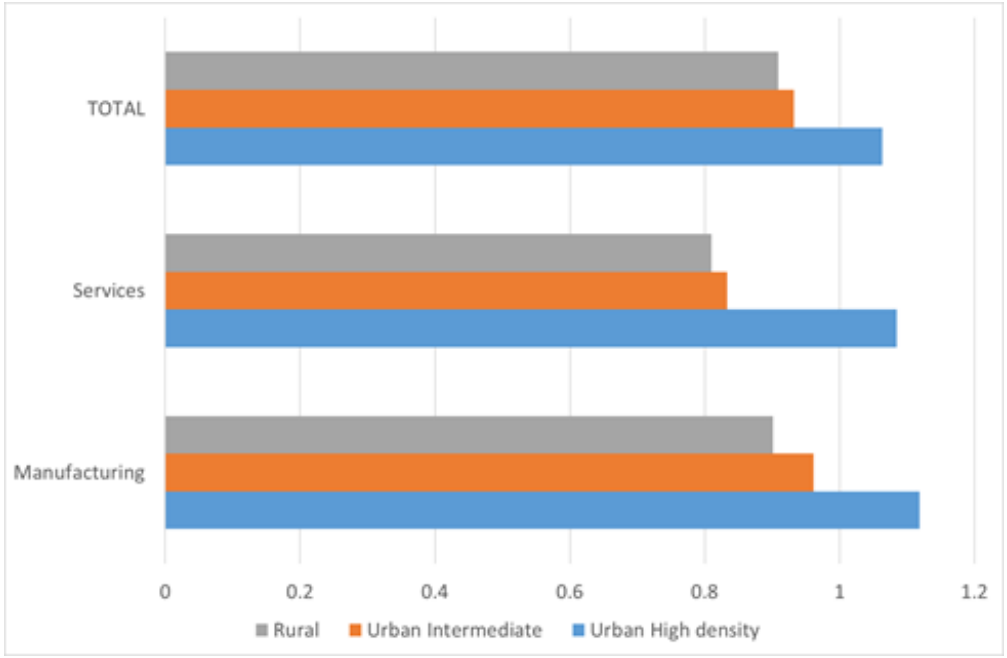
	Manufacturing		Services		Total	
	Productivity	Wages	Productivity	Wages	Productivity	Wages
Urban High Density	69.026	37.476	53.958	29.858	57.738	31.416
Urban Intermediate	64.035	32.209	38.307	22.944	48.700	27.541
Rural	62.172	30.187	34.897	22.287	46.455	26.859
Total	65.389	33.502	47.445	27.529	53.143	29.538

Productivity: Value added per employee (full time equivalent)
Wages: Gross wages per payroll registered employee (full time equivalent)

Urbanization, productivity and wages in the Lombardy Region

- Aggregate patterns of productivity (on the left) and wages (on the right): between-area variations.





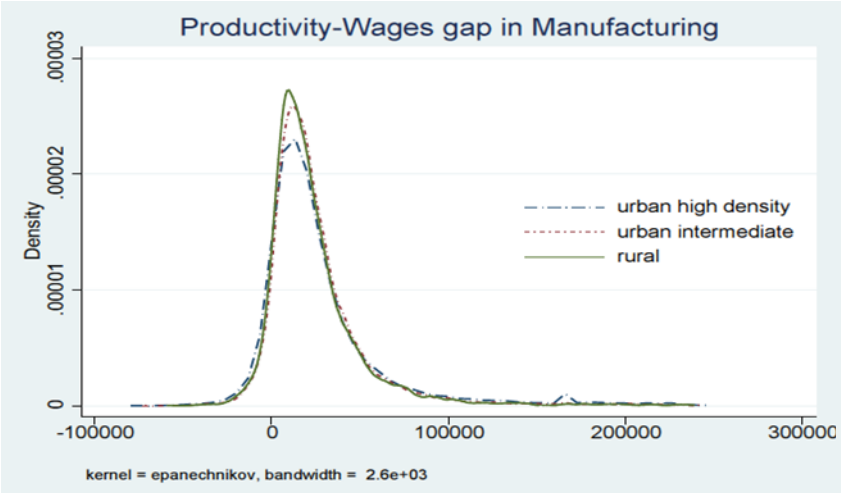
- Establishments in high-density areas are better off than elsewhere. However, the productivity gain is mainly concentrated in services, whereas differences across areas are less pronounced in manufacturing.

