Impact of public investment upon economic performance and budgetary consolidation efforts in the European Union

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In a period of heightened concern about fiscal consolidation in the Euro zone, a politically expedient way of dealing with the situation is to cut public investment. A critical question, however, is whether or not political expediency comes at a cost, in terms of both long-term economic performance and future budgetary consolidation efforts. In fact, one would expect any type of investment, including public investment, to improve the long-term economic performance. Moreover, to the extent that public investment increases output in the long-term, it also expands the tax base and, therefore, tax revenues in the long term. It is conceivable that public investment has such strong effects on output, that over time it generates enough additional tax revenues to pay for itself. It is equally plausible that the effects on output although positive are not strong enough for the public investment to pay for itself. In the first case, cuts in public investment hurt long-term growth and make the future budgetary situation worse. In the second case, cuts in public investment hurt the long-term economic performance without hurting the future budgetary situation. In this paper we investigate this question empirically in the context of a number of countries in the Euro zone using a vector auto-regressive/error correction mechanism approach to determine the effects of aggregated public investment on output, employment and private investment. Our ultimate objective is to determine in which regime do the different countries seem to fit and determine to what extent cuts in public investment may turn out to be counter-productive in the long-term from a budgetary perspective.

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1. Introduction

In the seventies, the USA was affected by a decline in productivity. Several explanations were presented at the time, without referring, however, to the role of investment in infrastructures. In 1989 Aschauer[1], when studying together, in econometric terms, the declines in investment and in productivity not only regarding USA but also a set of other developed countries, obtained results that conveyed a relationship between public investment and economic growth. The obtained estimations in this work indicate that not only public capital proves to be productive, but also investment in public infrastructures makes private capital more profitable. That fact opened the political and economical debate that took place in the 90's concerning public infrastructures and which was supported by the endogenous growth theory.

[1] "Is Public Expenditure Productive?", *Journal of Monetary Economics*, vol. 23, pp. 177-200.

The empirical works accomplished with the purpose of determining the impact of public investment upon growth have been following three distinct approaches. The very first one, adopted by Aschauer, uses one sole production function in which the public capital stock is incorporated as an additional input, not paid in this case, together with labour and private capital. The second approach is named the behaviour one[2]. The different authors make use of the dual theory in the estimation of a cost or profit functions in which the public infrastructure is incorporated as a fixed factor, with the purpose of determining the savings verified in costs[3]. More recently and also with the purpose of appraising the relationships between public capital and economic growth, there has been a gradual use of the auto-regressive/error correction mechanism approach vector (VAR/ECM). This model has the advantage of not imposing, in advance, any causality direction between the variables and of not requiring identification conditions derived from the economic theory. The VAR/ECM approach includes output, employment, private investment, and public investment and is designed to address the aforementioned econometric criticisms in a rigorous and comprehensive manner while highlighting the dynamic feedbacks among the different variables as well as the endogeneity of public investment decisions.

In this paper we will follow the VAR approach, adopting the methodology suggested by Pereira (2000) and Pereira and Andraz (2001). We will try to attain conclusions concerning public investment impact on the performance of other variables subject to analysis for eight countries of euro area: Austria, Belgium, Finland, France, Germany, Italy, Netherlands and Portugal.

However, in the context of the Stability and Growth Pact these countries have priorities in terms of growth, labour market flexibility and sustainable public finances. Since 2001 the fiscal position is deteriorated in the euro area where budget deficits were substantial, and in some cases above the 3 % of GDP excessive deficit ceiling. Faced with these budgetary pressures and political constraints, the margin of manoeuvre in budgetary matters is very limited and cuts in public investment have often been regarded, at least implicitly, as the easy way out. Indeed, unlike the effects of reductions in other types of spending or of tax hikes, the effects of cuts in public investment take some time to reverberate throughout the economy.

