

Public Expenditure and Economic Growth: Empirical Evidence for the EU

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Abstract

The relationship between government size and economic growth is a major task in the economic literature and this paper is devoted to public expenditure. We empirically study the relationship between public expenditure and economic growth in the European Union. Our approach consists on a quantile regression for the period 2004–2019. The results show a negative and significant impact of total public expenditure on economic growth, with a higher effect in the high tail of the growth distribution. In a more detailed analysis, the study of three large public expenditures, considering the percentage of total public expense, reveals an insignificant effect of health, and a negative impact of education and social protection, higher in the low tail of the growth distribution. Our findings allow better understanding of the effects of public policies on development beyond linear approaches.

Keywords: Public expenditure, growth, European Union, quantile regression

JEL Classification: C21, O47, H50

1. Introduction

The relationship between government size and economic growth has attracted significant attention in the literature in the last decades. Both tax burden and public expenditure may affect economic growth, and the analysis can distinguish between the total and the main components in both cases: specific taxes, distortionary or not, tax rates or progressivity in the former case; and several types of public expenditure, can affect economic growth in a positive or negative sense, as both theoretical models and empirical evidence reveal.

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In this paper, we focus on public expenditure and the effect on long-term economic growth considering a recent period with several cycles. Regarding the theoretical approach, the traditional distinction between productive and non-productive public expenditures should be noted, but this classification is not always justified¹. The neoclassical economic growth models (Solow, 1956; Swan, 1956 ; Sato, 1963; Lucas, 1988; King and Rebelo, 1990; Mankiw *et al.*, 1992) consider that taxation and expenditure can affect the level of income, but have no impact on the economic growth rate in the long run². In contrast, in the endogenous growth models (Romer, 1986; Barro, 1990; Barro and Xala-i-Martin, 1992; Cashin, 1995; Bajo-Rubio, 2000), government expenditure, and also taxation, have both temporary and permanent effects on economic growth³. The empirical evidence, reviewed in more detail in Section 2, is not conclusive. With a relevant negative effect of fiscal policy on growth found by Barro (1991), mixed results have been evidenced in empirical papers, reported in surveys such as Levine and Zervos (1993), Slemrod (1995), Agell *et al.* (1997), Fölster and Henrekson (1999), Nijkamp and Poot (2004) and Irmen and Kuehnel (2009).

We empirically analyse the effect of public expenditure on economic growth. Specifically, we focus on the European Union, especially interesting because it is an integrated economic area, although Member States enjoy a large degree of autonomy within their territories, and the period is from 2004 to 2019, including years of economic growth, the Great Recession and the recovery. We consider the total public expenditure, as percentage of GDP, a level indicator, and the percentage of three main expenditures in the total public expense, to explore the composition, namely health, education and social protection following the COFOG (Classification of the Functions of Government). In 2019, these categories represented 15.6%, 10.3% and 40.7% of total public expenditure in the EU-28 respectively, or 66.6% for the three categories jointly⁴.

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- 1 The traditional classification refers to productive expenditures: expenses on general public services, defence, education, health, housing, transport and communication. On the contrary, unproductive expenditures include social security and welfare, recreation and economic services (Bleaney *et al.*, 2001). An interesting paper about whether public expenditure is productive is Aschauer (1989). The connection between welfare and economic performance was discussed by Atkinson (1995) and Baier and Glomm (2001). Afonso *et al.* (2014) concluded a positive theoretical relationship between productive public expenditure and growth. Finally, Ferreira *et al.* (2012) revised the composition of public expenditures in the EU, and Apergis *et al.* (2013) and Ferreira *et al.* (2014) analysed the convergence of public expense in the EU.
 - 2 See Carboni and Medda (2011) for a recent theoretical modelling of the relationship between public spending and economic growth in a neoclassical framework.
 - 3 From another perspective, we could analyse Wagner's law (see Wagner and Webber, 1977; Henrekson, 1993; or more recently, Jaen-García, 2018), where expenditure is an endogenous factor of growth, versus Keynes' law, where public expenditure is considered an exogenous factor or policy instrument to influence growth. See Ramírez-Cedillo and López-Herrera (2021) for a recent comparative study for LATAM.
 - 4 The other expenditures refer to: (1) general public services, (2) defence, (3) public order and safety, (4) economic affairs, (5) environmental protection, (6) housing and community amenities, and (7) recreation, culture and religion.
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Our main contribution consists of a quantile regression approach, a flexible model which allows us to deal with different effects along the growth distribution. Compared to the average behaviour achieved in linear models, the quantile regression captures different patterns along the distribution of economic growth. The choice of this approach is mainly founded in the mixed results achieved in the literature, reviewed in Section 2, and essentially based on linear models. Precisely that review of the empirical literature is also a major contribution of this manuscript.

The results show a negative and significant impact of total public expenditure on economic growth, higher at the top of the growth distribution. In addition, while health public expense appears as insignificant, a negative effect is concluded for education and social protection expenditures. Our findings support the hypothesis of a nonlinear impact of public expenditure on economic growth, a result to be properly considered in the public policy decisions.

The rest of the paper is organized as follows. Section 2 reviews the empirical literature on public expenditure and economic growth, followed by the empirical strategy based on quantile regression. Section 3 presents the data and main results. Section 4 contains the discussion and, finally, the main conclusions are drawn in Section 5.

2. Empirical Literature Review

Due to the large empirical literature on government size and economic growth and the objective of this paper, we only consider empirical papers on public expenditure and economic growth for a group of countries, avoiding studies for isolated countries or regions. Table 1 summarizes selected papers on total public expenditure and economic growth, while Table 2 focuses on some specific expenditures, namely health, education⁵ and social protection, and growth. The evidence is mixed, especially for the total expense, although most studies concluded a negative relationship, and education. Finally, in the case of health, the evidence shows a negative impact in some empirical studies, but insignificant in others and even mixed results.

5 Agenor and Neanidis (2011) analysed the optimal allocation of government spending between health, education (and infrastructure) in an endogenous growth framework.

Table 1: Selected papers on public expenditure and economic growth (total expense)

Paper	Data	Results
Landau (1983)	100 countries 1961–1976	Negative
Saunders (1985)	OECD 1960–1981	Insignificant
Ram (1986)	115 countries 1960–1980	Positive
Conte and Darrat (1988)	22 countries 1960–1984	Mixed results
Castles and Dowrick (1990)	OECD 1960–1985	Insignificant
Engen and Skinner (1992)	107 countries 1970–1985	Negative
Easterly and Rebelo (1993)	World 1970–1988	Insignificant
Cashing (1994)	23 countries 1971–1988	Mixed results
Lin (1994)	62 countries 1960–1985	Positive in short run and insignificant in long run
Hansson and Henrekson (1994)	14 countries 1970–1987	Negative
Devarajan <i>et al.</i> (1996)	43 countries 1970–1990	Insignificant
Kneller <i>et al.</i> (1999)	22 OECD countries 1970–1995	Mixed results (positive for productive and insignificant for non-productive)
Bleaney <i>et al.</i> (2001)	OECD 1970–1995	
Fölster and Henrekson (2001)	Rich countries 1970–1995	Negative
Strauss (2001)	64 countries	Insignificant
Gupta <i>et al.</i> (2005)	39 countries 1990s	Mixed results
Angelopoulos <i>et al.</i> (2007)	23 OECD countries 1970–2000	Positive (share of productive expenditure)
Bose <i>et al.</i> (2007)	30 countries 1970–1990	Mixed results (positive: capital expenditure and insignificant: current expenditure)
Angelopoulos <i>et al.</i> (2008)	64 countries 1980–2000	Mixed results
Gregoriou and Ghosh (2009)	15 countries 1972–1999	Mixed results
Afonso and González-Alegre (2011)	15 EU countries 1971–2006	Negative
Martins and Veiga (2014)	156 countries 1980–2010	Quadratic, U-inverted (with Human Development Index)
Castro (2018)	15 countries 1990–2012	Positive
Szarowská (2022)	4 countries 2000–2020	Mixed results

