

# **Can public capital cause dual inflation? The Spanish evidence.**

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## **Abstract**

In this paper we built a simple two-sector model where public spending (or public capital) has a positive impact on productivity of both sectors. The main theoretical result, that is consistent with the traditional Balassa-Samuelson model, is that inflation might be affected by the evolution of public capital due to its impact on productivity. In fact, an increase in the stock of public capital can generate dual inflation if the elasticity of output to public capital is higher in the tradable sector. Finally, we use Spanish data to estimate the theoretical model. And we find that the empirical results back anecdotal evidence regarding Spanish dual inflation.

## 1. Introduction

During the late nineties, Economic and Monetary Union (EMU) was perceived by peripheral European countries as an opportunity to reduce inflation and gain nominal and financial stability. Nowadays, this aim has been achieved. However, it is also evident that EMU does not necessarily mean a single inflation rate among countries. Adopting a common monetary policy does not preclude automatically inflation differences. The reason is that those divergences can be caused by real factors that do not disappear in a single monetary regime.

More generally, in many developed countries prices of those sectors that face foreign competition (tradable sectors) have contributed to moderate inflation. On the contrary, prices of non-tradable sectors, that do not face international competition, have misbehaved. This differentiated behaviour among prices is particularly clear in the case of the Spanish economy. This phenomenon, i.e., the divergent behaviour between non-tradable and tradable prices, is commonly known as “dual inflation”.

**[insert Figure 1]**

In this context, Spain can be considered as a "paradigm". On the one hand, there is a dual inflation process: prices of the non-tradable sector grow systematically faster than prices of tradable sector. In addition, Spain maintains persistently a higher rate of inflation than those of the “core EMU”<sup>1</sup>. This inflation gap among Spain and other EMU countries, though relative small, is perceived as an economic problem, because it could entail a permanent competitiveness loss<sup>2</sup>. This increase in relative prices and in costs can no longer be corrected by exchange rate depreciations, as it was the usual way in the past.

In this paper we show that fiscal policy can play a significant role on the dual inflation phenomenon. Nevertheless, we are not focus in the traditional fiscal channel, i.e., a fiscal expansion that increases aggregate demand and then exacerbates pressure on non-tradable prices. In this paper, public expenditure has a positive impact on productivity and, surprisingly, it is through this channel the way fiscal policy can generate dual inflation.

We develop a model where public spending has a positive impact on output, following Barro (1990). In addition, the model has two productive sectors, the tradable and the non-tradable. From this point of view, this paper is consistent with the standard Balassa-Samuelson model<sup>3</sup>. However, the positive externality of public spending on output is not necessarily homogeneous along different sectors.

The main result of the paper is that public productive expenditure has a larger impact on the output of the tradable sector, in the case of Spanish economy. This is the expected result, as productive public spending is, mainly, infrastructures. We show that, given the specific productive structure of the Spanish economy, an increase in public spending results in a rise of non-tradable prices, generating dual inflation.

The paper is organised as follow: in section 2 we present the model. Section 3 presents the evidence for the Spanish economy and section 4 summarises our main findings.

## 2. The model

We develop a simple model of a small open economy with fixed exchange rate and perfect mobility of private capital. This economy has two competitive sectors, the tradable and the non-tradable. The tradable sector faces foreign competition and its price is internationally given. On the contrary, domestic market determines the price of non-tradable sector. Finally, both sectors use public spending as a productive input, without any direct cost.

As it is mentioned before, there is one competitive firm in each sector and it uses a Cobb-Douglas technology that exhibits constant returns to scale in private inputs.

$$Y_{i,t} = A_t^i G_t^{\beta_i} L_{i,t}^\alpha K_{i,t}^{1-\alpha}$$

Where Y represents output in each sector (i=T for tradable and NT for non-tradable), A is total factor productivity or a technological parameter, K is private capital and L is labour. Parameter  $\alpha$  is the elasticity of output with respect to labour. Variable G is productive public spending. At this point, we follow Barro (1990) that introduces public expenditure as a productive input. It is easy to realise that public spending generates a positive externality on production only if  $\beta_i > 0$ . Finally, subindex t represents time.