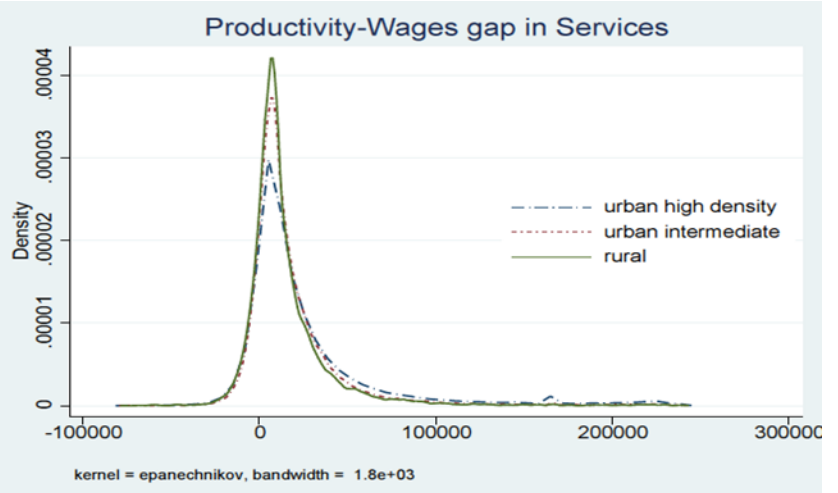
- The wage gain, conversely, is less differentiated between these two sectors.

The productivity-wage gap at the plant level: sectoral distributions

MANUFACTURING
(N=54,491)

Similar spread around center values in all locations

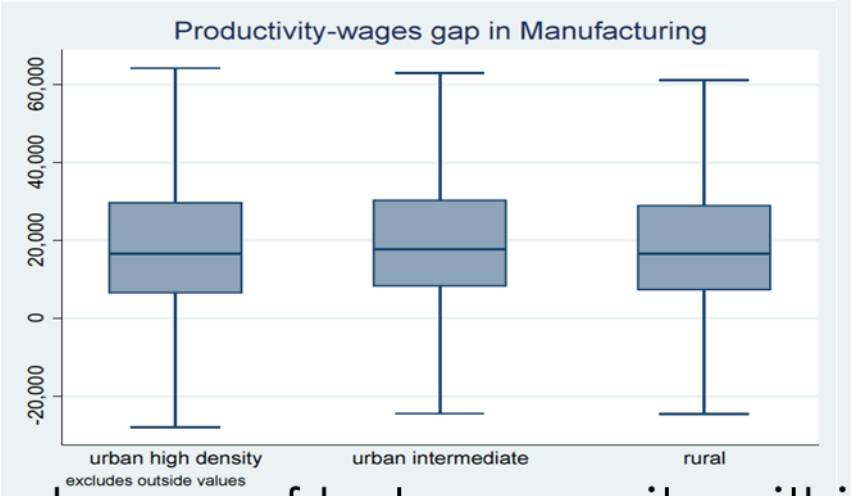


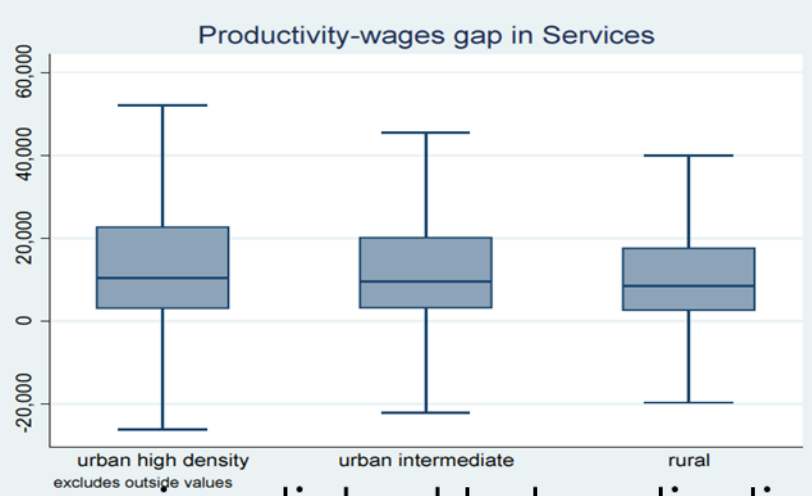


SERVICES
(N=200,198)

