



# Socioeconomic effects and the role of public spending decomposition on income mobility: a moderated regression model

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## Abstract

The aim of this paper is to investigate, empirically, what components of public spending imply a decreasing effect on income mobility, and what components create income opportunities, also discussing the role of government effectiveness. The role of the components of government expenditure is analysed in the association between intergenerational income mobility and socioeconomic characteristics, which are relevant for the life chances of children. Using the Global Database on Intergenerational Mobility, containing estimates of intergenerational income mobility at country level, and applying the moderated regression model, the results show strikingly consistent patterns. A country with more disadvantaged conditions displays less intergenerational income mobility than other countries, but public spending has a moderating role in improving the life chances of children towards upward economic mobility. Public investment devoted to those socioeconomic characteristics that create income opportunity may lead to less government effectiveness in the achievement of income mobility.

**Keywords** Government expenditure effectiveness · Income mobility · Moderator effect · Public spending · Socioeconomic effects

**JEL Classification** C51 Model Construction and Estimation · H5 National Government Expenditures and Related Policies · J62 Job, Occupational, and Intergenerational Mobility · Z13 Economic Sociology, Economic Anthropology, Language, Social and Economic Stratification

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## Introduction

The work of [4, 5] is the first theoretical framework used by economists and sociologists to explain the income transmission across generations of families. Since then, a rich literature has focused on the measurement of intergenerational income elasticity and several empirical studies have investigated the determinants affecting the intergenerational income mobility [28, 35, 6, 7, 14].

Income mobility seems to be mainly associated to investment in human capital and income inequality. The negative relationship between income inequality and income mobility has been shown in various studies, starting from the work by [34] to the recent meta-analysis by [2]. The importance of investment in human capital for a country in increasing the income mobility is recognized in several contributions [31, 40, 17]. However, other socioeconomic factors may affect income transmission. Recently, particular attention amongst the neighbourhood factors has been given to crime, empirical studies show that a decline in crime increases the expected income rank [11, 33]. There is evidence that health shocks could contribute to intergenerational mobility (i.e., less ability to work, high medical expenses), as well as people moving out of an income class may have very different life expectancy patterns than those staying [18, 8, 22]. Kearney [21] reports evidence that there are improved economic opportunities for women and minorities, but gender and racial wage gaps persist. Urbanization is usually connected with a high rate of social mobility in developed countries, but it will not automatically improve prospects for mobility for the urban poor [15, 30].

This brief review of studies shows that, if on the one hand, there is a rich literature on income mobility and its relationship with income inequality and education opportunity; on the other hand, there are few studies on the association between income transmission and other socioeconomic factors, such as health conditions, urbanization, crime, gender and racial gaps. Furthermore, since growing up under disadvantaged socioeconomic conditions may negatively affect the life chances of children, an important role may be assumed by the adoption of public policies that aim to create opportunities for people living into disadvantaged backgrounds [11, 29, 37, 32, 33]. In particular, to improve the disadvantaged conditions, government expenditure should be devoted to social protection, education, health care, public order, housing and community development. Government spending for education has been identified in various studies as an important policy instrument for income mobility and redistribution [10, 27, 36, 38]. Other components of public spending may also play a crucial role in improving the life chances of children born in disadvantaged conditions towards upward economic mobility [39], but the literature on the analysis of the impacts of the components of government expenditure is limited to few studies [24] show, for selected components of public spending (education, welfare, health, housing and community development), that government expenditure has a greater impact on the income of children from the poorest families than on the income of children coming from rich families. More recently, Nam [25] investigates the moderating role of government spending, considered as aggregated of the previous mentioned components, in the association between income inequality and

intergenerational income mobility. Huang et al. [20] find that there is greater income mobility in high-spending regions.

While there is a growing number of studies facing if and how the socioeconomic conditions and government expenditure affect intergenerational income mobility, there is a limited number of studies that have empirically examined the effects of socioeconomic factors on intergenerational income mobility conditioned on public spending. To address the question, using a moderated regression analysis with cross-country data, this paper investigates the role of the components of government expenditure in the association between intergenerational income mobility and socioeconomic characteristics, which are relevant for the life chances of children.

The findings of the paper confirm a consistent pattern for the socio-economic variables: the intergenerational income mobility increases in the countries with less inequality (income, racial and gender), less crime, more education and more life expectancy. The findings also show that there is a moderating role of the components of public spending in reducing income persistence, which differs amongst the socioeconomic characteristics. Finally, the results show that the existence of disadvantaged conditions may decrease the government expenditure effectiveness leading to less income mobility, as well as public investment devoted to improve those socioeconomic conditions that create income opportunity may lead to less government effectiveness.