In this model, public spending can be easily interpreted as infrastructures. In this sense, Aschauer (1989), in a pioneer paper, shows that infrastructures have a positive effect on output. Argimon *et al.* (1993), Bajo and Sosvilla (1993) and Mas *et al.* (1994) find a similar result for the Spanish economy.

Each firm maximises profits and it is straightforward that prices are:

$$P_t^i = \frac{\phi W_t^\alpha R_t^{1-\alpha}}{A_t^i G_t^{\beta_i}}$$

Where  $\phi$  is a constant and it is equal to  $\alpha^{-\alpha}(1-\alpha)^{\alpha-1}$ ,  $W$  is nominal wage and  $R$  represents the interest rate. This price structure implies that the evolution of relative prices of tradable goods and non-tradable is as follows:

$$\frac{P_t^{NT}}{P_t^T} = \frac{A_t^T}{A_t^{NT}} \frac{G_t^{\beta T}}{G_t^{\beta NT}} = \frac{A_t^T}{A_t^{NT}} G_t^{\beta T - \beta NT}$$

If we take logs in previous expression, we can write:

$$p_t^{NT} - p_t^T = (a_t^T - a_t^{NT}) + (\beta_T - \beta_{NT})g_t$$

### 3. Empirical evidence for the Spanish economy

In order to show that our hypothesis makes sense we provide some empirical evidence. First, we built the Solow Residual of both sectors<sup>4</sup>. And second, we compare the difference between both Solow Residuals with the relative prices of both sectors. In others words we compare  $\frac{P_t^{NT}}{P_t^T}$  with  $\frac{A_t^T}{A_t^{NT}} G_t^{\beta T - \beta NT}$ . We find a correlation of 0.99 between the two time series. We replicate the analysis but using the first differences of both series. In this case the correlation is lower, but still quite significant, 0.44. This evidence suggests that dual inflation, at least in the Spanish case, can be originated by productivity growth differences between the tradable and the non-tradable sector, i.e., we are facing a dual inflation process à la Balassa-Samuelson. Obviously, the following relevant question is about the role of public productive capital.

**[insert Figure 2]**

At this point we try to estimate the above-mentioned expression in order to evaluate the effect of public expenditure on inflation differential of both sectors. But there are some empirical problems that have to be solved before. First, public spending includes very different items, but we are only interested in those that are productive. Therefore, we use the stock of Spanish public capital<sup>5</sup> as a proxy for productive public capital. On the other hand, we have to distinguish between tradable and non-tradable goods in order to identify inflation divergences. So, we consider agricultural and industrial goods as tradable items. Services<sup>6</sup> and construction are treated as non-tradable goods. Deflators of agriculture and industry are used to build the inflation rate of tradable goods. We built non-tradable inflation in the same way.<sup>7</sup> Finally, output elasticity with respect to labour is

calibrated for whole economy. We found that  $\alpha$  is 0.62.<sup>8</sup> One could think that that model is excessively simple. In particular, we have imposed the same elasticity of output with respect to labour in both sectors and, perhaps, there would be significant differences. If we loosen that restriction and recalibrate the elasticity of each sector, we obtain  $\alpha_T=0.631$  and  $\alpha_{NT}=0.604$ . In our opinion we can ignore this difference in order to estimate the simplest model.

So, we are going to estimate, for the period 1970-1998, the following standard error correction model to capture our long-term relationship:

$$\pi_t^{NT} - \pi_t^T = \gamma_0 + \gamma_1(\pi_{t-1}^{NT} - \pi_{t-1}^T) - \gamma_2(p_{t-1}^{NT} - p_{t-1}^T - \gamma_3 g_{t-1}) + \gamma_4 d86 + \varepsilon_t$$

Where  $\pi_t^{NT} - \pi_t^T$  represents the sectorial inflation difference and d86 is a dummy variable. This variable collects the impact of the value-added tax (VAT) on relative prices. VAT went into force in Spain in 1986.