Source: Author's own elaboration

Table 2: Selected papers on public expenditure and economic growth (health, education and social protection)

Paper	Data	Results
Health		
Devarajan <i>et al.</i> (1996)	43 countries 1970–1990	Insignificant (but negative)
Afonso and González-Alegre (2011)	15 EU countries 1971–2006	Negative
Dao (2012)	28 countries 2008–2010	Negative
Martins and Veiga (2014)	156 countries 1980–2010	Mixed (inverted U-shaped)
Halıcı-Tülüce <i>et al.</i> (2016)	44 countries 1995–2012	Negative
Piabuo and Tieguhong (2017)	11 countries 1995–2015	Positive
Education		
Hansson and Henrekson (1994)	14 countries 1970–1987	Positive
Devarajan <i>et al.</i> (1996)	43 countries 1970–1990	Insignificant (but negative)
Al-Yousif (2008)	6 countries 1977–2004	Mixed results
Afonso and González-Alegre (2011)	15 EU countries 1971–2006	Positive
Dao (2012)	28 countries 2008–2010	Negative
Martins and Veiga (2014)	156 countries 1980–2010	Mixed results (U-shaped)
Trabelsi (2017)	50 countries 1980–2010	Mixed results
Social protection		
Castles and Dowrick (1990)	OECD 1960–1985	Positive in some social expenses
Hansson and Henrekson (1994)	14 countries 1970–1987	Positive (social security)
Bellettini and Ceroni (2000)	61 countries	Positive (social security)
Afonso and González-Alegre (2011)	15 EU countries 1971–2006	Negative (social transfers)
Martins and Veiga (2014)	156 countries 1980–2010	Mixed results (U-shaped)

Source: Author's own elaboration

3. Empirical Strategy

We employ a quantile regression approach⁶ to capture different patterns along the distribution of economic growth. Contrary to linear regression, which summarizes the average relationship between the regressors and the dependent variable, this semiparametric approximation, proposed by Koenker and Basset (1978) and revised in Buchinsky (1998), Koenker and Hallock (2001), Yu *et al.* (2003), Koenker (2017) and Waldmann (2018), minimizes the deviations in absolute value with asymmetric weighting, instead of minimizing the squares of the errors as in ordinary least squares (OLS). The standard errors of the coefficient estimates are estimated using bootstrapping.

$$y_i = x_i\beta_\theta + u_{\theta i} \quad (1)$$

$$\text{Quant}_\theta(y_i|x_i) = \inf \{y : F_i(y|x) \geq \theta\} = x_i\beta_\theta \quad (2)$$

$$\text{Quant}_\theta(u_{\theta i}|x_i) = 0, \quad (3)$$

where $\text{Quant}_\theta(y_i|x_i)$ denotes the conditional quantile of y_i on the vector x_i . Thus, the quantile θ ($0 < \theta < 1$) solves the expression:

$$\min_{\beta} \frac{1}{n} \left\{ \sum_{i: y_i \geq x_i\beta} \theta |y_i - x_i\beta| + \sum_{i: y_i < x_i\beta} (1-\theta) |y_i - x_i\beta| \right\}. \quad (4)$$

In this way, in the quantile regression approach, with the 0.05, 0.25, 0.50, 0.75 and 0.95 quantiles considered, the estimated marginal effects from the estimates of β would indicate how the 5%, 25%, 50%, 75% and 95% conditional quantiles would be affected at all x values. Thus, quantile regression analyses the similarity or dissimilarity of regression coefficients at different points of the distribution of the dependent variable, economic growth in our case.

In methodological terms, the quantile regression estimator can be more efficient than OLS if errors deviate from normality and, in addition, the quantile estimators are less sensitive to outliers. Besides, quantile regression provides a richer characterization of the data and is invariant to monotonic transformations.

4. Data and Results

We study the European Union and, specifically, 25 countries due to unavailability of data for Bulgaria, Croatia and Romania. The period of the empirical analysis is 2004–2019.

6 In a related context, this methodology has also been employed by Delgado (2021) for the determinants of fiscal decentralization in the EU, and Blanco and Delgado (2019) for the relationship between taxation and economic growth also for the European Union.

The data have been obtained from Eurostat⁷. The independent variable is economic growth, specifically growth of GDP per capita. As explanatory variables, we consider the following, and the model also includes year and country dummies.

- *PopGrowth*: population growth;
- *Invest*: total fixed assets (%GDP);
- *HumCap*: human capital, measured as upper-secondary and post-secondary non-tertiary education (levels 3 and 4) and tertiary education (levels 5–8), with respect to population from 15 to 64 years;
- *ExpRD*: expenditure on research and development (% GDP);
- *Debt*: public debt (% GDP)⁸;
- *PublicExp*: total public expenditure (% GDP);
- *Health*: public expenditure in health as percentage of total public expenditure;
- *Education*: public expenditure in education as percentage of total public expenditure;
- *SocialProt*: public expenditure in social protection as percentage of total public expenditure.

The main statistics are reported in Table 3. As is well-known, the EU comprises heterogeneous countries, regarding development, role of the public sector, or education and human capital, as can be observed in these statistics.

In addition, for the public expenditure, we have computed the coefficient of variation (CV) along the time, as an indicator of the sigma convergence process, to determine whether the dispersion diminished in the period, denoting sigma convergence, or increased, revealing sigma divergence. The sigma convergence approach is used here as an exploratory analysis of the expenditure data. It should be remarked that sigma convergence is a technique broadly employed for convergence analysis in several areas, growth included, and it allows us to summarize the dispersion pattern of the entire sample across years. Specifically, sigma convergence is a sufficient, but not necessary, condition for beta convergence (where lagged territories progress more than the others), and this general overview can be further analysed by other approaches such as club convergence (Delgado and Presno, 2023).

These measures (CV) are plotted in Figure 1, and we also include the (unweighted) average of the expenditures in each case: total, health, education and social protection public expenses.