The paper proceeds as follows. (“[Measurement of intergenerational income transmission](#)”) provides a brief presentation of the main theoretical model beyond the measurement of intergenerational income transmission in empirical studies. (“[Analysis of the socioeconomic effects](#)”, “[Analysis of the effects of public spending decomposition](#)” respectively, investigate the effects of socioeconomic factors and public spending decomposition. (“[Moderated regression model](#)”) presents the moderated regression model and discusses the role of government expenditure and its effectiveness in the association between income mobility and the socioeconomic characteristics. (“[Conclusions](#)”) sets conclusions.

## Measurement of intergenerational income transmission

The theoretical framework for the measurement of the intergenerational income transmission follows that of [4, 5].

There are two generations, parents (*generation  $t-1$* ) and children (*generation  $t$* ), the intergenerational income transmission is estimated through the following equation:

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t \quad (1)$$

where  $y_{t-1}$  is the permanent income of parents and  $y_t$  is the child lifetime income when adult,  $\alpha$  is the average income of the children when adults,  $\varepsilon_t$  is the unobserved components, and  $\beta$  is the intergenerational income elasticity (IGE). A higher intergenerational income elasticity  $\beta$  implies a lower degree of income mobility.

Studies reporting comparison of estimates of intergenerational income elasticity,  $\beta$ , show that developed countries have high income mobility, the Nordic European countries have the lowest values of intergenerational income elasticity; in developing countries, estimates show that the income mobility is really very limited [35, 6, 26, 7, 14]. Disadvantaged conditions in a country may imply less favourable endowments to be passed from parents to sons, less human capital investment and less returns to capital. The implications are that if we do not consider the socioeconomic factors, the estimates of intergenerational income elasticity may result biased. Amongst the components of government expenditure, higher public investment in education has been identified in various studies as an important policy instrument for boosting income mobility and redistribution [10, 27, 36, 38]. Differently, for the other components of public expenditure, the literature is limited, but they may also play a crucial role in improving opportunity for the life chances of children [24, 20, 25, 39].

Due to limited availability of data on IGE at country level, previous studies reporting cross-country analysis on IGE consider small samples; for example, Boudreaux [9] reports an empirical analysis of the institutional determinants on income mobility using a sample of 25 observations, with estimates of IGE from different studies on income transmission. In this paper, a greater sample has been used with the distinctive advantage of employing a consistent data set on IGE at country level. Data on the variable IGE come from the Global Database on Intergenerational Mobility [16], containing estimates of absolute and relative intergenerational income mobility by 10-year cohorts, covering individuals born between 1940 and 1989.

## Analysis of the socioeconomic effects

The method of Ordinary Least Squares (OLS) with cross-country data is used to capture the relationship between intergenerational income transmission and the socioeconomic factors. More formally, the empirical specification is simply constructed as follows:

$$IGE_i = \alpha + \beta X_i + \varepsilon_i \quad (2)$$

where the dependent variable *IGE* measures the intergenerational income elasticity; *X* denotes the set of variables related to the socioeconomic characteristics;  $\varepsilon$  is the stochastic error term and *i* is the subscript for country.

Higher values of IGE indicate greater intergenerational income persistence and, hence, lower income mobility. The set *X* includes the proxies related to the socioeconomic conditions, which are: Gini index for income inequality; school enrolment (secondary, % gross) for education; prison population rate for crime; life expectancy at birth for the health indicator; urbanization rate; labour force participation rate (% of female population ages 15+) for female labour participation; international migrant stock for immigration. The sample is constructed on the annual data of 24 OECD Member States over the period 1995–2000. In the Appendix, Table A1

reports the list of countries. Table A2 presents the description of the variables with the data sources and summary statistics.

Table 1, in column (1.1), reports the OLS regression results of the socioeconomic effects on IGE. The selected explanatory variables exhibit the predicted sign. The coefficient upon income inequality is positive confirming the existence of the so-called Gatsby curve between income inequality and IGE, firstly defined by Krueger [23] based on Corak's data [14]. For the proxy related to education, the coefficient is negative suggesting, as reported in several studies, the importance of the formation of human capital for a country in increasing the intergenerational mobility. Higher life expectancy leads to higher income mobility. This result is consistent to the fact that higher life expectancy increases human capital, which contributes to the rise of GDP per capita as well as income mobility [19]. Countries with higher levels of urbanization will experience reductions in the IGE, this is because it is easier to promote social mobility through access to education and labour market opportunities when children and workers are clustered in urban areas; also studies show that migrants in urban areas have more upward social mobility than those in rural areas. The coefficient upon female labour participation is negative confirming previous studies that reveal how gender attitudes are a key transmission mechanism for intergenerational economic mobility. The presence of immigrants positively affects IGE. It is well-recognized that immigrants have lower socio-economic outcomes than natives, and this impacts on the outcomes of their children negatively in terms of upward income mobility. The exposure to neighbourhood violence may be a central mechanism by which growing up in areas of concentrated disadvantage reduces the life chances of children to move upward in the income distribution; however, the OLS results do not show any substantial relationship between the arrest rate, used as proxy for crime, and IGE. Almost all the coefficients are statistically significant. Considering the results in terms of magnitude, they may appear small and not relevant, but if we consider that IGE is defined on the range between 0 and 1, these small marginal effects call to pay attention to the socio-economic conditions and how they may affect income mobility. For example, if we increase female labour participation and education by one percentage point, then the income mobility will go up, respectively, by 0.004 and 0.001. The strongest positive effect on income mobility is due to the health indicator, a unit change in life expectancy is associated with an increase in income mobility that is 0.025 larger. Differently, an increase by 1 percent in income inequality and immigration would lead to a decrease in income mobility, respectively, by 0.3 and 0.1 percent.