The result is present in table 1.

**[insert Table 1]**

As it was expected, the coefficient  $\gamma_3 = \beta_T - \beta_{NT}$  is positive and significant, validating a Balassa-Samuelson effect. This result suggests that public capital has a positive impact on productivity, albeit its repercussion through economic sectors is heterogeneous. Specifically, productive public spending benefits productivity tradable sector the most. In other words, dual inflation is generated because productivity in tradable sector grows faster than in non-tradable sector.

In last decades, Spain has carried out an economic policy to provide an adequate level of public capital.<sup>9</sup> In fact, public capital, compared with private one, has grown systematically faster since 1980. This higher level of public infrastructures has fostered tradable sector productivity with respect to non-tradable sector. Our result suggests that an unexpected outcome of this policy has been a dual inflation.

**[insert Figure 3]**

#### **4. Conclusions**

In this paper we develop a simple Balassa-Samuelson model of dual inflation and we analyse the effects of including public spending in this framework. We try to clarify if public spending could have an effect on inflation. This effect takes place if first, public expenditure is productive and second; the impact of public spending on productivity is not homogeneous among sectors. If public spending has a higher positive effect on tradable sector productivity then an increase in productive public spending (i.e. infrastructures) results in dual inflation.

When we analyse the Spanish economy, find that both conditions are fulfilled. The results suggest that an expansionary fiscal policy could have a negative impact on inflation.

The traditional or keynesian channel says that an increase in public expenditures pressures aggregate demand, leading to higher prices of non-tradable goods. This alternative "supply side" channel brings up the same result on relative prices as the traditional one.

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#### **5. References**

Argimón, I., J.M. González-Páramo, M.J. Martín and J.M. Roldan (1993). "Productividad e infraestructuras en la Economía española", *Moneda y Crédito*, 198, 207-241

Aschauer D. (1989): "Is Public Expenditure Productive?", *Journal of Monetary Economics*, 23, pag. 177-200.

Bajo, O. and Sosvilla, S. (1993). "Does public capital effect private sector performance?", *Economic Modelling*, July, 179-184.

Balassa, B. (1964): "The Purchasing-Power-Parity doctrine", *Journal of Political Economy*, 76, pag. 584-594

Barro, R. (1990): "Government Spending in a Simple Model of Endogenous Growth", Journal of Political Economy, 9, pag. 103-125.

Betts, C.M. and T.J. Kehoe (1999): "Tradability of goods and real exchange rate fluctuations", Manuscript, University of Southern California.

BBVA Foundation. Databases. Capital Stock and Income in Spain (1964 – 2000).

Froot, K. Kenneth, R. (1994): "Perspectives on PPP and Long Run Real Exchange Rate", NBER Working Papers, 4952.

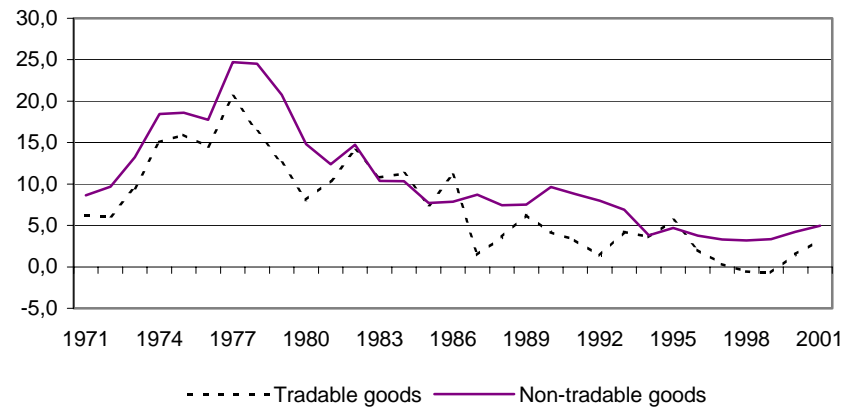
Instituto Nacional de Estadística. [www.ine.es](http://www.ine.es)

Mas, M., Maudos, J., Pérez, F. and Uriel, E.(1994). "Capital público y productividad en las regiones españolas", Moneda y Crédito, 198, 163-192.

