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Environmental fiscal reform and unemployment in Spain in the presence of an informal sector

Anil Markandya[1], Mikel González-Eguino and Marta Escapa

This policy briefing reports the results obtained in two recent papers (Markandya et al 2012 and Gonzalez-Eguino et al 2012) where the role of Enviromental Fiscal Reform (EFR) is revisited for the case of Spain. We analyse the implications of including into the standard models an important additional dimension: the presence of an informal sector. We conclude that, if the distortions created by the shadow economy are considered, the case for an environmental tax reform where revenues are used to reduce labour taxes is strengthened.

Keywords: Environmental fiscal reform, shadow economy, unemployment, Spain

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1. Introduction

The literature relevant to the relationship between environmental taxation and employment creation is centred on the suggestion by Pearce (1991) that environmental taxes not only produce improvements in the environment but also positive economic and social outcomes. In order to obtain his "double dividend" governments must use the revenues from environmental taxes to reduce other taxes in the economy. For example a carbon tax could be used to reduce social security taxes, which should increase the demand for labour as well as reducing emissions of CO2. This conclusion, however, is affected by the fact that carbon taxes raise the prices of goods other than labour, thus reducing the real wage and spending by households. This in turn reduces the demand for labour, affecting the possibility of a double dividend.

The issue has been studied in some depth and, theoretically, it is difficult to establish that such a double dividend will emerge from the tax reforms. Studies have been conducted, using economy-wide models, such as applied general equilibrium models, to investigate the actual economic structures of several European countries and they find that environmental fiscal reform (EFR) of the kind described do indeed generate a decrease in unemployment and a reduction in pollution (Majochi, 1996; Markandya, 2011). The question that remains open is the size of the benefit in each dimension and the other impacts of EFR (distributional impacts etc.).

In the case of Spain there have been a few studies that have addressed this question (Manresa and Sancho, 2005, Faen et al, 2009) and they do find a double dividend if we increase taxes on energy or carbon and reduce them on labour. The magnitude of these effects varies across the papers due to: (a) the assumed degree of substitution between capital, energy and labour and (b) the extent to which real wages go up when there is a decrease in unemployment. For (a) the more substitution there is between energy and capital, the more likely it is that an increase in energy prices will result in more capital being used rather than labour and so the effect on the labour market will be smaller. For (b) the higher is the 'elasticity' of the wage-unemployment relationship, the more likely is it that any increase in the demand for labour will

result in an increase in the real wage, cancelling the benefits of the tax reduction and making the overall employment benefit smaller. These papers estimate the range of the unemployment gain for a tax equivalent to about US$22-24/ton CO2 (€17-18/ton CO2) and it appears to be 0.1% to 0.6% for plausible values of the key parameters.

Here we summarise, for a non-technical audience, the results obtained in two recent papers (Markandya et al 2012 and Gonzalez-Eguino et al 2012) where the role of an EFR is revisited for the case of Spain. We report the results obtained from the literature for Spain and compare them with those obtained with a new model that incorporates an important additional dimension: the presence of an informal sector.

It is well known that such a sector exists and has a significant role in the economy. What is less appreciated is the fact that changes in labour taxes can make it more attractive to switch out of the informal sector and into the formal sector. This can increase government revenues, making it possible to reduce labour taxes while increasing carbon taxes by a greater amount and thus increasing the demand for labour more than was previously estimated.

The rest of the policy briefing proceeds as follows. Section II lays out the basic model and some key features of the Spanish economy; section III gives the results and Section IV provides some conclusions.