Higher concentration around center values

Higher median gap in manufacturing compared to services in all the locations





Correlation between the gap and the degree of urbanization

A higher degree of heterogeneity within services linked to localization factors

The econometric specification (1)

- ***Three dependent variables of interest:*** labour productivity (value added per employee, ***log Y***), wages (ratio of gross wages to the total number of employees, ***log W***) and the productivity-wage gap (***log(Y/W)***):

$$y_i = \begin{cases} \log Y \\ \log W \\ \log Y - \log W \end{cases}$$

- We separately estimate cross-country regressions for each of them on measures of the ***degree of urbanization*** as well as on a set of ***firm-specific*** and other ***area characteristics***

- Two alternative specifications to investigate possible impact heterogeneity across sectors

  - 1) Sectoral estimates (for each of the eight *S* sectors of the Htech classification)

  - 2) Inclusion of interaction terms when pooling observations from different sectors (or macro-sectors)

The econometric specification (2)

1) Computing and comparing sectoral estimates (for each of the eight sectors of the Htech classification)

$$y_i = \beta_0 + \beta_1 H_i + \beta_2 R_i + \beta_3 X_i + \beta_4 I_{a;i} + \beta_5 Exp_i + \varepsilon_i$$

where:

- H_i = dummy variable for plants located in "***High-density***" areas
- R_i = dummy variable for plants located in "***Rural***" areas
- X_i = plant-specific characteristics (vector)
- $I_{a;i}$ = other area characteristics (vector)
- Exp_i = dummy variable for exporters

ε_i = error term

➔ Marginal effects of location upon the dependent variables are simply measured by $\hat{\beta}_1$ and $\hat{\beta}_2$

The econometric specification (3)

- X_i ***Plant-specific characteristics:***

- Size (set of dummies for plants with a number of employees in the intervals 10-49, 20-49, 50-249, 250-499, 500 and more; less than 10 = reference category)

- Characteristics of the workforce: age composition (age classes 30-49 and 50+), education, gender, fixed vs temporary contract.

Other area characteristics:

- Employment rate (computed at the Local Labor Market level) $I_{a;i}$

The econometric specification (4)

2) Including interaction terms in a regression pooling units from different sectors

$$y_i = \beta_0 + \beta_1 H_i + \beta_2 R_i + \sum_{j=1}^{S-1} \beta_{3j} (H_i * S_{ij}) + \sum_{j=1}^{S-1} \beta_{4j} (R_i * S_{ij}) + \beta_5 X_i + \beta_6 I_{a;i} + \beta_7 Exp_i + \varepsilon_i$$

where:

S_{ij} = dummy variable (=1 if establishment *i* belongs to business sector *j*, with *j=1,2,…S*)

➔ The estimated marginal impact of, e.g., a high-density location for a plant belonging to sector *h* is:

$$\frac{\partial y_i}{\partial H_i}_{|i \in S_h} = \hat{\beta}_1 + \sum_{j=1}^{S-1} \hat{\beta}_{3j} S_{ij} = \hat{\beta}_1 + \hat{\beta}_{3h}$$

Only OLS estimates for this specification (results do not qualitatively differ)

Endogeneity issues (1)

$$y_i = \beta_0 + \beta_1 H_i + \beta_2 R_i + \beta_3 X_i + \beta_4 I_{a;i} + \beta_5 Exp_i + \varepsilon_i$$

- All traditional sources of endogeneity bias potentially at work when estimating the productivity effects of urbanization.
- Likely most important source: omitted variables bias at both local and individual level (due to selection and self-selection – or «sorting»- effects), as unobservables may influence both location choices and outcomes.
- Exogeneity assumption might be questioned for other rhs variables as well. The export dummy particularly «problematic» ➔ treated as endogenous (rather than dropped from the specification).