7 The data are available at: <https://ec.europa.eu/eurostat/web/main/data/database>

8 Alternatively, we have also estimated the model with government deficit/surplus (% GDP), but the results are similar.

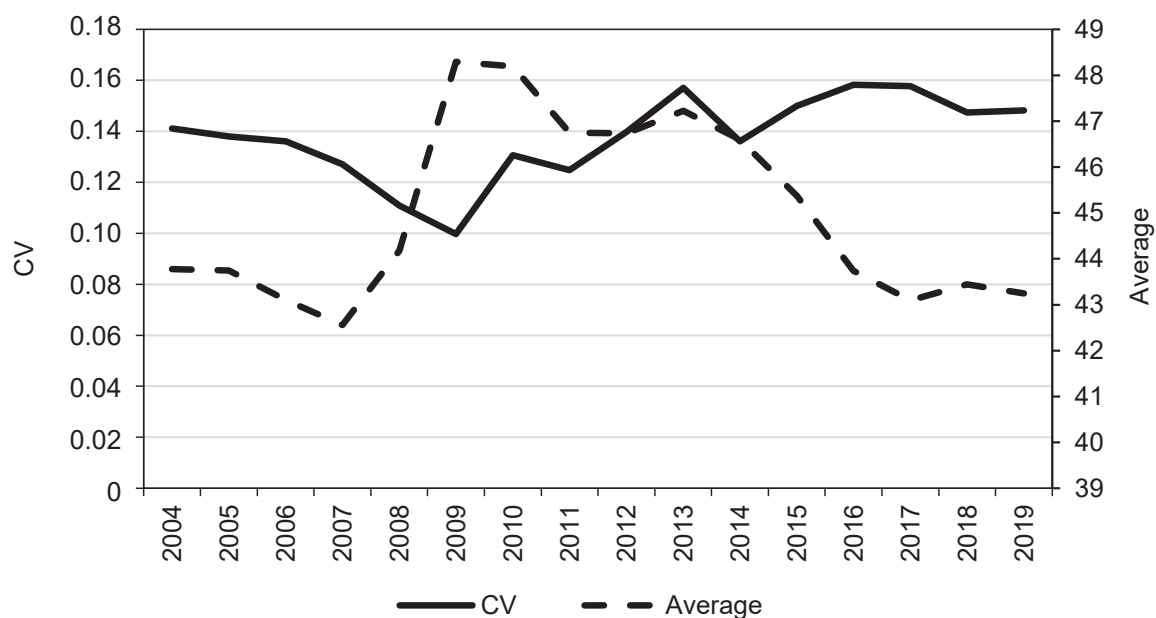
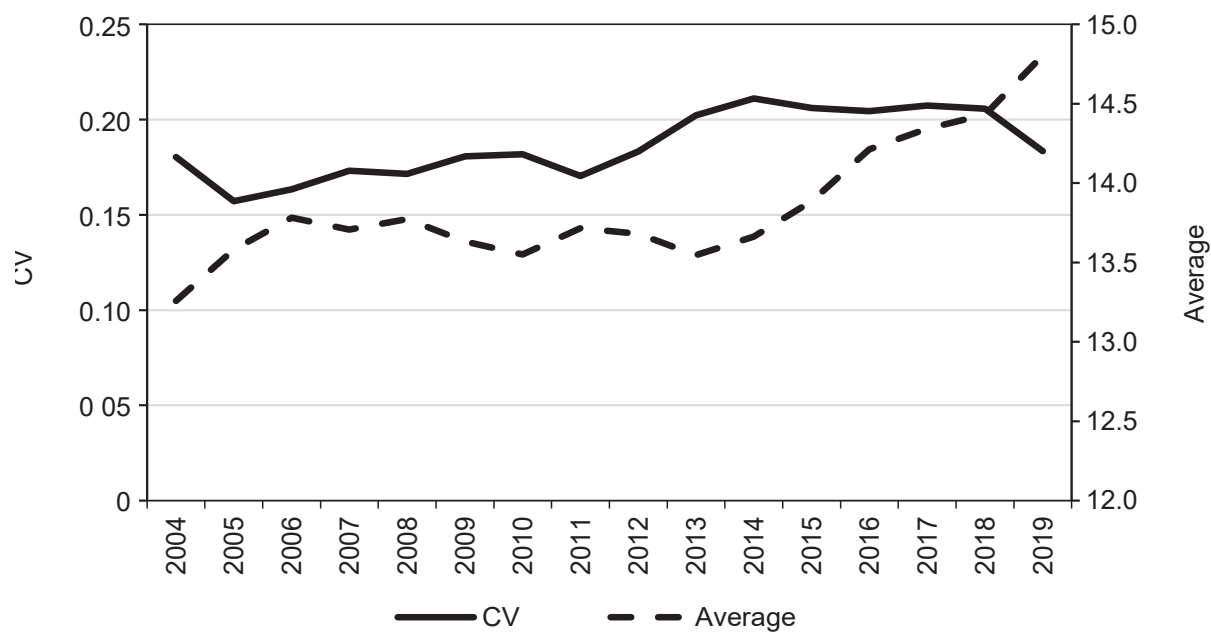
In the case of total public expenditure, we can observe two phases: with sigma convergence until 2010 and sigma divergence onwards, except in the last years. With regard to the health expenditure, the data reveal a sigma divergence process, ending in 2019. On the contrary, the education expenditure exhibits a clear sigma convergence path. Finally, the social protection expense presents a sigma convergence due to the drop experienced due to the Great Recession; however, this process is partially broken in recent years. In summary, the sigma convergence analysis reveals noticeable differences in the evolution of the three expenditure functions.