2. A New Applied General Equilibrium Model for Spain

2.1 Key Features of the Model

Here we describe in general the new model that we use. The model is described in greater detail in González-Eguino et al (2012). The structure is a familiar one, based on a static Applied General Equilibrium model of the same kind as used by Manresa and Sancho (2002) and Fæn et al. (2009). The

model we use comprises the following: (a) nine production sectors, (b) a representative consumer, (c) a government which collects taxes and supplies public goods and services and (d) the "Rest of the World", which trades with Spain. Primary factors are capital (K), formal labour (LF), informal labour (LI) and energy inputs in the form of coal, fuel oil, gas and electricity, we do not diferenciate beteween skilled and unskilled labor. Unemployment is modelled through a wage curve so that the real wage increase as unemployment falls (Blanchflower and Oswald, 1995, 2005). The relationship between unemployment and the real wage is quantified through an elasticity of the wage curve, for which we take typical values from previous Spanish studies.

The main differences from earlier models are the following:

There are two kinds of labour: formal and informal, which are imperfect substitutes for each other in production and σ_L corresponds to the elasticity of substitution between them. As $\sigma_L \to \infty$ formal and informal labour become perfect substitutes. If $\sigma_L = 0$ there is no substitution between the two kinds of labour.

Although total labour endowment is fixed, as is the initial allocation of labour between the formal and informal sectors, there is mobility between them which is modelled through an an equilibrium condition that relates the real-wage differential and unemployment, following Harris and Todaro (1970). The mobility between formal and informal market takes place to the point where the real wage for informal employment is equal to expected formal wage. The expected wage in the formal sector is the wage, w_F, times the formal employment rate $(1 - u)$. If unemployment 'u' rises, the gap between formal and informal wages widens and more labour moves to the informal sector, lowering wages there until the two are equal again.

The dynamics work as follows. As labour taxes fall the demand for formal labour rises and unemployment falls. This causes a shift in labour to the formal sector until the point at which a new

equilibrium is established between a higher wage in the informal sector equal to the expected wage informal sector (and a smaller informal sector).

2.2 Data on Unemployment and the Informal Sector in Spain

Spain has traditionally had a high level of unemployment relative to its European neighbours and other trading partners as well as a large informal labour market. Regarding unemployment the current level of around 24%, while high, is in fact not dissimilar to that experienced in 1995 and the low levels of 1998-2006 were exceptional for the country.

The other important feature of the labour market in Spain is the informal or shadow economy. A comprehensive survey regarding definitions and estimation procedures of the shadow economy can be found in Schneider and Enste (2000). In Schneider (2011) and Buehn and Schneider (2011) a review of the main empirical studies that measure the size of the shadow economy is provided. The conclusion from these studies is that the main driving forces of the shadow economy are tax and social security contribution burdens, 'tax morale' (or the intrinsic motivation of individuals to pay taxes) and the intensity of state regulations.

Arrazola et al. (2010) estimate the size of the shadow economy for Spain following different methodologies. They conclude that for the period 2005-08 the shadow economy represented 21.5% of GDP, with a loss of revenue for the government of 7% of GDP. This shadow economy engages 4.3 million shadow jobs. These results are in line with those collected by Buehn and Schneider (2011), where the average shadow economy in Spain corresponds to 22.5% of GDP from 1999 to 2007. To date, however, the CGE models for Spain that look at the double dividend do not address this aspect of the labour market.

2.3 Calibrating the Model

The initial equilibrium data come from the Symmetric Input Output Table (INE 2009a). Energy consumption in physical units for each sector and fossil fuel is estimated from the sectoral energy balance sheets (Eurostat, 2005) and emissions are calculated via the standard coefficients2 for coal, oil and gas. The reaction of agents to changes is reflected through elasticities of substitution as given in Babiker et al. (2001). Based on the cited studies (Arrazola et. al (2010), Buehn and Schneider (2011)) the base case shadow economy is taken as 20% of the official GDP and the official unemployment rate is set at 20%. It is commonly accepted that there are some economic sectors where the shadow economic activities are more important because the percentage of undeclared work is higher than in others. Therefore, we assume three types of sectors according to their high, medium or low contribution to the shadow economic activity. The selection of sectors under each category and the level of informal labour are based on Hvidtfeldt (2011)3.

