The Price Effects of Indirect Taxation in the Regional Economy of Andalusia[1]

By
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Abstract

The goal of this paper is to use a regional social accounting matrix (SAM) to empirically study the price burden of indirect taxes in the regional economy of Andalusia, Spain, a developing region located in the south of the Iberian peninsula. The methodology we use is that of the well-known input-output subset of a SAM model. Adopting this approach we are able to capture the existent structural interdependence among productive sectors and we are able to evaluate the implicit weights and price elasticities of the different indirect taxes, as well as indicators of consumer's welfare variations. The database used in the analysis is the SAMAND95 (Social Accounting Matrix of Andalusia, Spain, for 1995) developed by the authors. The main result of the paper is that taxes on labour use by firms carry the largest price burden of all indirect taxes, hence exerting a constraining role on the regions' competitiveness.

1. Introduction

Regional governments in Spain have seen the scope of their responsibilities, both political and economic, enlarged in the last twenty years. The political process of reform of a largely rigid and centralised government structure has shifted to the regional governments many of the formerly centralised decision making processes. At the same time that regional governments have assumed greater levels of responsibility in the design of regional development plans, the move towards globalisation within the

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industrialised European countries has added new constraints but also new possibilities for emergent local economies (Curbelo, 1998). The increasing availability of microeconomic regional data makes it feasible to study the impact on the regional economy of policies designed and carried out from within (the regional government) or from above (the higher levels of government, either national or supranational).

The ability to assess policies gains importance in the context of developing regions. It may provide detailed information to be taken into account when ordering priorities and may yield insights for complementary regional public policies beyond those conventional policies aiming at income redistribution. The region of Andalusia is located, and encompasses, the whole geographical south of Spain, from the Mediterranean Sea in the east to the Portuguese border in the west. Andalusia is presently considered a developing region within the Spanish or European economic framework.

The work presented in this paper is an attempt at evaluating the impact on prices and consumers' welfare of the tax system, specifically the subset of indirect taxes, on the regional economy of Andalusia. We aim therefore at obtaining an indicator of total indirect tax weight. Such an indicator could be interesting to assess the distortions on relative prices exerted by the different indirect tax figures. It would also allow us to measure the quantitative weight of the indirect taxes on the prices, yielding a measure of the inflationary cost-push of each tax. A major concern of the present analysis is to detect and quantify the burden exerted by indirect payroll taxes. It has been observed in other related studies for the whole economy of Spain, as in Sancho (1988) based on a SAM of Spain for 1980 and Polo and Sancho (1996) using a 1990 Spanish SAM, that labour taxes play a crucial role in price formation. We feel it is therefore relevant to examine if such a result still holds with the newer and more current data available at the regional level.

A convenient methodological set-up for this analysis is that of the Social Accounting Matrix (SAM). A SAM is a square tabular database that incorporates, for a given period and level of sectoral disaggregation, the complete flow of incomes in the economy and contains, in addition, an input-ouput table as a data submatrix. The SAM of Andalusia yields a compact, disaggregated representation of all value transactions taking place in the base period. The SAM used in this paper (SAMAND95) has been recently developed by Cardenete and Moniche (2001) based upon a previous SAM laid out in Cardenete (1998). The extracted input-output data subset is used to implement a linear production model that captures the existent interdependence among productive sectors and it leads to a natural evaluation of the tax burden, both in absolute levels and elasticities, of the different indirect taxes. Needles to say, the interpretation of the results, their validity, and their currentness depend, on the one hand, upon the well-known limitations of the methodology and, on the other hand, upon the quality and age of the data base. Although techniques to update SAMs and input-output tables do exist, one has to appraise the trade-off between having an older database with a reliable microdata set or having an extrapolation. Any update, constructed from a combination of partial sectoral data and more recent aggregate macro figures, is subject to transformations and adaptations that will inevitably and subtly alter the structure of the initially available microdata. With these considerations in mind, the selected approach for the SAMAND95 has been to keep the latest officially available input-output data.

The paper is divided in four parts. Section 2 briefly presents some of the main antecedents of the model being used. In Section 3 we present the methodology; after introducing the base economy and its technology we lay out the rules governing price formation. We go onto obtaining the different features and price and welfare indicators calculated from the data in the SAMAND95. In Section 4 we outline and discuss the empirical results. We close the paper with a section that summarises the results and limitations of the analysis.

2. Brief literature review

In the empirical applications of the theory of general equilibrium we can distinguish between Walrasian models (whose numerical implementations are known as Computable General Equilibrium –CGE– models) and SAM type models.

A distinguishing trait of CGE models is that they allow for substitution between factors in response to changes in relative factor prices, or shifts in households' demand again in reaction to changes in consumption prices. Demands and supplies (for goods, services, and factors) are coherently integrated in a system that matches them thanks to the balancing role of relative prices. Prices and quantities are endogenous variables in the model, and an algorithmic equilibrium is achieved through an iteration process between prices and quantities.

These models have their foundations in modern microeconomic theory and have had a spectacular development starting in the 80's dealing with fiscal and trade issues beyond the size constraints of previous analytical models. In the first area, Scarf and Shoven (1984), Ballard et al. (1985) and Whalley (1985) have collected and expanded the most relevant aspects and applications of this methodology. In the trade area we have Dervis, de Melo and Robinson (1982), Robinson (1987), Decaluwé and Martens (1988), and Roland-Holst and Tocarick (1989) as main contributors. The most general contribution is probably that of Shoven and Whalley (1992).