## Analysis of the effects of public spending decomposition

To investigate the effects of the government expenditure on income mobility, five components of public spending have been included in the analysis, which are especially targeted to improve the disadvantaged conditions and to promote upward mobility [24]; they are the government expenditure devoted to social protection, education, health care, public order and safety, housing and community development. The regression model specified in Eq. (2) is extended as follows:

**Table 1** OLS regression (dependent variable: intergenerational income elasticity)

	(1.1)	(1.2)	(1.3)
Constant	2.409 (7.589)***	0.916 (3.155)***	1.368 (4.403)***
Income inequality (Gini index)	0.004 (1.427)	0.003 (1.52)	0.005 (2.401)**
School enrolment, secondary (% gross)	– 0.001 (1.688)*	– 0.001 (1.315)	– 0.002 (4.009)***
Life expectancy at birth (years)	– 0.025 (5.473)***	– 0.001 (0.127)	– 0.016 (1.993)**
Urbanization rate	– 0.001 (0.488)	0.001 (1.58)	0.002 (2.317)**
Labour force participation rate, female (% of female population ages 15+)	– 0.004 (2.973)***	– 0.001 (0.828)	– 0.002 (1.993)**
International migrant stock (% of population)	0.003 (2.658)***	0.005 (5.07)***	0.004 (3.739)***
Prison population rate (per 100,000 of national population)	0.000 (5.065)***	0.001 (7.404)***	0.000 (3.957)***
Social protection (government expenditure per capita, ln)		0.118 (4.625)***	
Education (government expenditure per capita, ln)		– 0.249 (10.215)***	
Public order and safety (government expenditure per capita, ln)		0.088 (3.842)***	
Health (government expenditure per capita, ln)		– 0.114 (4.901)***	
Housing and community development (government expenditure per capita, ln)		0.069 (5.576)***	
Social protection (government expenditure, % GDP)			0.004 (1.646)
Education (government expenditure, % GDP)			– 0.015 (1.142)
Public order and safety (government expenditure, % GDP)			0.111 (6.689)***
Health (government expenditure, % GDP)			– 0.014 (2.343)**
Housing and community development (government expenditure, % GDP)			0.043 (3.297)***
Number of observations	144	144	144
$R^2$	0.63	0.84	0.8
Adj $R^2$	0.61	0.83	0.78
$F$ -test	33.23***	58.34***	43.23***

**Table 1** (continued)

Absolute *t*-statistics are displayed in parentheses under the coefficient estimates

\*Statistically significant at the 10% level

\*\*Statistically significant at the 5% level

\*\*\*Statistically significant at the 1% level

$$IGE_i = \alpha + \beta_1 X_i + \beta_2 Z_i + \varepsilon_i \quad (3)$$

where the vector *Z* includes the components of public spending. Table A2 reports details on the government expenditure by function with the data sources and summary statistics.

Table 1 shows the results using as proxy the natural log of government expenditure per capita, in columns (1.2), and government expenditure as share of GDP, in columns (1.3).

They confirm a consistent pattern for the socio-economic variables: the intergenerational income mobility increases in the countries with less income inequality, immigration and crimes; income mobility occurs in those countries with more education and female participation in the labour market. For the components of government expenditure, the results show that an increase by 1 percent in government expenditure as share of GDP for education and health care would lead to an increase in income mobility by 0.23 percent. The effects of the government education and health expenditure per capita are stronger than the effects of the government expenditure as share of GDP. In fact, we have that an increase by 1 percent in government expenditure per capita for education and health care would lead to an increase in income mobility, respectively, by 0.71 and 0.33 percent. This means that income mobility is higher in those countries where there is more public investment per capita devoted to education and health care rather than just an increase in the government expenditure as share of GDP. Furthermore, the OLS estimates show that the government expenditure oriented to improve some disadvantaged conditions does not lead to an increase in income mobility; this occurs for the public spending devoted to social relief, such as social expenditure and housing and community development expenditure, and government expenditure for public order and safety.