Nevertheless, a positive impact of public investment on output may represent also a positive impact on the tax Fiscal consolidation and so a critical question is whether or not political expediency comes at a cost, in terms of both long-term economic performance and future budgetary consolidation efforts. One would expect any type of investment, including public investment, to improve the long-term economic performance. Moreover, to the extent that public investment increases output in the long-term, it also expands the tax base and, therefore, tax revenues in the long term. It is conceivable that public investment has such strong effects on output, that over time it generates enough additional tax revenues to pay for itself. It is equally plausible that the effects on output although positive are not strong enough for the public investment to pay for itself. In the first case, cuts in public investment hurt long-term growth and make the future budgetary situation worse. In the second case, cuts in public investment hurt the

[2] It is designation given by Sturm (1998) in "Public Capital Expenditure in OCDE Countries", U.K: Edward Elgar Publishing.

[3] The results of this saving only appear if the substitution effects of some private inputs come to exceed the complementary effects of other production factors.

long-term economic performance without hurting the future budgetary situation. To identify which scenario applies in these countries is fundamental to access the impact, and ultimately the wisdom, of any public investment cuts. And so, we study not only the long-term effects of public-sector investment on output but to determine to what extent cuts in this type of public investment may turn out to be counter-productive in the long-term from a budgetary perspective.

This paper is organised as follows. In Section 2 we present the data, perform stationarity and co-integration tests, and proceed to determine the best VAR/ECM structures. In Section 3, we address the issue of the identification of exogenous innovations to public-sector investment as well as the measurement of the effects of such innovations. In Section 4 we present the main results on the long-term effects of public-sector investment on output, employment and private investment as well as the potential budgetary implications of such results. Finally in Section 5, we present some concluding remarks.

2. Data and preliminary empirical results

2.1 Data and some stylised facts

The variables considered are GDP (Y), employment (L), private investment (Ip) and gross fixed capital formation of governments (Ig).

We use annual data for the period 1980-2003 for all the countries. The data was obtained from the National Accounts as published in OECD (2005). All variables are measured in millions of constant 2000 euros except for employment, which is measured in thousand of employees.

Some of the basic information about public-sector investment is displayed in Figure 1. Public-sector investment as a percentage of the GDP decreased for all the period in Austria, Belgium and Germany. In the beginning of the period these countries presented high values, about 4%, and in the end almost that they were come close to 1%. The remaining countries show a pattern more uniform with values always very next to 3%. However, Portugal presented superior values slightly.

2.2 Univariate and cointegration analysis

We use the Augmented Dickey-Fuller (ADF) t-test to test the null hypothesis of a unit root and the Schwarz Criteria or Bayesian Information Criterion (BIC) to determine the optimal the deterministic components.

Test results are reported in Table 1. For all of the variables in log-levels the t-statistics are greater than the critical values, either at 5% or at 1% significance levels, and that, therefore, we cannot reject for any of the variables the null hypothesis of a unit root. When applied to the first differences of the log-levels, i.e., to the growth rates of the original variables, however, the ADF tests allow us to reject the null hypothesis of the unit roots for all variables, since all the t-statistics are lower than the 5% critical values. Therefore, we can infer that all variables are stationary in first differences. This is consistent with the macroeconomic literature and, in particular, with similar findings for the Portuguese case [see, for example, Pereira and Andraz, (2004a, 2004b)].

Having established that all variables are integrated of order one, we now test for cointegration among output, employment, private investment and public-sector investment. Due to our relatively small sample we use the Engle-Granger procedure, which is less vulnerable than the Johansen procedure to the

small sample bias toward finding cointegration when it does not exist (Gonzalo and Lee, 1998; Gonzalo and Pitarakis, 1999). Following the standard Engle-Granger procedure, we perform four tests, each one with a different endogenous variable. This is because it is possible that one of the variables enters the cointegrating relationship with a statistically insignificant coefficient. In this case, a test that uses such variable as the endogenous variable would not detect cointegration. We apply the ADF t-test to the residuals of the different regressions. The optimal lag structure is chosen using the BIC and we consider alternative specifications for the deterministic components.

Cointegration test results are reported in Table 2. We find that, in aggregate level and in the case of six countries, except France and Netherlands, the test statistics are higher that the 5% critical values, and therefore, in no case can we reject the null hypothesis of a unit root in the residuals of the estimated equations. In the case of France and Netherlands one of the four tests suggests the possibility of cointegration. The results are similar when we use the Johansen test. Accordingly, we do not find evidence of cointegration among the variables for all the countries. The absence of cointegration is consistent with other results in the literature [see again Pereira and Andraz (2004a, 2004b) for the Portuguese case]. Furthermore, the absence of cointegration is not problematic conceptually either. This means that the data does not show evidence of convergence to the so-called great ratios among the aggregate variables in the economy.