3. The Results

Simulations were carried out where CO2 taxes increased to the point at which CO2 emissions fell by amounts ranging from 5% to 30%. The revenues obtained from the CO2 emission permits were "recycled" via (i)) lump sum transfers (LST tax reform), (ii) reducing taxes on labour (L tax reform) or

[2] The physical emission coefficients used are the standard used by Eurostat (2005): tonnes of CO_2 per Ktoe for coal (4.104), oil (2.851) and gas (2.187).

[3] Hvidtfeldt et al. (2011) use an interview survey to estimate the percentage of undeclared work for different sectors of the Danish economy in 2010. They obtain that 48% of undeclared work is done in the construction sector, followed by agriculture (47%), motor vehicle sales and repairs (43%), manufacturing (36%), transport and telecommunications (31%) and hotel and restaurant (30%).

(iii) reducing taxes on capital (K tax reform). We assume that all these tax reforms are revenue neutral (government revenue is fixed) so welfare impacts can be compared. The main results are as follows:

A. With no mobility between the two labour sectors and with unemployment in the formal sector fixed, all three tax reforms reduce welfare as measured by the equivalent variation. For a 15% reduction in emissions the fall in welfare is about 0.1% and there is virtually no difference between the three tax reforms. If, however, we allow for mobility between the sectors and make the elasticity of the wage curve around 0.1 (a typical value, see Blanchflower and Oswald 2005) we find that the three reforms result in major differences in welfare. Whereas the LST and K tax reforms still reduce welfare, the L tax reform increases welfare. Again looking at a 15% reduction in emissions we find that welfare in cases (i) and (ii) falls by about 0.91%, in case (iii) it now increases by about 2.9%.4

B. As far as unemployment and the shadow economy are concerned the main findings are shown in Table 1. The case considered is a 15% reduction in the emissions of CO2 in Spain and the three tax reforms are compared. Table 1 shows a major gain with labour tax recycling in terms of reduced unemployment. The latter falls by 3.5% with this tax, while it actually rises slightly in the case of a recycling of revenues with a lump sum tax or with a capital tax. The level of CO2 tax required to achieve the 15% reduction in emissions, however, is quite high – around US$62 per ton CO2 emitted.

C. We have also analysed the relative contributions of wage-unemployment flexibility and of movements between the formal and informal sectors for the case of the labour tax recycling

[4]The welfare effects depend strongly on the elasticity of the wage curve (θ) and the degree of substitutability between formal and informal labor (σ_L). A sensitivity analysis of the effects of changes in both parameters can be found in González-Eguino et al. (2012).

scheme. We find that the reduction in unemployment is smaller when there is no flexibility between formal and informal labour and when unemployment is fixed5. We also note for each case, carbon taxes needed to achieve the 15% reduction in emissions are different. Finally, we look at the reduction in local pollutants as a result of the tax reforms. These include SO2, NOx, Non-Metallic Volatile Organic Compounds, nitrous oxides, ammonia and particulate matter. Coefficients of emissions per unit of output by sector were taken from the National Statistical Office of Spain (INE 2009b) and valued in monetary terms using estimates for Spain made in the EU CASES Project (Markandya et al., 2010)6. In addition we value the reductions in CO2, for which a range of estimates is available, with a lower bound of €17.2/tonne CO2-eq ($21/tonne) and a higher bound of €32/tonne CO2-eq (US$39/tonne)7. The CO2-eq estimates are taken from the EC (European Commission, 2008), the UK government (DECC, 2009) and a study conducted for the French government (Centre d'analyse stratégique, 2009). The results show a reduction in damages of the order of 1-2 billion euros ($1.2-2.4 billion) with the labour tax recycling scheme. These reductions in total damages amount to between 0.3% (lower bound of CO2-eq) and 1.1% (higher bound of CO2-eq) of GDP and represent a significant addition to the EV welfare measures that were described above. We also find that the reduction in damage is greater with the K and LST reforms than it is with the L tax reforms The reason for this is the greater reductions in emissions that one

[5] In this case unemployment still falls a little because workers from the informal sector are brought into the formal sector and this reduces the measured level of unemployment.