## Moderated regression model

In the analysis of the effects of the socioeconomic conditions and of the components of the public expenditure on the intergenerational income transmission, a couple of research questions, neglected in literature, merit to be faced. One question is related to the role of government expenditure in the association between the socioeconomic conditions and income mobility. The other question aims to investigate if the socioeconomic characteristics may reduce the government expenditure effectiveness, which can be measured by the achievement of creating income mobility.

These questions involve the concept of moderator, which typically addresses “when or under what conditions”, a predictor variable alters the strength of the relationship between another independent variable and a dependent variable [3].

In the regression analysis, the moderator variable is connected to the exogenous variable multiplicatively and is integrated into the analysis as interaction term. In detail, in the first step, a regression model, called basic model, is formulated including both the socioeconomic variables in the set  $X$ , and the component of the government expenditure  $z_i$  from the set  $Z$  as follows:

$$IGE_i = \alpha + \beta_1 X_i + \beta_2 z_i + \varepsilon_i \quad (4)$$

After that, in a second step, a regression model, called interaction model, is formulated where the product term, between the socioeconomic variable  $x_i$  from the set  $X$ , and the component of the government expenditure  $z_i$ , is additionally taken into the regression equation as follows:

$$IGE_i = \alpha + \beta_1 X_i + \beta_2 z_i + \beta_3 (x_i * z_i) + \varepsilon_i \quad (5)$$

The significance of the regression coefficient  $\beta_3$  belonging to the interaction term in Eq. (5), that is the  $t$ -test, shows if there is a moderating effect of the government expenditure in increasing income mobility (if  $\beta_3 > 0$ ), or if the socioeconomic characteristic may lead to a decrease in government expenditure effectiveness (if  $\beta_3 < 0$ ). Therefore, the change of the coefficient of determination  $R^2$  from the base model to the interaction model is a measure of the effect size indicating how much criterion variance is additionally explained by the product term and, therefore, can be ascribed to the moderator effect due to component of the government expenditure or to the socioeconomic characteristic [1]. The strength of the moderator effect is often displayed in form of the effect size index ( $f^2$ ):

$$f^2 = \frac{R_i^2 - R_b^2}{1 - R_i^2} \quad (6)$$

where by  $R_i^2$  and  $R_b^2$  are the coefficient of determination, respectively, of the interaction model and of the basic model. For the evaluation of the effect size, Cohen [12] and Cohen et al. [13] have conventionally established the following values: low if  $0.02 < f^2 < 0.15$ ; medium if  $0.15 \leq f^2 < 0.35$ ; high if  $f^2 \geq 0.35$ .

The interactions between  $x_i$  and  $z_i$  can take three typical patterns [13]: (a) enhancing interactions, in which both  $x_i$  and  $z_i$  affect the outcome variable in the same direction and together they have a stronger effect than a merely additive one; (b) buffering interactions, in which  $z_i$  weakens the effect of  $x_i$  on the outcome, or in which  $x_i$  weakens the effect of  $z_i$  on the outcome; and (c) antagonistic interactions, in which  $x_i$  and  $z_i$  have the same effect on the outcome, but the interaction is in the opposite direction.

The moderated regression model is applied considering that public spending for social protection and education is oriented to reduce income inequality, to increase labour participation of female and to sustain immigrants; public spending for education is devoted to increase human capital as well as to decrease inequality (income,



gender and minority) and crime; government expenditure for public order and safety allows of increasing the enforcement level against the criminal activities; public spending for housing and community development occurs in urbanized cities; public health expenditure is relevant to increase life expectancy reducing illness and mortality, as well as to improve the health conditions of immigrants.

Table 2 shows mixed results for the coefficients upon the interaction of the socio-economic variables with their related components of government expenditure per capita. Table A3 in the Appendix reports the basic model. The results can be aggregated in three sets.

The first set includes the interactions that take a buffering pattern statistically significant, in which the component of public spending per capita weakens the effect of the socioeconomic characteristics on IGE. In detail, the moderating role of government education expenditure in increasing income mobility is found in association with labour participation of female, immigration and crime. Also government expenditure for social protection and health care result to assume a moderating role that yields more income mobility in association with immigration. In terms of effect size, the strength of public spending as moderator variable is very low for labour participation of female, approximately medium for immigration, and almost high for crime.