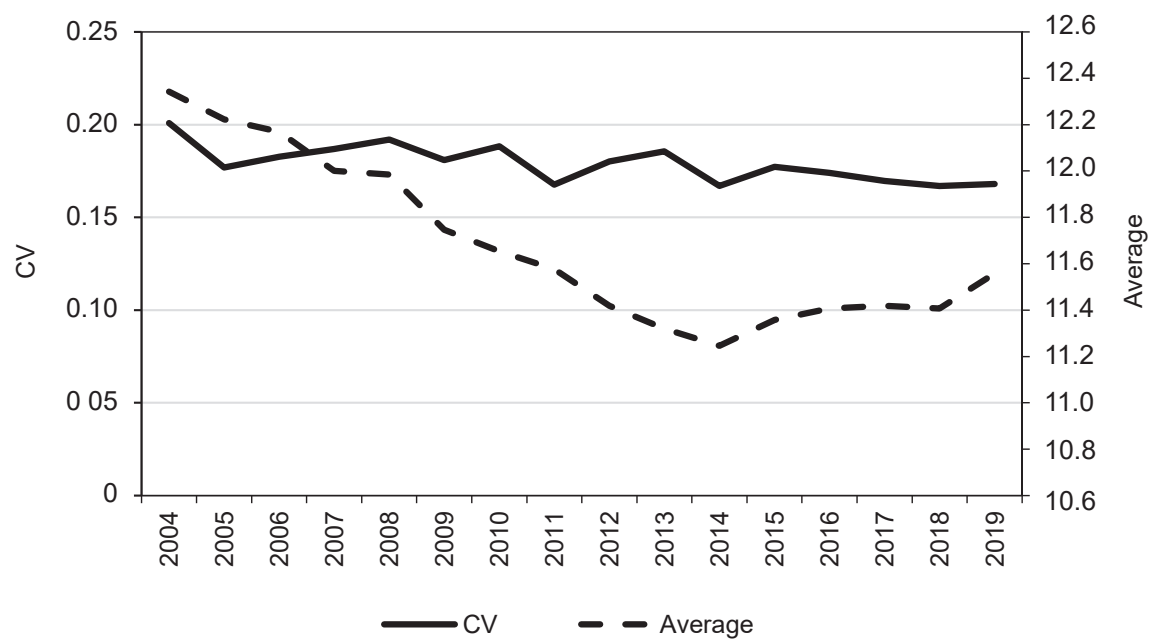
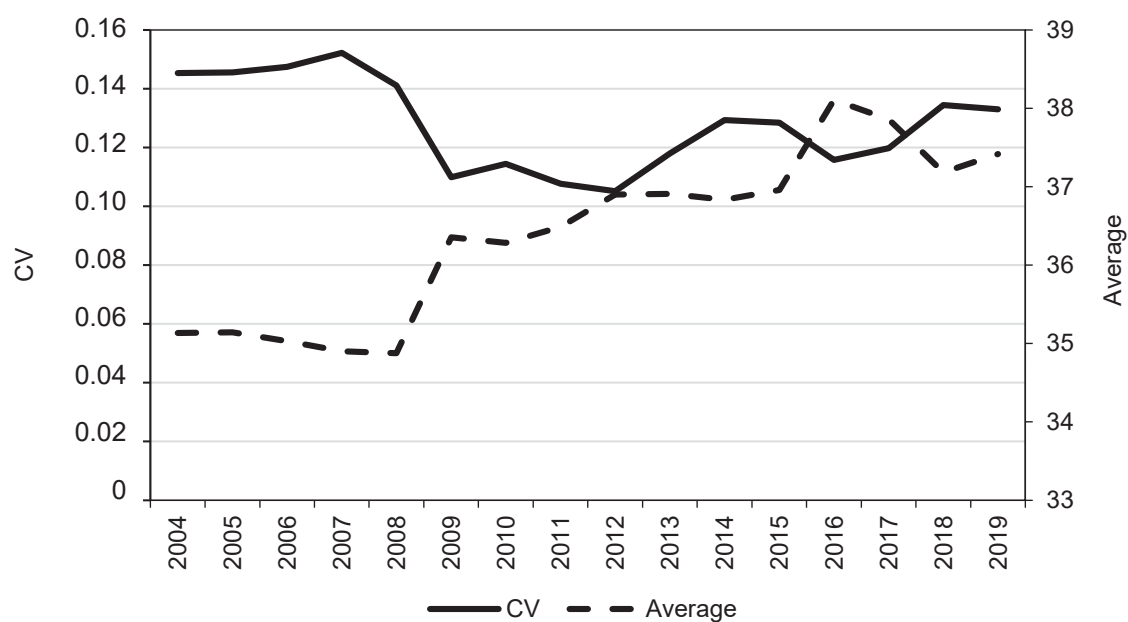
The main results are summarized in Table 4 and the coefficients are plotted in Figures 2 and 3, for the public expenditures and other determinants, respectively.

Table 3: Summary statistics

Variable	Mean	Std. dev.	Min	Max
<i>Growth</i>	1.82	3.69	−14.29	23.97
<i>PopGrowth</i>	0.36	0.86	−2.85	3.75
<i>Invest</i>	21.79	4.37	10.58	53.59
<i>HumCap</i>	71.51	12.95	25.70	88.90
<i>ExpRD</i>	1.62	0.87	0.34	3.75
<i>Debt</i>	63.24	35.40	3.80	186.40
<i>PubExp</i>	45.35	6.41	24.50	65.10
<i>Health</i>	13.90	2.68	5.40	19.50
<i>Education</i>	11.77	2.15	7.10	18.10
<i>SocialProt</i>	36.57	4.80	23.30	45.80
Obs.	400	–	–	–

Source: Author's own elaboration

Figure 1: Sigma convergence of public expenditure**1a) Total****1b) Health**

1c) Education**1d) Social protection**

Source: Author's own elaboration

Table 4: Results from the quantile regression

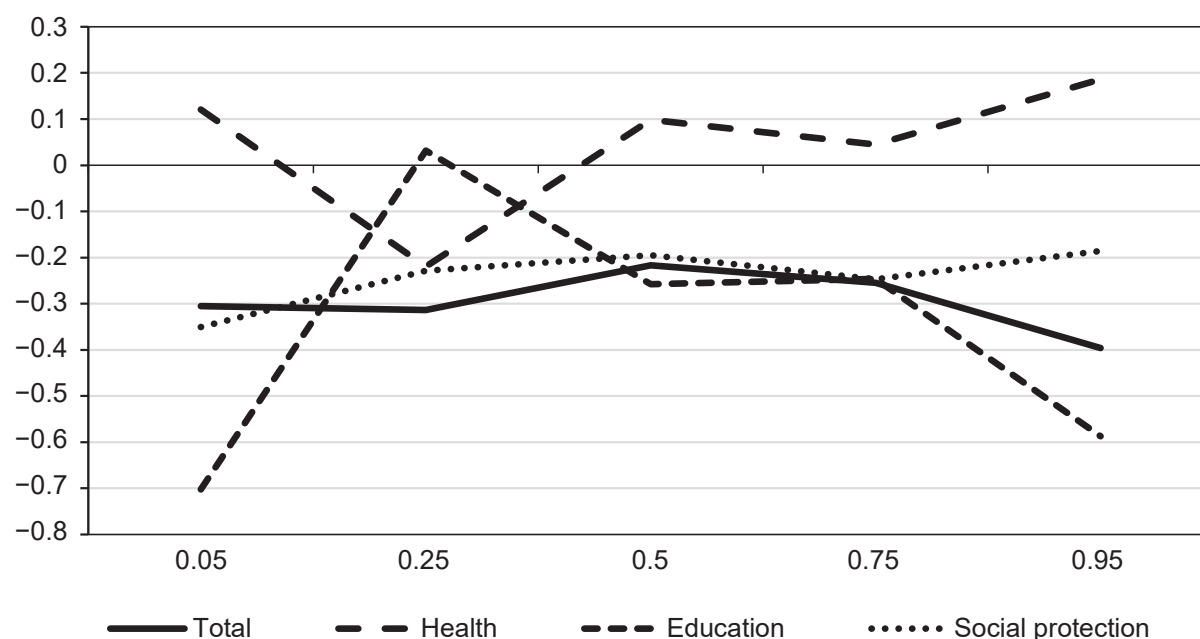
Better above 0.05						
	Linear	0.05	0.25	0.50	0.75	0.95
PopGrowth	−1.4363*** (0.2903)	−1.7396*** (0.1582)	0.9438*** (0.1369)	−1.0383*** (0.2246)	−1.4348*** (0.2496)	−1.0481*** (0.0000)
Invest	0.0446 (0.0536)	0.0141 (0.0292)	0.0645** (0.0253)	0.1865*** (0.0415)	0.2387*** (0.0461)	0.3133*** (0.0000)
HumCap	0.1523*** (0.0516)	0.1837*** (0.0281)	0.1250*** (0.0243)	0.0825** (0.0399)	0.1401*** (0.0443)	0.1893*** (0.0000)
ExpRD	0.6440 (0.5807)	0.9225*** (0.3164)	0.1966 (0.2738)	0.5540 (0.4492)	0.4974 (0.4992)	0.8637*** (0.0000)
Debt	0.0020 (0.0146)	−0.0550*** (0.0080)	0.0168** (0.0069)	0.0350*** (0.0113)	0.0306** (0.0126)	0.0608*** (0.0000)
PublicExp	−0.4370*** (0.0575)	−0.3056*** (0.0313)	−0.3133*** (0.0271)	−0.2168*** (0.0445)	−0.2545*** (0.0494)	−0.3961*** (0.0000)
Health	−0.1330 (0.1571)	0.1205 (0.0856)	−0.2195*** (0.0741)	0.0981 (0.1216)	0.0447 (0.1351)	0.1862*** (0.0000)
Education	−0.4284** (0.1915)	−0.7023*** (0.1043)	0.0317 (0.0903)	−0.2577* (0.1482)	−0.2464 (0.1646)	−0.5869*** (0.0000)
SocialProt	−0.3878*** (0.0733)	−0.3506*** (0.0399)	−0.2285*** (0.0346)	−0.1946*** (0.0567)	−0.2468*** (0.0630)	−0.1857*** (0.0000)

Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively. Standard errors in parentheses.

Source: Author's own elaboration

4.1 Total public expenditure

Our results show a negative and significant effect of total public expenditure on economic growth. This negative result is in line with most previous literature, but we detect that the effect is more intense in the top tail of the economic growth distribution. These differences may help explain some mixed results obtained in the literature, suggesting a nonlinear relationship and, therefore, enabling different public expense policies for the countries. Having confirmed this expected negative impact for the total expenditure, we analyse the results achieved for the expense functions considered in this study.

Figure 2: Quantile results, expenditure

Source: Author's own elaboration

4.2 Health

The public health expenditure is not significant to explain the economic growth, except in the tails of the growth distribution, namely for lowest (0.25) and highest (0.95) growths, where the impact is negative and positive respectively. As stated in Section 2, the available empirical results are inconclusive, with negative, mixed or even positive results, partially depending of the development degree of the territories analysed and the quality of the health systems, the impact of the expenditure on economic growth being potentially positive in countries with poorer health ecosystems. The relation between health and productivity and human capital should also be remarked (Mushkin, 1962; Cole and Neumayer, 2006).

4.3 Education

In the case of education, the effect is negative and significant in most quantiles, with higher values at the extremes of the distribution, denoting a U-shaped relation. Again, the literature shows mixed results, both theoretically, such as Blankenau and Simpson (2004) in the context of an endogenous growth model, and empirically, concluding both a positive relationship (Hansson and Henrekson, 1994), negative (Dao, 2012), mixed (Martins and Veiga, 2014; Trabelsi, 2017) or inconclusive (Devarajan *et al.*, 1996; Al-Yousif, 2008). Our negative effect may be interpreted with some

caution: firstly, we are measuring the impact of public expenditure, and not the total expense (public and private); and secondly, we are analysing the effect of the expense, the quantity, without including quality of education systems. A further analysis including these considerations should be useful to complete this analysis about education.

4.4 Social protection

The public expenditure on social protection has a negative and significant impact on economic growth, especially for low-growth scenarios, that is, at the bottom of the growth distribution. It should be remarked that this expense falls into the category of unproductive expenditures, with expenses not intended to boost economic growth. Thus, this negative effect is the expected one, as this category or function contains expenditures such as sickness and disability, old age, survivors, family and children, unemployment, housing or social exclusion, with aims related with equity and redistribution. With regard to previous literature, it should also be noted that the results reviewed in Section 2 refer to social security, and thus they are not directly comparable with our findings.

4.5 Other determinants

Population growth presents a negative and significant impact on economic growth. It should be noted that population may affect productivity and growth both positively and negatively, with an undetermined net effect depending on whether the inducements to human capital and expansion of knowledge are stronger than diminishing returns to natural resources (Becker *et al.*, 1999; Johnson, 1999).

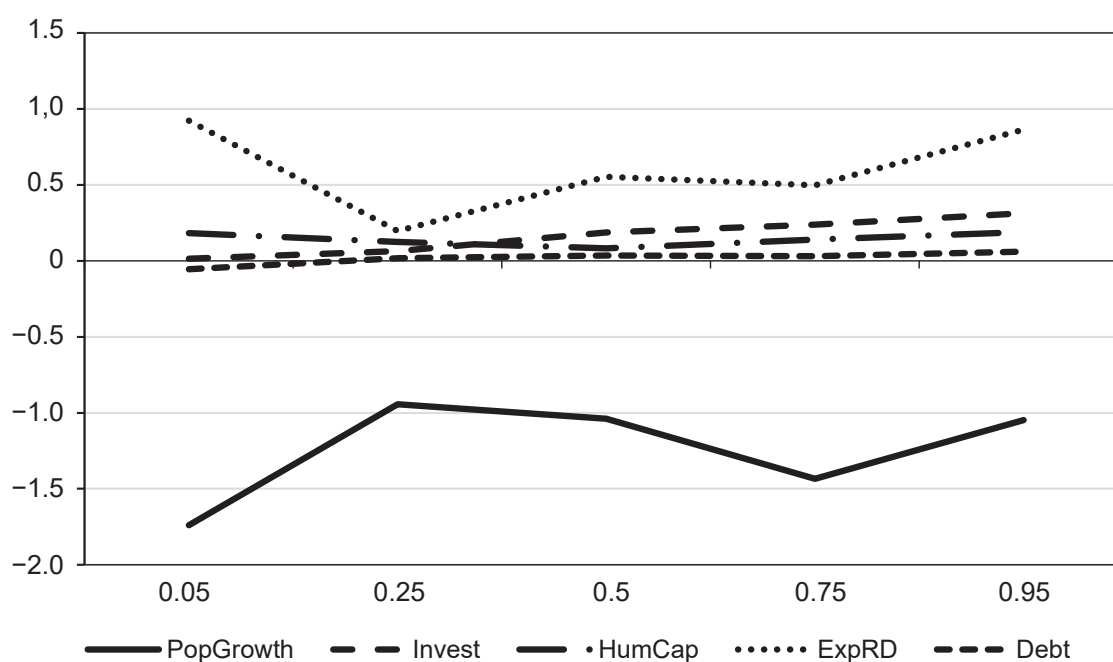
In the case of investment, as expected, the effect is positive and statistically significant, with an increasing effect along the distribution of economic growth.

The expenditure on research and development shows a positive effect, also as expected, but only significant at the extremes of the growth distribution. Recently, Sokolov-Mladenović *et al.* (2016) concluded a positive and significant impact of R&D in the EU. However, Inekwe (2015) found a positive relation for upper middle-income economies, but insignificant for lower income economies. Thus, the empirical evidence about the impact of R&D is mixed despite the theoretically expected positive relationship with economic growth.