2.3 VAR estimation

We have determined that all of the variables in log-levels are stationary in first differences and that they are not cointegrated. Accordingly, we follow the standard procedure in the literature and determine the specifications of the VAR models using growth rates of the original variables. We estimate a VAR model, which include output, employment, and private investment. For Germany we also use a dummy because the unification in 1991.

The model specifications are determined using the BIC. The test results, which are reported in Table 3, suggest that the best specification, for France is a VAR model of first order with a constant term and trend, for Portugal and Italy is a VAR model of first order without a constant term and trend and for the remaining countries is a VAR model of first order with a constant term.

Details of the VAR estimates are available upon request. The only point worth mentioning here is that the matrices of contemporaneous correlations among the estimated residuals show a block diagonal pattern, with innovations in public-sector investment showing a low contemporaneous correlation with the remaining variables. The correlations between innovations in public-sector investment and in the other three variables are in absolute among 0.02 and 0.58. By contrast, contemporaneous correlations among the private-sector variables range from 0.18 and 0.87 in these different countries.

3. On the identification and Measurement of the Effects of Innovations

3.1 Identifying Innovations in the public-sector investment variables

In order to determine the effects of public investment we use the impulse-response functions associated to the estimated VAR models. In determining these effects it is important to consider innovations in public-sector investment that are not contemporaneously correlated to shocks in the other

variables, thereby avoiding reverse causation problems. In dealing with this issue, we draw from the approach in the monetary policy literature [see, for example Christiano, Eichenbaum and Evans (1996), Christiano, Eichenbaum and Evans (1998), and Rudebush (1998)]. This approach was adapted in Pereira (2000, 2001) to the area of public investment in infrastructures in the United States and applied to the Portuguese case in Pereira and Andraz (2004a, 2004b).

Ideally, the identification of exogenous shocks to public investment would result from knowing what fraction of the government appropriations is due to purely non-economic reasons. The econometric counterpart to this idea is to imagine a policy function, which relates the rate of growth of public investment to the relevant information set. In our case, the relevant information set could include the past and current observations of the growth rates of the private sector variables. The residuals from this policy function reflect the unexpected component to the evolution of public investment and are uncorrelated with other innovations.

In the central case, we assume that the relevant information set for the public sector includes past but not current values of the other variables. This is equivalent in the context of the standard Choleski decomposition to assuming that innovations in public-sector investment lead innovations in the other variables. This means that we allow innovations in public-sector investment to affect the other variables contemporaneously, but not the reverse. We have two reasons for making this our central case. First, it is reasonable to assume that the private sector reacts within a year to innovations in public-sector investment decisions. Second, it also seems reasonable to assume that the public sector is unable to adjust public investment decisions to innovations in the private-sector variables within a year. This is due to the time lags involved in information gathering and decision-making. Despite the imminent plausibility of this central case scenario, when reporting the effects of public-sector investment we consider all twenty-four possible orderings of the variables within the context of the Choleski decomposition and present the corresponding range of results.

The policy functions are reported in Table 4. Our result suggest that changes in public-sector investment are positively correlated to the lagged changes in private investment for France and Italy, negatively correlated to lagged changes in output for France, positively correlated to the lagged changes in output for Netherlands and positively correlated to the lagged changes in labour for Finland. This means that public-sector investment is not an exogenous variable but rather follows a well-defined policy rule. Indeed, growing output means also a growing tax base and the potential for greater public-sector investment while growing private investment tends to encourage public investment in that both are complementary. In France, the negative evolution of the product originates positive alterations of public investment, leading to an acceleration of this, perhaps it acts as a counter-cyclical tool. In Finland the results suggest that a positive growth of labour needs a human capital formation.

For Austria, Belgium, Germany and Portugal the result suggest that changes in public-sector investment are uncorrelated to lagged changes in private sector variables and so we can say it is exogenous. It maybe interesting to note the findings in Pereira and Andraz (2004a, 2004b) for public investment in transportation infrastructures in Portugal suggest that the changes in public investment are uncorrelated with changes in the private sector variables and therefore public investment in transportation

infrastructures is an exogenous variable. This is due to the fact that investment in public infrastructure in the last couple of decades, however, has been mostly linked to the EU Structural Transfer Programs.