The second set includes the results that show an antagonistic interaction, in which the socio-economic characteristics and the components of government expenditure have the same effect on the IGE, but the interaction is in the opposite direction leading to a moderating role of public spending in increasing income mobility. This is found statistically significant for the public order and safety expenditure per capita in the association between crime and IGE with a very high effect size. There is also an antagonistic interaction between the government expenditure devoted to social protection and female labour participation, but it is not statically significant, and the effect size is very low.

The third set includes the socioeconomic characteristics that show an antagonistic interaction statistically significant with government expenditure reducing its effectiveness in the achievement of creating income mobility. In this set we find that income inequality decreases the effectiveness of public spending devoted to social protection and, hence, there is a positive effect of the interaction term on IGE. Also there is an antagonistic interaction with positive effect on IGE between public education expenditure and the proxy related to schooling, and public health expenditure with life expectancy. These latter results suggest that public investment devoted to improve those socioeconomic conditions that create income opportunity (i.e., education, life expectancy and urbanization), leads to less government effectiveness. The effect size is found to be high for the interaction term between government expenditure for health and life expectancy, low in the other interactions.

Table 3 reports the results of the interaction model in which the government expenditure per capita by function has been substituted with the components of the government expenditure, as share of GDP. Table A4 in the Appendix reports the basic model. The results mainly show an antagonistic interaction between

**Table 2** Interaction model (dependent variable: intergenerational income elasticity)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Constant	4.198***	0.813	2.016**	13.101***	2.936***	0.551	0.176	1.069***	0.362	1.115***	-0.862***	-0.172
Income inequality (Gini index)	-0.052***	0.001	0.001	-0.003	0.003	0.002	0.001	-0.001	-0.000	-0.002	0.000	0.000
School enrollment, secondary (% gross)	-0.001	-0.001*	-0.015*	-0.002**	-0.001	-0.001**	-0.001**	-0.002***	-0.002***	-0.001**	-0.001**	-0.001**
Life expectancy at birth (years)	-0.025***	0.005	0.007	-0.156***	-0.02***	-0.009	0.007	-0.002	0.009*	-0.002	0.021**	0.003
Urbanization rate	0.000	0.000	0.000	-0.001*	-0.012*	-0.000	0.000	0.000	0.000	-0.001	-0.002**	-0.002**
Labour force participation rate, female (% of female population ages 15+)	-0.002	-0.001	-0.002	-0.004***	-0.004***	0.016	0.008	-0.003***	-0.001	-0.004***	-0.003***	-0.004***
International migrant stock (% of population)	0.004***	0.006***	0.006***	0.001	0.003**	0.004***	0.006***	0.048***	0.036***	0.032***	0.002**	-0.001
Prison population rate (per 100,000 of national population)	0.000***	0.001***	0.001***	0.001***	0.001***	0.000	0.001***	0.000***	0.001***	0.001***	0.005***	0.006***
Social protection (government expenditure per capita, ln)	-0.258***					0.078		-0.017				
Education (government expenditure per capita, ln)		-0.13*	-0.31***				-0.058		-0.093***		-0.016	
Public order and safety (government expenditure per capita, ln)												0.131***
Health (government expenditure per capita, ln)				-2.048***						-0.035*		
Housing and community development (government expenditure per capita, ln)					-0.176*							
Income inequality (Gini index) <sup>a</sup> Social Protection (government expenditure per capita, ln)	0.007***											

**Table 2** (continued)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Income inequality (Gini index)*Education (government expenditure per capita, ln)		0.000										
School enrolment, secondary (% gross)*Education (government expenditure per capita, ln)			0.002*									
Life expectancy at birth (years)*Health (government expenditure per capita, ln)				0.026***								
Urbanization rate*Housing and community development(government expenditure per capita, ln)					0.002							
Labour force participation rate, female (% of female population ages 15 +)*Social Protection (government expenditure per capita, ln)						- 0.002						
Labour force participation rate, female (% of female population ages 15 +)*Education (government expenditure per capita, ln)										- 0.001***		
International migrant stock (% of population)*Social Protection (government expenditure per capita, ln)												- 0.005***