Finally, public debt exhibits a positive and statistically significant effect on growth, except at the beginning of the distribution of growth (5%), where it is negative and increasing. The rela-

tion between public debt and growth has been analysed in the literature⁹, especially after the work of Reinhart and Rogoff (2010) and their finding about the negative nonlinear effect on growth if public debt exceeds 90% of GDP. However, this result has been revised in other papers, with different thresholds. For example, Égert (2015) concluded that this nonlinear relation is quasi inexistent and found both negative and positive impacts in different scenarios. Gómez-Puig and Sosvilla-Rivero (2017) found that a harmful impact of debt on growth does not occur beyond the same debt ratio threshold in all EMU countries, and Sosvilla-Rivero and Gómez-Puig (2019) concluded that the impact of public debt on economic growth changes not only across countries, but also over time, and Panizza and Presbitero (2014) found no evidence that public debt had a causal effect on economic growth. Finally, our finding of a positive relationship between public debt and economic growth could be explained by expansionary fiscal policies, leading to debt accumulation, but avoiding protracted recessions (DeLong and Summers, 2012). This explanation fits well in the period considered in this study, with the Great Recession and the strong fiscal measures adopted by many European countries with the impact on government deficit and public debt.

Figure 3: Quantile results, other determinants



Source: Author's own elaboration

⁹ Le Van *et al.* (2019) theoretically analyse the relationship between public debt and economic growth in an endogenous growth model, distinguishing domestic and external debt.

4.6 Discussion

We provide new empirical evidence on the relationship between public expenditure and economic growth, specifically for the EU, an interesting study case because it is an integrated economic area, although Member States enjoy a large degree of autonomy within their territories. The results achieved in a quantile regression approach, with different impacts along the distribution of economic growth, allow better understanding of the effects of public policies on development beyond linear approaches and variation of some public policies in different phases of the economic cycle. The effects of fiscal policy, and some other determinants, on economic growth tend to be nonlinear in different degrees.

However, it should also be noted that public policies, and some public expenditures in particular, pursue goals other than growth, related essentially to inequality¹⁰ and protection of vulnerable groups. These last objectives are of special interest in episodes of economic crisis, namely the Great Recession or the current crisis derived from COVID-19, when the welfare state is called to play a relevant role with the consequent effects on public expenditure and debt.

5. Conclusion

The relationship between government size and economic growth has been under debate in the last decades, on the side of both public expenditure (total and its main components) and taxation, again total (tax burden) and certain taxes and the progressivity of the tax system. The theoretical predictions and the empirical evidence, although extensive, are certainly inconclusive.

In this paper, we focused on public expenditure. We analysed the case of the EU, specifically 25 countries, in the period 2004–2019, covering years of economic growth, the Great Recession and the recovery. Specifically, we adopted a quantile regression approach, a flexible model which allows us to deal with different effects along the growth distribution.

The results show a negative and significant impact of total public expenditure on economic growth, higher at the top of the growth distribution. In addition, while health public expense appears as insignificant, a negative effect is concluded for education and social protection expenditures. Regarding the other explanatory variables, we found a negative and significant effect of population growth, a positive and significant impact of investment, a positive but insignificant

10 The relationship between inequality or redistribution and economic growth has also attracted researchers in the last decades. See, for example, Aghion *et al.* (1999) or Thewissen (2014), who did not find a robust association between inequality and growth, or redistribution and growth for a panel of countries.

effect of expenditure on research and development (except at the extremes of the distribution), and a positive and significant impact of public debt.

Our findings, achieved in a quantile regression approach, with different effects along the distribution of economic growth, with the usual caveats that accompany any empirical investigation and specifically given the relatively short time frame of the analysis (15 years), allow better understanding of the effects of public policies on development beyond linear approaches and variation of some public policies in different phases of the economic cycle. However, it should be noted that public policies, and especially some public expenditures, pursue goals other than economic growth, related particularly to (income) inequality.

Finally, additional empirical research is needed in this area. The relationships between fiscal policy and economic growth are complex and variable in time and territory. Specifically, considering the heterogeneity of the EU, it would be interesting to analyse CEECs versus highly developed countries, or also Eurozone versus the rest of the EU countries.

References

- Afonso, A., González Alegre, J. (2011). Economic growth and budgetary components. A panel assessment for the EU. *Empirical Economics*, 41, 703–723, <https://doi.org/10.1007/s00181-010-0400-9>
- Afonso, A., Monteiro, S., Thompson, M. (2014). Innovation economy, productive public expenditure and economic growth. *Metroeconomica*, 65(4), 671–689, <https://doi.org/10.1111/meca.12054>
- Agell, J., Lindh, T., Ohlsson, H. (1997). Growth and the public sector: a critical review essay. *European Journal of Political Economy*, 13(1), 33–52, [https://doi.org/10.1016/S0176-2680\(96\)00031-6](https://doi.org/10.1016/S0176-2680(96)00031-6)
- Agenor, P. R., Neanidis, K. C. (2011). The allocation of public expenditure and economic growth. *The Manchester School*, 79(4), 899–931, <https://doi.org/10.1111/j.1467-9957.2011.02197.x>
- Aghion, P., Caroli, E., Garcia-Penalosa, C. (1999). Inequality and economic growth: the perspective of the new growth theories. *Journal of Economic Literature*, 37(4), 1615–1660, <https://doi.org/10.1257/jel.37.4.1615>
- Al-Yousif, Y. K. (2008). Education expenditure and economic growth: some empirical evidence from the GCC countries. *The Journal of Developing Areas*, 42(1), 69–80, <https://www.jstor.org/stable/40376194>
- Angelopoulos, K., Economides, G., Kamman, P. (2007). Tax-spending policies and economic growth: theoretical predictions and evidence from the OECD. *European Journal of Political Economy*, 23(4), 885–902, <https://doi.org/10.1016/j.ejpoleco.2006.10.001>
- Angelopoulos, K., Philippopoulos, A., Tsionas, E. (2008). Does public sector efficiency matter? Revisiting the relation between fiscal size and economic growth in a world sample. *Public Choice*, 137(1/2), 245–278, <https://www.jstor.org/stable/40270861>