➔ $$y_i = \beta_0 + \beta_1 H_i + \beta_2 R_i + \beta_3 X_i + \beta_4 I_{a;i} + \beta_5 Exp_i + \varepsilon_i$$

Endogeneity issues (2)

- Strategy for IV estimation adopts (and extends) hints in Wooldridge (2010) for discrete variables:

1) Estimate ordinal probit model regressing the original urbanization index on the exogenous rhs variables and a set ***Z*** of suitable instruments, obtaining predicted conditional probabilities to be classified into one of the (three) categories of the Degurba index.

2) Estimate similar probit model for the export dummy, obtaining predicted probabilities of being exporters

3) Use individual predictions of being classified as «High density», «Rural» and «Exporter» as IV set in the 2SLS estimation of the original equation

NB Model is perfectly identified

Which variables to be included into the set ***Z*** ?

Endogeneity issues (3)

- Standard approach for finding suitable instrumental variables in the literature on agglomeration economies: geographical and historical factors influence urbanization (origin and developing of urban areas) but are reasonably uncorrelated to current firm performance (at least in modern industrial and services sectors).

- The probability of being exporter should be lower for younger firms (it takes time to generate the learning externalities -in terms of know-how and managerial competences- required to access foreign markets (Costa et al., SBE, 2017, «Internationalization Choices and Italian firm performance during the crisis»)

- ➔ Following Di Giacinto et al. (2014) and Costa et al. (2017) the set ***Z*** used in the probit regressions includes:

  - altitude

  - a lagged (1921) value of population density

  - a lagged (1971) value of schooling (share of the population holding at least a secondary school degree)

  - firm age

URBANIZATION AND PRODUCTIVITY

	Manufact. HT (N=2478)	Manufact. MHT (N=14562)	Manufact. MLT (N=17873)	Manufact. LT (N=19578)	Services HITS (N=12236)	Services KNWMS (N=44604)	Services OTHER (N=113133)	Services HOUSE (N=30225)
OLS estimates								
High density	0.065** (.026)	0.019 (.013)	0.018 (.014)	-0.008 (.015)	0.121*** (.017)	0.164*** (.031)	0.011 (.010)	-0.002 (.012)
Rural	-0.071 (.075)	-0.058** (.022)	-0.067*** (.016)	-0.035 (.023)	-0.082*** (.025)	-0.093*** (.024)	-0.032 (.025)	0.016 (.018)
IV estimates								
High density	-0.087 (.07)	0.079** (.029)	0.005 (.036)	-0.094*** (.030)	0.178*** (.038)	0.496*** (.150)	0.037 (.036)	-0.020 (.031)
Rural	-0.373** (.184)	0.003 (.061)	-0.091*** (.034)	0.022 (.044)	-0.080 (.057)	0.174 (.182)	0.208** (.087)	0.035 (.069)

URBANIZATION AND PRODUCTIVITY

Conley (1999) standard errors accounting for cross-sectional dependence

	Manufact. HT (N=2478)	Manufact. MHT (N=14562)	Manufact. MLT (N=17873)	Manufact. LT (N=19578)	Services HITS (N=12236)	Services KNWMS (N=44604)	Services OTHER (N=113133)	Services HOUSE (N=30225)
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URBANIZATION AND PRODUCTIVITY

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URBANIZATION AND WAGES

	Manufact. HT (N=2478)	Manufact. MHT (N=14562)	Manufact. MLT (N=17873)	Manufact. LT (N=19578)	Services HITS (N=12236)	Services KNWMS (N=44604)	Services OTHER (N=113133)	Services HOUSE (N=30225)
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Rural	-0.026 (.031)	-0.066*** (.009)	-0.064*** (.010)	-0.035 (.022)	-0.0004 (.013)	-0.045*** (.016)	-0.021 (.024)	-0.036*** (.017)
IV estimates								
High density	0.007 (.065)	0.091*** (.029)	-0.001 (.014)	0.023 (.017)	0.142*** (.028)	0.262*** (.078)	0.095*** (.026)	0.104*** (.013)
Rural	-0.373** (.)	-0.014 (.035)	-0.099*** (.026)	0.041 (.040)	0.062 (.038)	0.157 (.109)	0.198*** (.066)	0.039 (.039)