**Table 2** (continued)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
International migrant stock (% of population)*Education (government expenditure per capita, ln)									- 0.004***			
International migrant stock (% of population)*Health (government expenditure per capita, ln)										- 0.004***		
Prison population rate (per 100,000 of national population)*Education (government expenditure per capita, ln)											- 0.001***	
Prison population rate (per 100,000 of national population)*Public order and safety (government expenditure per capita, ln)												- 0.001***
Number of observations	144	144	144	144	144	144	144	144	144	144	144	144
R <sup>2</sup>	0.67	0.73	0.74	0.78	0.64	0.66	0.73	0.71	0.76	0.72	0.80	0.77
Adj R <sup>2</sup>	0.65	0.72	0.72	0.77	0.62	0.63	0.72	0.69	0.74	0.69	0.79	0.76
F-test	30.44***	40.89***	42.1***	52.88***	26.41***	28.29***	41.06***	35.69***	46.79***	37.86***	60.76***	50.31***
Interaction pattern	Ant	Buff	Ant	Ant	Ant	Ant	Buff	Buff	Buff	Buff	Buff	Ant
R <sub>1</sub> <sup>2</sup> -R <sub>0</sub> <sup>2</sup>	0.020	0.000	0.006	0.092	0.007	0.004	0.001	0.054	0.03	0.03	0.07	0.14
F <sup>2</sup>	0.062	0.000	0.022	0.419	0.020	0.012	0.003	0.185	0.106	0.104	0.334	0.614

Absolute *t*-statistics are displayed in parentheses under the coefficient estimates

Ant antagonistic, Buff buffering, Enh enhancing

\*Statistically significant at the 10% level

\*\*Statistically significant at the 5% level

\*\*\*Statistically significant at the 1% level

socioeconomic characteristic and the components of public spending decomposition. There is a statistically significant moderating role of public education expenditure in increasing income mobility in association with income inequality and crime. The results also confirm that public investment devoted to improve the socioeconomic conditions that create income mobility (i.e., education, life expectancy, urbanization and female labour participation), leads to less government effectiveness.

## Conclusions

This paper has investigated the mechanism linking intergenerational income transmission, socioeconomic characteristics and public spending decomposition.

If on the one hand, there is a growing number of studies facing if and how the socioeconomic conditions and government expenditure affect intergenerational income mobility; on the other hand, in literature there is a limited number of studies that have empirically examined the effects of socioeconomic factors on intergenerational income mobility conditioned on government expenditure.

In this context, the cross-country analysis suggests that: (i) if we do not consider socioeconomic characteristics, the intergenerational income elasticity may result biased; (ii) a country with more disadvantaged conditions displays less intergenerational income mobility than other countries; (iii) countries would benefit of higher income mobility if public spending has a moderating role in the association between socioeconomic variables and IGE; (iv) some socioeconomic characteristics may decrease the effectiveness of government expenditure in creating income mobility.

The policy implications are relevant providing to the policy-makers a better understanding of the nexus between income mobility, socioeconomic characteristics and the potential role of government expenditure. In detail, the findings on the socioeconomic effects show that the intergenerational income mobility increases in the countries with less income inequality, crime and immigration; more education creates opportunity in income transmission, as well as gender attitudes are important for upward economic mobility in a country. Amongst the components of government expenditure, those devoted to education are beneficial for income mobility assuming also a moderating role in the association with inequality (income, gender and ethnic) and crime. Also social protection expenditure has a moderating role for immigration and female labour participation, as well as health care expenditure yields more income mobility in the association with immigration. Finally, government expenditure effectiveness is reduced if public investment is devoted to socioeconomic characteristics that have a positive association with income mobility, such as education, life expectancy and urbanization.

## Appendix

See Appendix Tables [A1](#), [A2](#), [A3](#), [A4](#).

**Table 3** Interaction model (dependent variable: intergenerational income elasticity)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Constant	3.517***	1.816***	3.658***	5.649***	2.839***	2.386***	3.529***	2.403***	2.846***	2.382***	1.397***	1.178***
Income inequality (Gini index)	-0.042***	0.039***	0.005**	0.001	0.005**	0.004	0.004	0.004	0.003	0.002	0.006***	0.005**
School enrolment, secondary (% gross)	-0.001	0.001	-0.009***	-0.001**	-0.001	-0.001*	0.000	-0.001	-0.002***	-0.001	0.000	-0.002***
Life expectancy at birth (years)	-0.025***	-0.031***	-0.028***	-0.064***	-0.027***	-0.025***	-0.03***	-0.025***	-0.023***	-0.022***	-0.019***	-0.01**
Urbanization rate	0.001	-0.002**	-0.002	-0.002*	-0.005**	-0.000	-0.001	-0.001	0.001	-0.001	-0.002*	0.003***
Labour force participation rate, female (% of female population ages 15+)	-0.001	-0.001	-0.001	-0.003**	-0.004***	-0.003	-0.012**	-0.004***	-0.002	-0.004***	-0.002	-0.004***
International migrant stock (% of population)	0.001	0.004***	0.004***	0.002**	0.003***	0.003**	0.004***	0.001	-0.058***	0.004	0.005***	0.003**
Prison population rate (per 100,000 of national population)	0.001***	0.001***	0.001***	0.001***	0.000***	0.000***	0.001***	0.001***	0.000***	0.001***	0.006***	-0.002***
Social protection (government expenditure, % GDP)	-0.091***					0.004	0.001	0.001				
Education (government expenditure, % GDP)		0.147**	-0.231***				-0.197***		-0.119***		0.053**	
Public order and safety (government expenditure, % GDP)												0.002
Health (government expenditure, % GDP)				-0.754***						-0.011		