3.2 Measuring the effects of innovations in the public-sector investment variables

We consider the effects of one-time one-percentage point innovations in the rates of growth of public-sector investment. We expect these innovations to have at least temporary effects on the growth rates of the other variables. However, by definition, even temporary effects on the growth rates of the private sector variables will translate into permanent effects on the levels of these variables.

The long-term elasticities of the different variables with respect to public-sector investment as well as the corresponding ranges of variation are reported in Table 5. Long-term is defined as the time horizon over which the growth effects of innovations disappear, i.e., the accumulated impulse-response functions converge. These elasticities represent long-term accumulated percentage point changes per one percentage point in long-term accumulated change in public investment. A cursory look at the results suggests that the ranges of variation for the elasticity figures are always relatively small. This means that our central assumptions are not only the most plausible but are also robust. This fact offers no surprise, since as pointed out, the matrices of contemporaneous correlations among the estimated residuals display low correlations between innovations in public-sector investment and in private-sector variables.

In Tables 6 and 7 we report marginal product figures. These figures measure the change in million euros in output and private investment and the number of jobs created for one million euros in accumulated change in public-sector investment. We obtain the marginal products by multiplying the average ratio of the private sector variable to public-sector investment for the last ten years, by the corresponding elasticity. The choice of average ratio for the last ten years is designed to reflect the relative scarcity of public-sector investment without letting these ratios be overly affected by business cycle factors. In turn, rates of return are calculated from the marginal product figures by assuming a life horizon of twenty years for all types of public capital assets. These are the rates which, if applied to one euro over a twenty-year period, yield the value of the marginal products. They are adjusted to accommodate a linear depreciation rate of 5%, which is implicit in the life horizon of twenty years.

4. Public-sector investment and economic performance

4.1 On the effects of public-sector investment on employment and private investment

Estimation results reported in Table 6 suggest that public-sector investment has a positive effect on both employment and private investment to Finland, France, Germany, Italy and Portugal and a negative one to Austria, Belgium and Netherlands. These figures imply that, to the former, public-sector spending lead to the creation in the long-term, respectively, of 30, 32, 371, 129 and 68 for each million of euros in public-sector investment and that private investment increases in the long-term by 1.5, 1.4, 2.5, 0.7 and 4.4 million euros for each million of euros in public-sector investment.

By contrast, we find that public-sector investment to Austria, Belgium and Netherlands decreases the number of jobs, in the long term, respectively, in 21, 3 and 219, for each million of euros and that private investment decreases in the long-term by 0.09, 2.7 and 4.6 million euros for each million of euros in public-sector investment.

4.2 On the effects of public-sector investment on output

Estimation results reported in Table 7 suggest that public-sector investment has a positive effect on output for all the countries, except for Netherlands, which corresponds to a marginal product of 0.3, 0.2, 1.7, 3.6, 7.0, 8.6 and 3.2 respectively to Austria, Belgium, Finland, France, Germany, Italy and Portugal. This means that the increase of one million euros in public investment induces a long-term increase of 0.3, 0.2, 1.7, 3.6, 7.0, 8.6 and 3.2 million euros in output respectively.

Although these positive values the corresponding annual rate of return to Austria and Belgium are highly negative. Finland has a rate below what one would expect from private sector investments. On the other hand the results for Germany and Italy are greatly above.

4.3 On the budgetary impact of public-sector investment

Having established that public-sector investment affects output positively in the long-term, we now turn to its potential long-term budgetary impact. To understand the issue we need to recognise that a positive effect of public-sector investment on output also means an increased tax base and, therefore, translates into increased tax revenues. It is, therefore, conceivable that over time public-sector investment has such strong effects on output that it generates enough additional tax revenues to pay for itself. It is equally plausible that the effects on output although positive are not strong enough for public-sector investment to pay for itself. In the first case, cuts in current public-sector investment not only hurt long-term growth but also make the future budgetary situation worse. In the second case, such cuts hurt the long-term output prospects but help budgetary situation in the long-term.