URBANIZATION AND WAGES

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URBANIZATION AND THE PRODUCTIVITY-WAGE GAP

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High density	-0.031 (.020)	-0.017*** (.007)	-0.002 (.009)	-0.049*** (.009)	0.030*** (.013)	0.093*** (.016)	-0.028*** (.008)	-0.058*** (.014)
Rural	-0.046 (.065)	0.008 (.017)	-0.003 (.013)	0.002 (.010)	-0.081*** (.022)	-0.048*** (.016)	-0.011 (.011)	0.051*** (.018)
IV estimates								
High density	-0.094 (.084)	-0.012 (.016)	0.006 (.027)	-0.118*** (.019)	.0360* (.021)	0.233*** (.073)	-0.058*** (.014)	-0.123*** (.033)
Rural	-0.440** (.201)	0.017 (.038)	0.009 (.027)	-0.019 (.021)	-0.142** (.057)	0.017 (.079)	0.010 (.031)	-0.005 (.052)

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Further results (1)

Table 4. OLS estimation: manufacturing and services establishments

Variable	Productivity	Wages	Gap
Size 10-19	0.236***	0.183***	0.0545***
	[0.00659]	[0.00500]	[0.0106]
Size 20-49	0.267***	0.223***	0.0460***
	[0.00566]	[0.00803]	[0.00984]
Size 50-249	0.289***	0.265***	0.0252*
	[0.00807]	[0.00999]	[0.0131]
Size 250-499	0.300***	0.280***	0.0202
	[0.0304]	[0.00947]	[0.0282]
Size 500 +	-0.263***	0.186***	-0.450***
	[0.0422]	[0.0212]	[0.0419]
Internazionalization	0.453***	0.289***	0.166***
	[0.00590]	[0.00443]	[0.00462]
Aged 30-49	0.326***	0.217***	0.109***
	[0.0310]	[0.0204]	[0.0115]
Aged 50+	0.467***	0.291***	0.176***
	[0.0691]	[0.0402]	[0.0298]
High education	0.768***	0.542***	0.225***
	[0.0458]	[0.0534]	[0.00999]
Males	0.163***	0.294***	-0.128***
	[0.0482]	[0.0358]	[0.0134]
Temporary contracts	-0.212***	-0.210***	-0.00202
	[0.0204]	[0.0181]	[0.0283]
Employment rate	0.0135***	0.00868*	0.00487**
	[0.0062]	[0.00513]	[0.00212]

Further results (2)

- ***Concerning previous estimates:***

- Higher size is generally associated to higher productivity and wages. However, units in the largest class (500 employees and more) are less productive and the coefficient in the productivity-wage equation turns out to be systematically and significantly negative independently on the sector at hand.

- Exporting firms enjoy sizable productivity advantages, which only partially into higher labor compensation

- In manufacturing a higher share of male and «old» workers raises more wages than productivity (➔ negative coefficients in the gap regressions).

- A larger share of highly educated workers generally increases more productivity than wages

- ***Concerning other (unreported) estimates:***

- Alternative techniques to tackle endogeneity, e.g. Propensity Score Matching (after transforming the Degurba index into a binary variable and excluding the export dummy) produce similar results

Summary of results

- In general, we find that agglomeration economies play a significant but conditional role in affecting productivity and wage differentials, also after controlling for firm-specific factors (in particular, job-related characteristics) and selection effects.
- However, estimated effects are quite heterogeneous across sectors, depending on their technological characteristics.
- The effect of locating in “High-density” urban areas on the productive-wage gap is significantly positive only in highly knowledge-intensive services sectors (this echoes Kampelmann’s et al., 2018).
- For firms supplying less technologically sophisticated services and for manufacturing plants, the impact is either not significant or negative.
- Locating in “Rural” areas generally exerts a downward (or not significant) impact on the productivity-wage gap.

grazie

ANDREA MARINO | anmarino@istat.it

Istat | Istituto Nazionale di Statistica