**Table 3** (continued)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Housing and community development (government expenditure, % GDP)					- 0.439**							
Income inequality (Gini index)*Social Protection (government expenditure, % GDP)	0.003***											
Income inequality (Gini index)*Education (government expenditure, % GDP)		- 0.007***										
School enrolment, secondary (% gross)*Education (government expenditure, % GDP)			0.002***									
Life expectancy at birth (years)*Health (government expenditure, % GDP)				0.01***								
Urbanization rate*Housing and community development(government expenditure, % GDP)					0.006**							
Labour force participation rate, female (% of female population ages 15 +)*Social Protection (government expenditure, % GDP)						0.000						

**Table 3** (continued)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Labour force participation rate, female (% of female population ages 15 +)*Education (government expenditure, % GDP)							0.002**					
International migrant stock (% of population)*Social Protection (government expenditure, % GDP)								0.000				
International migrant stock (% of population)*Education (government expenditure, % GDP)								0.012***				
International migrant stock (% of population)*Health (government expenditure, % GDP)										0.000		
Prison population rate (per 100,000 of national population)*Education (government expenditure, % GDP)											- 0.001***	
Prison population rate (per 100,000 of national population)*Public order and safety (government expenditure, % GDP)												0.001***



Table 3 (continued)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Number of observations	144	144	144	144	144	144	144	144	144	144	144	144
$R^2$	0.73	0.7	0.71	0.69	0.66	0.63	0.69	0.63	0.77	0.64	0.73	0.79
Adj $R^2$	0.72	0.68	0.69	0.67	0.64	0.61	0.67	0.61	0.76	0.62	0.71	0.77
$F$ -test	40.92***	35.18***	35.62***	32.7***	29.43***	25.63***	33.3***	25.67***	50.91***	26.89***	40.01***	55.29***
Interaction pattern	Ant	Ant	Ant	Ant	Ant	Buff	Ant	Enh	Ant	Buff	Ant	Buff
$R_1^2$ - $R_6^2$	0.10	0.02	0.02	0.04	0.02	0.00	0.01	0.00	0.09	0.00	0.05	0.02
$f^2$	0.38	0.07	0.08	0.14	0.05	0.00	0.03	0.00	0.41	0.00	0.17	0.11

Absolute  $t$ -statistics are displayed in parentheses under the coefficient estimates

Ant antagonistic, Buff buffering, Enh enhancing

\*Statistically significant at the 10% level

\*\*Statistically significant at the 5% level

\*\*\*Statistically significant at the 1% level

**Table A1** List of countries

Code*	Country
AUS	Australia
AUT	Austria
BEL	Belgium
CHE	Switzerland
CZE	Czech Republic
DEU	Germany
DNK	Denmark
ESP	Spain
FIN	Finland
FRA	France
GBR	United Kingdom
GRC	Greece
IRL	Ireland
ITA	Italy
KOR	Rep. of Korea
LUX	Luxembourg
LVA	Latvia
NLD	Netherlands
NOR	Norway
PRT	Portugal
SVK	Slovakia
SVN	Slovenia
SWE	Sweden
USA	United States of America

\*World Bank country code

**Table A2** Description of variables, data sources and summary statistics

Variable	Mean	S.D	Min	Max	Source
<i>Dependent variable</i>					
Intergenerational income elasticity	0.35	0.17	0.11	0.89	Global Database on Intergenerational Mobility
<i>Socioeconomic variables</i>					
Income inequality (Gini index)	31.17	4.78	23.00	40.50	UNU-Wider Database
School enrolment, secondary (% gross)	107.15	19.41	82.16	156.55	World Bank Indicators Database
Prison population rate (per 100,000 of national population)	130.21	132.46	55	683	World Prison Brief ( <a href="https://www.prisonstudies.org/">https://www.prisonstudies.org/</a> )
Life expectancy at birth (years)	76.51	2.48	66.39	79.78	World Bank Indicators Database
Urbanization rate	73.55	10.7	50.62	97.13	World Bank Indicators Database
Labour force participation rate, female (% of female population ages 15 +)	61.58	9.03	42.68	77.08	World Bank Indicators Database
International migrant stock (% of population)	9.51	7.54	0.28	32.04	World Bank Indicators Database
<i>Government expenditure variables</i>					
Social protection (government expenditure, % GDP)	15.44	5.13	2.32	25.25	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Education (government expenditure, % GDP)	5.16	0.95	3.22	7.17	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Public order and safety (government expenditure, % GDP)	1.62	0.63	0.74	4.34	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Health (government expenditure, % GDP)	5.47	1.49	1.33	7.66	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Housing and community development (government expenditure, % GDP)	0.84	0.53	0.11	5.45	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Social protection (government expenditure per capita, ln)	7.89	0.95	5.64	9.09	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Education (government expenditure per capita, ln)	6.85	0.79	4.83	7.88	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>