Samuelson, P. (1964): "Theoretical notes on trade problems", Review of Economics and Statistics, 46, pag. 145-154.

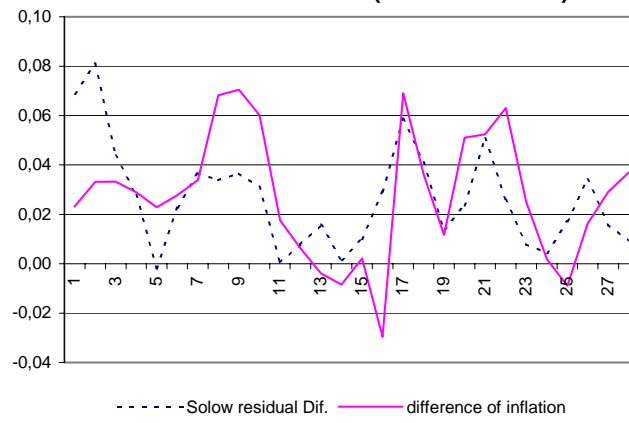
Wyplosz, C. and Laszlo, H. (1995): "Equilibrium Real Exchange Rates in Transition", NBER Working Papers, 1145.

**Figure 1**  
**The Spanish Dual Inflation (yoy)**

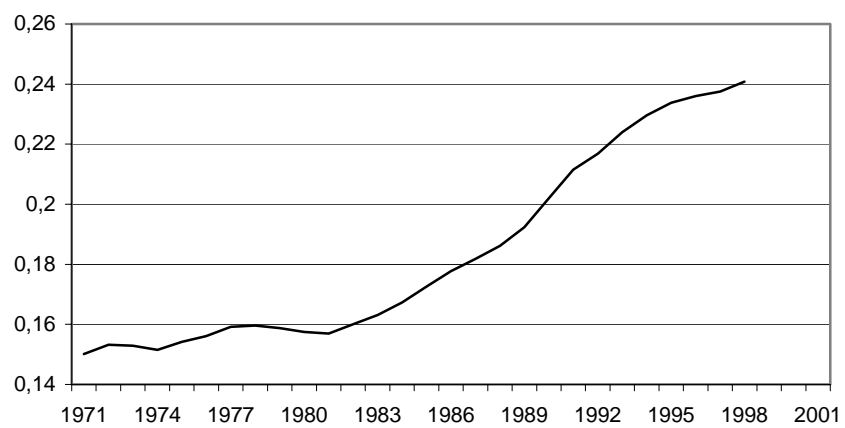




**Figure 2**  
**D Pnt/Pt and D(Solow residuals)**



**Figure 3**  
**Public capital / Private capital**



**Table 1**

	Coefficient	t-Statistic
$\gamma_0$	-1.67	-4.0
$\gamma_1$	0.55	5.2
$\gamma_2$	0.26	4.2
$\gamma_3$	0.53	22.7
$\gamma_4$	-0.05	-5.0
$R^2$	0.73	

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<sup>1</sup> Germany, Italy and France, basically.

<sup>2</sup> Wyplosz and Laszlo (1995) and Froot and Kenneth (1994) show that a higher increase in non-tradable prices (versus tradable prices) can be interpreted as real exchange rate appreciation and this ends up in a competitiveness loss.

<sup>3</sup> See Balassa (1964) and Samuelson (1964).

<sup>4</sup> We have data for the period 1970-1998. These data is provided by BBVA Foundation.

<sup>5</sup> This variable excludes private infrastructures and is a variable in real terms. These data is provided by BBVA Foundation.

<sup>6</sup> Services that aren't intended to be sold are excluded (free services to the public).

<sup>7</sup> We follow Betts and Kehoe (1999) in this point.

<sup>8</sup> We use annual data from Instituto Nacional de Estadística.

<sup>9</sup> Spanish public infrastructures have been financed mainly by the European Structural Funds.