The effective tax rate[4] for Austria, Belgium, Finland, France, Germany, Italy, and Portugal were 34.4%, 20.4%, 31.2%, 39.1%, 27.8%, 23.8% and 31.6%, in that order. Given that one million euros in public sector-investment lead to an accumulated increase in output of 0.28, 0.19, 1.70, 3.63, 7.01, 8.63 and 3.23 million euros, this means that tax revenues increase in the long term by 0.10, 0.04, 0.53, 1.42, 1.95, 2.05 and 1.02 million euros, respectively. Accordingly, public-sector investment does not pay for itself over time in the form of future tax revenues in Austria, Belgium and Finland. Therefore, cuts in public-sector investment although undesirable from the standpoint of long-term output performance do not have an adverse effect in the long-term budgetary position of the public sector.

The analysis to the others countries provides a richer picture. The public-sector investment spending in one million euros increases tax revenues over time by 1.42, 1.95, 2.05 and 1.02 million euros, to France, Germany, Italy and Portugal. This means that cuts in public-sector investment have adverse long-term effects on both GDP and the budgetary situation to these four countries.

It is, in this context, relevant to compare these results with the results obtained in Pereira and Andraz (2004a, 2004b) for public investment in transportation infrastructures, including national roads, municipal roads, highways, ports, airports and railroads. The estimated marginal product for these types of public investments is 9.5 million euros. This implies that in the long-term the public sector would collect 3.33 million euros in tax revenues for each million euros in public infrastructure spending. Accordingly, public investment in transportation infrastructures more than pays for itself and is a good

[4] This is the average overall (corporate plus personal) tax rate for the years since 2000 to 2005, according to OECD tax database (for Finland we considered only 2005, because the data are not available).

strategy from a long-term public budgetary perspective. Clearly, despite all semantic similarities, not all public investments are created equal.

5. Concluding remarks

In this paper we address a question of the utmost importance in the context of budgetary policy in eight Euro area countries, namely, the long-term economic and budgetary effects of public-sector investment. The impact of public-sector investment on output is important in itself from a long-term growth perspective. It is also important from a long-term budgetary perspective. This is because a positive impact on output also represents a positive impact on the tax base and therefore, leads to the critical empirical question of whether or not public-sector investment pays for itself in the form of future tax revenues. If it does, then current cuts in public investment spending not only jeopardise long-term growth but also make the long-term budgetary situation more difficult. If not then only the negative long-term growth effects remain but public investment cuts do help the budgetary situation in the long-term.

In this paper we find that public-sector investment has a positive effect on long-term economic performance for seven countries, except for Netherlands. Therefore, public-investment spending cuts to help current budgetary consolidation efforts come with a price in terms of long-term economic performance. We find, however, the positive effects are not strong enough for public-sector investment spending to pay for itself in the form of future tax revenues in Austria, Belgium and Finland. Therefore, cuts in public-sector investment spending seem to be an effective way to deal with the public budgetary situation in the short term without jeopardising the long-term budgetary situation. It is important to note, however, that the results in France, Germany, Italy and Portugal suggest that cuts in public investment would affect output so strongly that would also have negative long-term effects on the effort toward fiscal consolidation. This is consistent with recent evidence in Pereira and Andraz (2004a, 2004b) in transportation infrastructures to Portugal. Clearly not all types of public-sector investment are the same.

