Was there a height urban premium in Italy after the second World War?

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1 Extended summary

According to anthropometric literature, adult height is considered a proxy variable for overall biological health since it reflects various factors, such as nutrition, workload and disease during childhood and adolescence, in addition to genetics (Steckel, 2009). Similarly, differences in adult height based on socioeconomic conditions experienced during physical development from birth, place of residence, labour market, institutional settings, among others, have been utilized to examine inequality in various regions or countries. As a result, height has been shown to be a reliable indicator of territorial inequality. In this vein, a comparison of populations of varying sizes and functions can enhance our comprehension of health inequality in different geographical contexts. One of the key factors contributing to inequality in height is the disparity between urban and rural areas, attracting attention of a large number of scholars. Extensive literature suggest the idea of an "urban height penalty" for countries experiencing rapid industrialization and population growth due to the demographic transition in the late eighteenth and mid-nineteenth centuries was documented (A'Hearn, 2003; Komlos, 1998; Groote and Tassenaar, 2020). However, during the late nineteenth century the height disparity between urban and rural populations began to narrow or even revers, suggesting an "urban premium" (Linares-Luján and Parejo-Moruno, 2021; Ramon-Muñoz and Ramon-Muñoz, 2024). This shift can be attributed to improvements in transportation and market integration, which have increased the supply of food in cities, public investments in water supply and sanitation which have led to improved health conditions in urban areas, and finally to medical services which expanded more rapidly in cities and large towns compared to rural areas. The transition from urban height penalization in the 19th century to a rural height penalty in the 20th century is not a universal phenomenon. Similarly, there is evidence indicating a

height advantage in rural areas in both Europe and the USA during the 19th and 20th centuries. On the contrary, other studies have shown a decrease in height in rural areas, with this height penalty persisting in Europe until at least the adult generations before the Second World War. From this premise, it is evident that there has not been a singular and permanent evolutionary trend in the height disparity between urban and rural areas, and more research is required on the rural-urban gap. This article contributes to the well-established literature on living standards and inequalities between urban and rural male population in the mid-twentieth century Italy. By utilizing anthropometric data of conscripts for the 1951 birth cohort, the study aims to shed light on disparities between urban and rural populations in Italy and within the macro-areas of the South, Center and North and examines how growth patterns have evolved in various living environments.

2 Data and method

This research uses information from the compulsory medical examination process ascertaining fitness (or lack thereof) for military service in the Italian Army and Air Force for all Italian males for the 1951 cohort. The archives of the military districts situated in the North, Center, South and Islands of Italy maintained this information by the "matriculation sheet" (foglio d'immatricolazione). The dataset corrected for errors, incongruences such as duplicates and implausible values for conscript height and missing values for height includes 78,513 individual records. Specifically, it contained relevant information, such as date of birth, municipality of birth and residence, profession, education (highest degree attained) and other socio-demographic indicators. Anthropometric data encompasses height while standing chest, abdominal perimeter and weight. Health records on pathologies, disabilities, physical and mental impairments were recorded for conscripts judged temporarily and permanently unfit.

In order to confirm the existence of an *urban height premium* after the Second World War in Italy, we estimate a regression model (Eq. 1) and test if the relationship between population size and height is significant:

$$Height_{ji} = \beta_0 + \beta_1 POPSIZE_{ji} + \beta_2 Z_{ji} + \mu_{ji}, \tag{1}$$

where, the dependent variable is the height of a large percentage of the 1951 Italian cohort of conscript males ($Height_{ji}$) who were called up for military inspection in the 1970 draft (the recruit j residing in municipality i born in 1951). The other variables included in the model are $POPSIZE_{ji}$ and Z_{ji}. $POPSIZE_{ji}$ is the main independent variable. Based on population of the analyzed period, we have constructed an *"Urban variable"*

that allows us to distinguish municipalities into three groups (or dummies): urban (> 20,000 inhabitants), mixed (5,000 − 20,000 inhabitants), and rural (< 5,000 inhabitants). The variable Z_{ji} designates a series of controls, namely population density, educational attainment and occupational skills of conscripts, and, finally, the error term μ_{ji}. Our dataset covers a substantial percentage of the male cohort born in 1951 and living in Italy in 1970, and it also has a comprehensive geographical range, including data for 3422 out of the 8035 municipalities existing in Italy in 1970. The descriptive statistics reported in Figure 1 highlight the existence of a positive height gap for conscripts born in an urban area with respect to those born in a mixed or rural area. These differences in height are widely significant in the Islands, being young males living in cities 2.59 cm, on average, taller with respect to those born in a rural area.