- Apergis, N., Christou, C., Hassapis, C. (2013). Convergence in public expenditures across EU countries: evidence from club convergence. *Economics & Finance Research*, 1(1), 45–59, <https://doi.org/10.1080/21649480.2013.862735>
- Aschauer, D. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2), 177–200, [https://doi.org/10.1016/0304-3932\(89\)90047-0](https://doi.org/10.1016/0304-3932(89)90047-0)
- Atkinson, A. B. (1995). The welfare state and economic performance. *National Tax Journal*, 48(2), 171–198, <https://www.jstor.org/stable/41789>
- Baier, S. L., Glomm, G. (2001). Long-run growth and welfare effects of public policies with distortionary taxation. *Journal of Economic Dynamics and Control*, 25(12), 2007–2042, [https://doi.org/10.1016/S0165-1889\(00\)00017-8](https://doi.org/10.1016/S0165-1889(00)00017-8)
- Bajo-Rubio, O. (2000). A further generalization of the Solow growth model: the role of the public sector. *Economics Letters*, 68(1), 79–84, [https://doi.org/10.1016/S0165-1765\(00\)00220-2](https://doi.org/10.1016/S0165-1765(00)00220-2)
- Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(5), 103–125,
- Barro, R. J., Sala-i-Martin, X. (1992). Public finance in models of economic growth. *The Review of Economic Studies*, 59(4), 645–661, <https://doi.org/10.2307/2297991>
- Becker, G. S., Glaeser, E. L., Murphy, K. M. (1999). Population and economic growth. *The American Economic Review*, 89(2), 145–149, <https://www.jstor.org/stable/117096>
- Bellettini, S., Ceroni, C. B. (2000). Social security expenditure and economic growth: An empirical assessment. *Research in Economics*, 54(3), 249–275, <https://doi.org/10.1006/reec.2000.0231>
- Blanco, F. A., Delgado, F. J. (2019). Taxation and economic growth in the European Union: a quantile approach. *Revista de Economía Mundial*, 51, 79–100.
- Blankenau, W. F., Simpson, N. B. (2004). Public education expenditures and growth. *Journal of Development Economics*, 73(2), 583–605, <https://doi.org/10.1016/j.jdeveco.2003.05.004>
- Bleaney, M., Gemmell, N., Kneller, R. (2001). Testing the endogenous growth model: public expenditure, taxation and growth over the long run. *Canadian Journal of Economics*, 34(1), 36–57, <https://doi.org/10.1111/0008-4085.00061>
- Bose, N., Haque, M. E., Osborn, D. R. (2007). Public expenditure and economic growth: A disaggregated analysis for developing countries. *The Manchester School*, 75(5), 533–556, <https://doi.org/10.1111/j.1467-9957.2007.01028.x>
- Buchinsky, M. (1998). Recent advances in quantile regression models: a practical guideline for empirical research. *The Journal of Human Resources*, 33(1), 88–126, <https://www.jstor.org/stable/146316>
- Carboni, O. A., Medda, G. (2011). Government spending and growth in a neoclassical model. *Mathematics and Financial Economics*, 4(4), 269–285, <https://doi.org/10.1007/s11579-011-0045-2>
- Cashin, P. (1995). Government spending, taxes, and economic growth. *Staff Papers – International Monetary Fund*, 42, 237–269, <https://www.jstor.org/stable/3867572>

- Castro, V. (2018). Functional components of public expenditure, fiscal consolidations, and economic activity. *Economics & Politics of Governance*, 30(1), 124–150.
- Cole, M. A., Neumayer, E. (2006). The impact of poor health on total factor productivity. *The Journal of Development Studies*, 42(6), 918–938, <https://doi.org/10.1080/00220380600774681>
- Conte, M. A., Darrat, A. F. (1988). Economic growth and the expanding public sector: A re-examination. *The Review of Economics and Statistics*, 70(2), 322–330, <https://www.jstor.org/stable/192831>
- Dao, M. Q. (2012). Government expenditure and growth in developing countries. *Progress in Development Studies*, 12(1), 77–82, <https://doi.org/10.1177/146499341101200105>
- Delgado, F. J. (2021). On the determinants of fiscal decentralization: Evidence from the EU. *Amfiteatru Economic*, 23(56), 206–220, <https://doi.org/10.24818/EA/2021/56/206>
- Delgado, F. J., Presno, M. J. (2023). Evolution of fiscal decentralisation in OECD countries: a club convergence analysis. *Amfiteatru Economic*, 25(63), 558–574, <https://doi.org/10.24818/EA/2023/63/558>
- Devarajan, S., Swaroop, V., Zou, H.-F. (1996). The composition of public expenditure and economic growth. *Journal of Monetary Economics*, 37(2), 313–344, [https://doi.org/10.1016/S0304-3932\(96\)90039-2](https://doi.org/10.1016/S0304-3932(96)90039-2)
- Easterly, W. and S. Rebelo (1993). Fiscal policy and economic growth: an empirical investigation. *Journal of Monetary Economics*, 32(3), 417–458, [https://doi.org/10.1016/0304-3932\(93\)90025-B](https://doi.org/10.1016/0304-3932(93)90025-B)
- Égert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? *Journal of Macroeconomics*, 43, 226–238, <https://doi.org/10.1016/j.jmacro.2014.11.006>
- Engen, E. M., Skinner, J. (1992). *Fiscal policy and economic growth*. NBER Working Paper No. 4223, <https://doi.org/10.3386/w4223>
- Ferreiro, J., Garcia del Valle, M., Gómez, C. (2012). Similarities and differences in the composition of public expenditures in the European Union. *Journal of Economic Issues*, 46(3), 633–660, <https://doi.org/10.2753/JEI0021-3624460303>
- Ferreiro, J., Carrasco, C. A., Gómez, C. (2014). Convergence of public expenditures and implementation of a single model of public finances in the European Union. *Revista de Economía Mundial*, 37, 75–102.
- Fölster, S., Henrekson, M. (1999). Growth and the public sector: a critique of the critics. *European Journal of Political Economy*, 15(2), 337–358, [https://doi.org/10.1016/S0176-2680\(99\)00010-5](https://doi.org/10.1016/S0176-2680(99)00010-5)
- Fölster, S., Henrekson, M. (2001). Growth effects of government expenditure and taxation in rich countries. *European Economic Review*, 45(8), 1501–1520, [https://doi.org/10.1016/S0014-2921\(00\)00083](https://doi.org/10.1016/S0014-2921(00)00083)
- Gómez-Puig, M., Sosvilla-Rivero, S. (2017). Heterogeneity in the debt-growth nexus: Evidence from EMU countries. *International Review of Economics & Finance*, 51, 470–486, <https://doi.org/10.1016/j.iref.2017.07.008>