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Table 1: Unit roots tests

		Augmented Dickey-Fuller					Augmented Dickey-Fuller		
country	series	lags	τ		country	series	lags	τ	
Austria	y	1	-2.1640	constant and trend	Belgium	y	0	-3.0196	constant and trend
	l	2	-2.9236	constant and trend		l	1	-2.6827	constant and trend
	ip	0	-2.7722	constant and trend		ip	1	-2.2208	constant
	ig	0	-1.6057	none		ig	0	-2.3161	constant
	Δy	0	-4.0050**	constant		Δy	0	-3.7955**	constant
	Δl	1	-3.4440*	constant		Δl	0	-3.6261*	constant
	Δip	0	-4.0258**	constant		Δip	0	-4.4391**	constant
	Δig	0	-4.1252**	none		Δig	0	-3.6173**	none
Finland	y	1	-3.1520	constant and trend	France	y	1	-2.7460	constant and trend
	l	1	-3.5287	constant and trend		l	1	-2.9794	constant and trend
	ip	0	-1.3986	constant		ip	1	-3.4760	constant and trend
	ig	0	-1.8838	constant		ig	0	1.8996	none
	Δy	1	-2.0019*	none		Δy	0	-3.1012*	constant
	Δl	1	-2.8719**	none		Δl	1	-2.1511*	none
	Δip	1	-2.9491**	none		Δip	1	-2.0318*	none
	Δig	0	-4.9669**	none		Δig	0	-3.4784**	none
Germany	y	1	-1.6900	constant and trend	Italy	y	1	-1.9987	constant and trend
	l	0	-1.7196	constant and trend		l	1	-2.9500	constant and trend
	ip	1	-1.7890	constant and trend		ip	1	-3.1228	constant and trend
	ig	1	-1.8585	constant and trend		ig	0	-2.5319	constant
	Δy	1	-2.9779*	constant		Δy	0	-3.5779*	constant
	Δl	0	-3.9041**	none		Δl	0	-2.6160*	none
	Δip	0	-2.8458**	none		Δip	0	-2.9547**	none
	Δig	0	-2.4374*	none		Δig	0	-5.5951**	none
Netherlands	y	1	-3.0786	constant and trend	Portugal	y	1	-3.5977	constant and trend
	l	1	-1.8407	constant		l	0	-2.5622	constant and trend
	ip	1	-2.5549	constant and trend		ip	1	-3.5328	constant and trend
	ig	0	-2.3836	constant and trend		ig	0	-1.8767	constant and trend
	Δy	1	-3.9142**	constant		Δy	1	-1.9839*	none
	Δl	1	-6.3969**	constant		Δl	0	-3.6933**	none
	Δip	0	-2.5561*	none		Δip	0	-2.9547**	none
	Δig	0	-3.3312**	none		Δig	0	-2.6694**	none

* significant at 5% level;** significant at 1% level

Table 2: Co-integration tests

		Augmented Dickey-Fuller					Augmented Dickey-Fuller		
country	series	lags	τ		country	series	lags	τ	
Austria	y	0	-3.1474	none	Belgium	y	0	-3.0327	none
	l	0	-2.2430	none		l	0	-1.9202	none
	ip	0	-2.8273	none		ip	0	-3.0722	none
	ig	0	-2.0465	none		ig	0	-3.1648	none
Finland	y	0	-0.7563	none	France	y	1	-4.1652*	none
	l	1	-1.8242	none		l	1	-2.1216	none
	ip	0	-2.2176	none		ip	1	-3.1986	none
	ig	0	-3.4607	none		ig	0	-2.3779	none
Germany	y	1	-2.4355	none	Italy	y	0	-3.3365	none
	l	0	-2.9568	none		l	1	-2.8431	none
	ip	1	-3.0341	none		ip	1	-3.3414	none
	ig	0	-1.9750	none		ig	0	-2.2166	none
Netherlands	y	1	-3.2165	none	Portugal	y	0	-2.0414	none
	l	1	-4.4229**	none		l	0	-2.2888	none
	ip	1	-2.7810	none		ip	1	-3.6052	none
	ig	0	-2.3750	none		ig	0	-2.6988	none

*significant at 5% level;** significant at 1% level

τ : critical values –3.74 and -4.30 respectively 5% and 1%

Table 3: BIC tests for VAR specification

country	tests	none	constant	const and trend
Austria	VAR(1)	-28.9738	**-29.4947**	-29.3539
Belgium	VAR(1)	-28.0111	**-28.3200**	-28.0939
Finland	VAR(1)	-26.2306	**-27.1945**	-26.8386
France	VAR(1)	-31.8392	-31.9318	**-32.4584**
Germany	VAR(1)	-26.2893	**-26.7745**	-26.7496
Italy	VAR(1)	**-29.6693**	-29.4912	-29.5403
Netherlands	VAR(1)	-30.3700	**-30.3921**	-30.1413
Portugal	VAR(1)	**-26.4936**	-26.2872	-26.2368