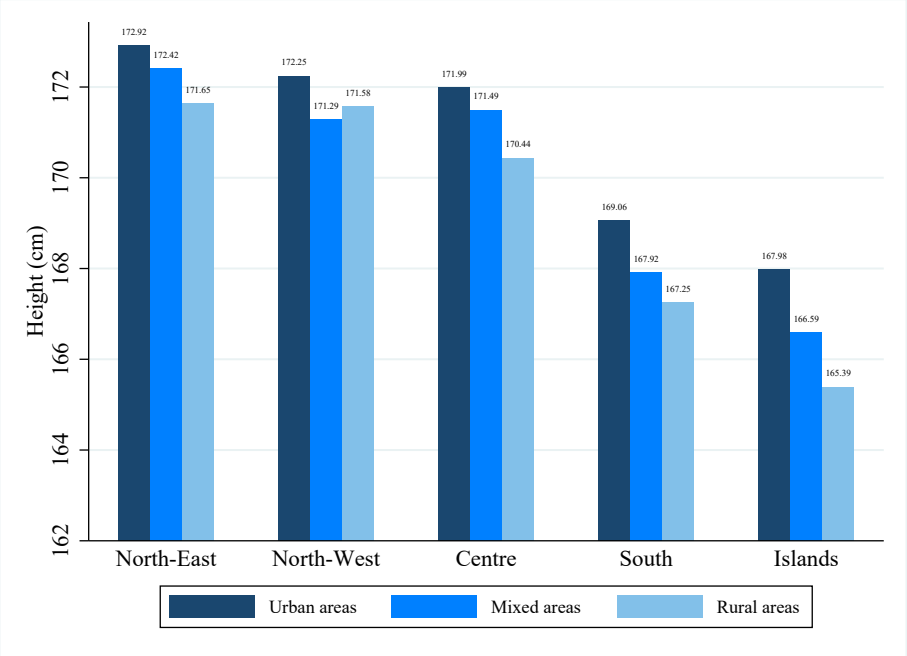

Figure 1: Height of conscripts born in 1951 accordingly to municipality size

3 Preliminary results

The point estimates suggest a positive and statistically significant association between urban male population and height. As evidenced in Table 1 (Column 1) conscripts born in rural areas were shorter at different degrees compared to those born in urban areas (the reference category) showing a monotonic increase: -1.34 cm and -2.78 cm, respectively, depending on whether they lived in mixed or rural areas. The effect of overcrowding does

not seem to concern Italian municipalities in 1951 since the population density variable enters with a positive and statistically significant sign (Column 2). When we control for education (Column 3), we find that higher educated people are significantly taller than illiterate one, as expected. By including a control variable, which accounts for occupational skills, the estimates (Column 4) show that professional are taller than low skilled workers, but shorter than students (the reference category).

Table 1: Estimates of urban-rural height gap in Italy (1951 birth cohort)

	(1)	(2)	(3)	(4)
Municipalities classification				
Mixed	-1.3393***	-0.8444***	-1.1294***	-0.7312***
	(0.0636)	(0.0722)	(0.0771)	(0.0789)
Rural	-2.7829***	-2.2279***	-2.3435***	-1.8501***
	(0.0556)	(0.0676)	(0.0720)	(0.0742)
Urban (ref.)				
Population density		0.0006***	0.0005***	0.0004***
		(0.0000)	(0.0000)	(0.0000)
Education				
At least 5-years			3.3307***	2.3043***
			(0.0745)	(0.0783)
Less than 5-years (ref.)				
Occupational skills				
Farmers				-2.9057***
				(0.1189)
Low skills				-2.6817***
				(0.0606)
Professional				-1.5626***
				(0.0874)
Student (ref.)				
Constant	170.6438***	170.0051***	167.0658***	169.3269***
	(0.0436)	(0.0477)	(0.0745)	(0.1074)
Observations	*78,513*	*78,513*	*64,850*	*61,494*
Adj. R^2	0.0314	0.0340	0.0669	0.0971

Notes: ***p<0.01, **p<0.05, *p<0.10. Robust standard errors are in round brackets. The modality 5-years of education included conscripts who attained at least their elementary education.

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