[6] Not all emissions that were quantified could be valued in monetary terms. In particular we could not value carbon monoxide (CO) and methane due to lack of estimates. Furthermore estimates for damages from PM were limited to PM10 as no emissions data were available for PM2.5.

[7] Conversion to US dollars has been done at the average annual exchange rate prevailing in 2005, the year for which the impacts have been estimated.

gets with the K and LST reforms, because of a bigger fall in output in the K and LST reforms and possibly a shift to capital-intensive sectors that have lower emissions.

Table 1: Economic Impacts of Different Tax Reforms (% Changes)

(σ_L= 5 and θ = 0.1)

	Alternative Tax Recycling		
	LST	K Tax	L Tax
Welfare	-0.91	-0.91	2.89
Shadow Economy (Base = 20%)	20.9	20.9	14.5
Unemployment (Base = 20%)	21.4	21.4	16.5
CO2 Tax US$/tCO2	45.8	45.7	62.4
CO2 Emissions	-15.0	-15.0	-15.0

LST: Lump Sum Tax; K Tax: Capital Tax; L Tax: Labour tax

4. Conclusions

The analysis of the double dividend for Spain indicates that replacing part of the labour taxes with a carbon tax could have the benefit of some reduction in unemployment and either a small loss of welfare or a small gain (as measured by the equivalent variation (EV)). The EV measure, however, does not take account of the benefits of reduced emissions of local pollutants. Our latest analysis shows that if these are included the environmental tax reform results in a notable increase in welfare (around 2-3%).

There is a question of the size of the fall in unemployment. The Manresa and Sancho study estimates a fall of around 0.6% for plausible parameter values. The Fæn et al. study focuses on differences between a reduction in the tax on skilled versus unskilled labour. Even if we take the more positive result (i.e. a recycling via reductions in skilled labour taxes), the fall is only about 0.3%. Part of the difference may be due to very different environmental taxes regimes. Manresa et al really do not impose a carbon tax but rather a heavy tax on energy and petroleum products, which generates significant revenue. The Fæn et al. study on the other hand is strictly a carbon permit scheme. It also has much higher substitution possibilities between energy and capital, with the result that the carbon tax results in a bigger shift from energy to capital and less of a shift from energy to labour.

On the other hand our study which is based on the 2005 input-output table, and which includes the informal labour market, estimates a gain of employment from an economy-wide carbon tax recycled via a reduction in labour taxes of around 3.5%. We also allow for significant substitution possibilities between capital-labour and energy so we are not excluding the possibility of shifts to capital when energy becomes more expensive.

However, the main explanation for the gains in welfare in labour that CO2 tax causes the informal sector to pay factor taxes because the CO2 tax leads to a general increase in the price level. This general price increase is an implicit tax on factors of production (labor and capital). Thus, via the CO2 tax, the government manages to shift from (a) a system where only the formal sector pays taxes on factors to (b) a system where both the formal and the informal sector pay such taxes. This improves efficiency on non-environmental grounds by broadening the factor tax base. Notice that the important welfare gains obtained are not extraordinary if we think that when including the shadow economy in the analysis the inefficiency of the current tax system also increases.

Of course the model is highly stylized and takes no account of dynamic effects. Hence we could not expect a tax reform to generate the changes in one period, but rather to take place over a number of quarters. There is also the question of distributional effects that need to be assessed; while the increase in energy prices are countered by an increase in real wages for those who are employed there is no such countering effect for those who are not working, in particular pensioners, and those who still remain unemployed. Some measures to address possible fuel poverty impacts on these groups would need to be introduced. Finally there is the issue of competitiveness. The models used allow for the trade impacts of higher energy prices but they do not allow for capital mobility, which could cancel some of the effects if the carbon tax was passed on to capital. This effect will be significantly reduced if the reform is harmonized across trading partners, particularly member states of the EU.

In spite of all these qualifications, however, we would conclude that our analysis strengthens the case for an environmental tax reform in Spain involving recycling via a labour tax reduction.

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