Table 4: Policy Functions

country		dummy	constant	trend	Δig(-1)	Δip(-1)	Δl(-1)	Δy(-1)
Austria	Δig	----	-0.0066 (-0.1108)	----	0.0121 (0.0478)	-0.2442 (-0.3215)	2.0533 (0.4274)	-1.2599 (-0.4472)
Belgium	Δig	----	0.0209 (0.3782)	----	0.2377 (0.9014)	0.2635 (0.4682)	0.1162 (0.0379)	-2.5449 (-0.8859)
Finland	Δig	----	0.0154 (0.4468)	----	-0.5156 (-2.0519)	-0.2485 (-0.5312)	2.7997 (1.6790)	0.3343 (0.2459)
France	Δig	----	0.1192 (2.2166)	-0.0037 (-1.4086)	0.0817 (0.3155)	0.9188 (1.9840)	3.3286 (1.2238)	-4.2032 (-2.1101)
Germany	Δig	-0.0229 (-0.9975)	-0.0508 (-1.5900)	----	0.1199 (0.5169)	-0.0963 (-0.1764)	0.1654 (0.6423)	2.3858 (1.4902)
Italy	Δig	----	----	----	-0.3881 (-1.5572)	1.3534 (1.8295)	0.1764 (0.0778)	-1.4590 (-1.0625)
Netherlands	Δig	----	-0.0313 (-1.1855)	----	-0.0433 (-0.1684)	-0.1636 (-0.3923)	-0.2023 (-0.3077)	2.5350 (1.7347)
Portugal	Δig	----	----	----	0.0070 (0.0327)	0.4614 (1.3500)	2.1096 (1.3569)	-0.6718 (-0.6128)

t-statistics in parenthesis

Table 5: Long-term accumulated elasticities with respect to public-sector investment

country	variable	output	employment	private investment
Austria	public investment			
	central case	0.0048	-0.0176	-0.0079
	range of variation	[-0.0238;0.0305]	[-0.0395;0.0091]	[-0.0849;0.1173]
Belgium	public investment			
	central case	0.0033	-0.0035	-0.2536
	range of variation	[-0.0035;0.0443]	[-0.0073;0.0216]	[-0.2805;-0.0033]
Finland	public investment			
	central case	0.0486	0.0474	0.2635
	range of variation	[-0.1936;0.0564]	[-0.2512;0.0558]	[-0.5342;0.2930]
France	public investment			
	central case	0.1106	0.0567	0.2711
	range of variation	[-0.0008;0.1106]	[-0.0193;0.0567]	[-0.1272;0.2711]
Germany	public investment			
	central case	0.1307	0.3594	0.2528
	range of variation	[-0.0662;0.1307]	[-0.1839;0.3594]	[-0.1759;0.2528]
Italy	public investment			
	central case	0.1970	0.1483	0.0955
	range of variation	[-0.4734;0.3391]	[-0.0758;0.1593]	[-0.5511;0.3536]
Netherlands	public investment			
	central case	-0.1968	-0.3311	-0.7733
	range of variation	[-0.1968;0.0090]	[-0.3311;0.0381]	[-0.7733;-0.1361]
Portugal	public investment			
	central case	0.1247	0.0595	0.7760
	range of variation	[-0.4788;0.1247]	[-0.1743;0.0595]	[-0.1551;0.7760]

Table 6: Long-term effects of public-sector investment on employment and private investment

country	employment		private investment	
	elasticity	number of jobs	elasticity	marginal productivity
Austria	-0.0176	-21	-0.0079	-0.0935
Belgium	-0.0035	-3	-0.2536	-2.7234
Finland	0.0474	30	0.2635	1.4800
France	0.0567	32	0.2711	1.3775
Germany	0.3594	371	0.2528	2.5341
Italy	0.1483	129	0.0955	0.6886
Netherlands	-0.3311	-219	-0.7733	-4.5945
Portugal	0.0595	68	0.7760	4.3540

Table 7: Long-term effects of public-sector investment on output

country	elasticity	marginal productivity	rate of return
Austria	0.0048	0.2775	-6.2
Belgium	0.0033	0.1925	-7.9
Finland	0.0486	1.6999	2.7
France	0.1106	3.6271	6.7
Germany	0.1307	7.0132	10.2
Italy	0.1970	8.6314	11.4
Netherlands	-0.1968	-6.5486	---
Portugal	0.1247	3.2349	6.0

Figure 1: Public investment in terms of GDP (%)