Table A2 (continued)

Variable	Mean	S.D	Min	Max	Source
Public order and safety (government expenditure per capita, ln)	5.65	0.62	4.11	6.62	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Health (government expenditure per capita, ln)	6.87	0.85	4.26	7.93	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>
Housing and community development (government expenditure per capita, ln)	4.92	0.77	2.89	7.38	<a href="https://ourworldindata.org/government-spending">https://ourworldindata.org/government-spending</a> <a href="https://data.oecd.org/gga/central-government-spending.htm">https://data.oecd.org/gga/central-government-spending.htm</a>

**Table A3** Basic model (dependent variable: intergenerational income elasticity)

	(1)	(2)	(3)	(4)	(5)
Constant	1.839***	0.827**	2.323***	1.387***	2.327***
Income inequality (Gini index)	0.002	0.001	0.003	0.000	0.003
School enrolment, secondary (% gross)	- 0.001*	- 0.001*	- 0.001	- 0.001	- 0.001
Life expectancy at birth (years)	- 0.012**	0.005	- 0.023***	- 0.003	- 0.023***
Urbanization rate	- 0.001	0.000	- 0.001	- 0.001	- 0.001
Labour force participation rate, female (% of female population ages 15+)	- 0.003**	- 0.001	- 0.003***	- 0.003***	- 0.004***
International migrant stock (% of population)	0.005***	0.006***	0.003***	0.004***	0.003***
Prison population rate (per 100,000 of national population)	0.000***	0.001***	0.000***	0.001***	0.000***
Social protection (government expenditure per capita, ln)	- 0.046***				
Education (government expenditure per capita, ln)		- 0.132***			
Public order and safety (government expenditure per capita, ln)			- 0.008		
Health (government expenditure per capita, ln)				- 0.079***	- 0.01
Housing and community development (government expenditure per capita, ln)		144	144	144	144
Number of observations	144	144	144	144	144
$R^2$	0.65	0.73	0.63	0.69	0.63
Adj $R^2$	0.63	0.72	0.61	0.67	0.61
$F$ -test	31.5***	46.35***	28.89***	37.26***	29.01***

Absolute  $t$ -statistics are displayed in parentheses under the coefficient estimates

\*Statistically significant at the 10% level

\*\*Statistically significant at the 5% level

\*\*\*Statistically significant at the 1% level

**Table A4** Basic model (dependent variable: intergenerational income elasticity)

	(1)	(2)	(3)	(4)	(5)
Constant	2.411***	2.664***	1.382***	2.392***	2.237***
Income inequality (Gini index)	0.004	0.003	0.005***	0.002	0.004*
School enrolment, secondary (% gross)	-0.001*	0.000	-0.002***	-0.001	-0.001**
Life expectancy at birth (years)	-0.025***	-0.028***	-0.017***	-0.022***	-0.024***
Urbanization rate	-0.001	-0.001	0.003***	-0.001	0.000
Labour force participation rate, female (% of female population ages 15+)	-0.004***	-0.001	-0.003***	-0.004***	-0.003***
International migrant stock (% of population)	0.003**	0.004***	0.004***	0.003**	0.003***
Prison population rate (per 100,000 of national population)	0.001***	0.001***	0.000***	0.001***	0.000***
Social protection (government expenditure, % GDP)	0.002	-0.055***			
Education (government expenditure, % GDP)					
Public order and safety (government expenditure, % GDP)			0.123***		
Health (government expenditure, % GDP)				-0.014**	
Housing and community development (government expenditure, % GDP)					0.043**
Number of observations	144	144	144	144	144
$R^2$	0.63	0.68	0.76	0.64	0.65
Adj $R^2$	0.61	0.66	0.75	0.62	0.63
$F$ -test	29.04***	36.14***	54.81***	30.42***	31.08***

Absolute  $t$ -statistics are displayed in parentheses under the coefficient estimates

\*Statistically significant at the 10% level

\*\*Statistically significant at the 5% level

\*\*\*Statistically significant at the 1% level

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s42495-022-00098-1>.

## Declarations

**Conflict of interest** The author has no competing interests to declare that are relevant to the content of this article.

**Ethical approval** This article does not contain any studies with human participants or animals performed by the author.

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