- Gregoriou, A., Ghosh, S. (2009). The impact of government expenditure on growth: empirical evidence from a heterogeneous panel. *Bulletin of Economic Research*, 61(1), 95–102, <https://doi.org/10.1111/j.1467-8586.2008.00297.x>
- Gupta, S., Clemens, B., Baldacci, E., et al. (2005). Fiscal policy, expenditure composition, and growth in low-income countries. *Journal of International Money and Finance*, 24(3), 441–463, <https://doi.org/10.1016/j.jimonfin.2005.01.004>
- Halıcı-Tülüce, N. S., Dogan, İ., Dumrul, C. (2016). Is income relevant for health expenditure and economic growth nexus? *International Journal of Health Economics and Management*, 16, 23–49, <https://doi.org/10.1007/s10754-015-9179-8>
- Hansson, P., Henrekson, M. (1994). A new framework for testing the effect of government spending on growth and productivity, *Public Choice*, 81, 381–401, <https://doi.org/10.1007/BF01053239>
- Henrekson, M. (1993). Wagner's law – A spurious relationship? *Public Finance*, 46(3).
- Inekwe, J. N. (2015). The contribution of R&D expenditure to economic growth in developing economies. *Social Indicators Research: An International and Interdisciplinary Journal for Quality-of-Life Measurement*, 124(3), 727–745, <https://doi.org/10.1007/s11205-014-0807-3>
- Irmen, A., Kuehnelt, J. (2009). Productive government expenditure and economic growth. *Journal of Economic Surveys*, 23(4), 692–733, <https://doi.org/10.1111/j.1467-6419.2009.00576.x>
- Jaén-García, M. (2018). Wagner's law: a revision and a new empirical estimation. *Hacienda Publica Española / Review of Public Economics*, 224(1), 13–35, <https://doi.org/10.1086/261727>
- Johnson, D. G. (1999). Population and economic development. *China Economic Review*, 10(1), 1–16, [https://doi.org/10.1016/S1043-951X\(99\)00002-4](https://doi.org/10.1016/S1043-951X(99)00002-4)
- King, R. G., Rebelo, S. (1990). Public policy and economic growth: developing neoclassical implications. *Journal of Political Economy*, 98(5), 126–150,
- Kneller, R., Bleaney, M. F., Gemmell, N. (1999). Fiscal policy and growth: evidence from OECD countries. *Journal of Public Economics*, 74(2), 171–190, [https://doi.org/10.1016/S0047-2727\(99\)00022-5](https://doi.org/10.1016/S0047-2727(99)00022-5)
- Koenker, R. (2017). Quantile regression: 40 years on. *Annual Review of Economics*, 9, 155–176, <https://doi.org/10.1146/annurev-economics-063016-103651>
- Koenker, R., Basset, G. (1978). Regression quantiles. *Econometrica*, 46(1), 33–50, <https://doi.org/10.2307/1913643>
- Koenker, R., Hallock, K. F. (2001). Quantile regression. An introduction. *Journal of Economic Perspectives*, 15(4), 143–156, <https://doi.org/10.1257/jep.15.4.143>
- Kolluri, B. R., Panik, M. J., Wahab, M. S. (2000). Government expenditure and economic growth: evidence from G7 countries. *Applied Economics*, 32(8), 1059–1068, <https://doi.org/10.1080/000368400322110>
- Landau, D. (1983). Government expenditure and economic growth: A cross-country study. *Southern Economic Journal*, 49(3), 783–792, <https://doi.org/10.2307/1058716>

- Le Van, C., Nguyen-Van, P., Barbier-Gauchard, A., et al. (2019). Government expenditure, external and domestic public debt, and economic growth. *Journal of Public Economic Theory*, 21(1), 116–134.
- Levine, R., Zervos, S. J. (1993). What we have learned about policy and growth from cross-country regressions. *American Economic Review*, 83(2), 426–430, <https://www.jstor.org/stable/2117702>
- Lin, S. A. Y. (1994). Government spending and economic growth. *Applied Economics*, 26(1), 83–94, <https://doi.org/10.1080/00036849400000064>
- Lucas, R. E. Jr. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42, [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Mankiw, N. G., Romer, D., Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407–437, <https://doi.org/10.2307/2118477>.
- Martins, S., Veiga, F. J. (2014). Government size, composition of public expenditure, and economic development. *International Tax and Public Finance*, 21, 578–597, <https://doi.org/10.1007/s10797-014-9313-4>
- Mushkin, S. J. (1962). Health as an investment. *Journal of Political Economy*, 70(5), 129–157, <http://doi.org/10.1086/258730>
- Nijkamp, P., Poot, J. (2004). Meta-analysis of the effect of fiscal policies on long-run growth. *European Journal of Political Economy*, 20(1), 91–124, <https://doi.org/10.1016/j.ejpoleco.2003.10.001>
- Piabuo, S. M., Tieguhong, J. C. (2017). Health expenditure and economic growth – a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries. *Health Economics Review*, 7, 23, <https://doi.org/10.1186/s13561-017-0159-1>
- Ram, R. (1986). Government size and economic growth: A new framework and some evidence from cross-section and time-series data. *American Economic Review*, 76(1), 191–203, <https://www.jstor.org/stable/1804136>
- Ramírez-Cedillo, E., López Herrera, F. (2021). Gasto público y crecimiento en América Latina: la ley de Wagner y la hipótesis de Keynes. *Investigación Económica*, 80(316), 109–132, <https://doi.org/10.22201/fe.01851667p.2021.316.76314>
- Reinhart, C. M., Rogoff, K. S. (2010). Growth in a time of debt. *American Economic Review*, 100(2), 573–578, <https://doi.org/10.1257/aer.100.2.573>
- Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002–1037, <https://www.jstor.org/stable/1833190>
- Sato, R. (1963). Fiscal policy in a neo-classical growth model: an analysis of the time required for equilibrating adjustment. *Review of Economic Studies*, 30(1), 16–23, <https://doi.org/10.2307/2296026>

- Saunders, P. (1985). Public expenditures and economic performance in OECD countries, *Journal of Public Policy*, 5(1), 1–21, <https://doi.org/10.1017/S0143814X00002865>
- Slemrod, J. (1995). What do cross-country studies teach about government involvement, prosperity and economic growth? *Brookings Papers on Economic Activity*, 26(2), 373–431.
- Sokolov-Mladenović, S., Cvetanović, S., Mladenović, I. (2016). R&D expenditure and economic growth: EU28 evidence for the period 2002–2012. *Economic Research*, 29(1), 1005–1020, <http://doi.org/10.1080/1331677X.2016.1211948>
- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94, <https://doi.org/10.2307/1884513>
- Sosvilla-Rivero, S., Gómez-Puig, M. (2019). New empirical evidence on the impact of public debt on economic growth in EMU countries. *Revista de Economía Mundial*, 51, 101–120.
- Strauss, T. (2001). Growth and government: Is there a difference between developed and developing countries? *Economics of Governance*, 2(2), 135–157, <https://doi.org/10.1007/PL00011023>
- Swan, T. W. (1956). Economic Growth and Capital Accumulation, 32(2): 334–361, <https://doi.org/10.1111/j.1475-4932.1956.tb00434.xb>
- Szarowská, I. (2022). Relationship between government expenditure and economic growth in Visegrad Group. *Financial Internet Quarterly*, 18(4), 12–22, <https://doi.org/10.2478/fiqf-2022-0024>
- Tanzi, V., Zee, H. H. (1997). Fiscal policy and long-run growth. *International Monetary Fund Staff Papers*, 44(2), 179–209, <https://doi.org/10.2307/3867542>
- Thewissen, S. (2014). Is it the income distribution or redistribution that affects growth? *Socio-Economic Review*, 12(3), 545–571, <https://doi.org/10.1093/ser/mwt019>
- Trabelsi, S. (2017). Public education expenditure and economic growth: the educational quality threshold. *Région et Développement*, 45, 99–112.
- Wagner, R. E., Weber, W. E. (1977). Wagner's law, fiscal institutions, and the growth of government. *National Tax Journal*, 30(1), 59–68.
- Waldmann, E. (2018). Quantile regression: a short story on how and why. *Statistical Modelling*, 18(3–4), 203–218, <https://doi.org/10.1177/1471082X18759142>
- Yu, K., Lu, Z., Stander, J. (2003). Quantile regression: applications and current research areas. *Journal of the Royal Statistical Society: Series D*, 52(3), 331–350, <https://doi.org/10.1111/1467-9884.00363>