SAM models, in contrast to CGE models, can be seen as extensions of classical input-output models. The flow of interdependencies encompasses a greater set of structural relations than those of input-output analysis, but adapting behaviour of quantities to changing relative prices is also ruled out. An analytical advantage of SAM models is their operational simplicity regarding their Walrasian counterparts. From a conceptual viewpoint, another key advantage of SAM models is that they project short-run policy evaluations, rather than the long-run adjustments typically supplied by CGE models, therefore providing more focused insights on practical observable policy effects. Seminal references to the SAM approach to multisectoral modelling can be found in Pyatt and Round (1979), Defourny and Thorbecke (1984), and Pyatt (1988, 1999).

In this paper we will be using this second methodology, that is, the social accounting matrix approach. Many authors that work in this area refer to this kind of *models as linear general equilibrium models* (as opposed to *non-linear* or *computable general equilibrium models* proper). We feel, however, that this terminology does not capture the true sense of this methodology since linear models of the Walrasian kind can also be constructed (Manresa and Sancho (2001)). Thus our preference for referring to them as SAM type models.

3. The Analysis: Data and Model characteristics

3.1 The database

The circular flow of income for the region is represented in the SAMAND95 database (Social Accounting Matrix for Andalusia, 1995, Cardenete and Moniche (2001)) a SAM that has the traditional square tabular format. The SAM comprises 37 institutional accounts, including 25 production sectors, identified in Table 2, 6 differential tax categories, 2 primary factors, a government sector, a foreign sector, a private consumption account and a capital (savings/investment) account. A simplified macro version of this SAM is presented in Table 1[2] below where the relationship between the SAM accounts and the National Income and Product Accounts can be readily seen. In the construction of the SAMAND95 the following main data sources were combined and reconciled: the 1995 Input-output Table for Andalusia, the 1995 Regional Accounts for Andalusia, and the 1995 Spanish Regional Accounts. As it is usual in building a SAM, it was necessary to establish a hierarchy of data sources in order to reconcile different available estimates for the same economic magnitudes. Given its wealth of micro data, the selected pivotal data source was the regional input-output table.

3.2 The economy

We consider an economy with 25 production sectors. The technology that characterises the economy is the traditional in linear economic models, where each sector produces a unique good or service under fixed coefficients and constant returns to scale. Primary factors include “Labour” and “Capital”. The “Foreign Sector” supplies a non-competitive commodity as an additional input to the total cost of production.

The public sector participates as a tax collection agent. Given the nature of the analysis, we focus on indirect taxation and distinguish four types of taxes. First, a "Social Security Tax paid by Employers (SSTE)", which represents a fiscal cost assumed by firms when using the labour factor. Second, an "Ad Valorem Excise Tax” that conglomerates different small tributes and subsidies that affect production

[2] The full SAMAND95 is available upon request from the authors.

Table 1: Macroeconomic SAM of the Andalusian Economy 1995

	Productive Sectors	Labour	Capital	Consumers	Saving/ Investment	Government	Foreign Sector
Productive Sectors	A	0	0	C	I	G	X
Labour	W	0	0	0	0	0	0
Capital	Π	0	0	0	0	0	0
Consumers	0	W	Π	0	0	0	0
Savings/Invest.	0	0	0	S	0	PD	-ROWD
Government	T1	0	0	T2	0	0	0
Foreign Sector	M	0	0	0	0	0	0

Source: Manresa & Sancho (1997).

A: Intersectoral Productive Relations,
C: Consumption,
G: Public Consumption,
I: Investment,
M: Imports,
PD: Public Deficit,
ROWD: Foreign Deficit,
S: Savings,
T1: Indirect Taxes,
T2: Direct Taxes,
X: Exports,
W: Wages,
Π : Capital Income.

activities and transactions (licenses, special taxes, etc.). Third, “Tariffs” collected from imports. Fourth and last, a “Value Added Tax (VAT)” that taxes the additional value at each one of the phases of the production and that it relapses in the last step of the chain, generally the final consumer.

3.3 Price formation

Given the production structure of the economy, production prices follow a standard average cost rule:

$$p_j = (1+\tau_j)\left(\sum_{i=1}^{25} q_i a_{ij} + (1+s_j)wl_j + rk_j + (1+t_j)pm_j am_j\right) \tag{1}$$

Final prices are affected by the Value-added tax yielding:

$$q_j = p_j(1+VAT_j) \tag{2}$$

The notation for the two equations follows:

p_j : production price of sector j

τ_j : "Ad Valorem Excise Tax" of sector j

a_{ij} : input-output technical coefficients

s_j : "Social Security Tax paid by Employers" of sector j

w : wage rate

l_j : labour technical coefficients of sector j.

r : capital services rate.

k_j : capital technical coefficients of sector j.

t_j : "Tariffs" on the imports of sector j.

pm_j : price of imported good j.

am_j : technical coefficients for foreign good j.

q_j : final price of sector j.

VAT_j : "Value Added Tax" of sector j.

Using the information contained in the SAMAND95 database we calibrate the technical coefficients a_{ij} , am_j , l_j , and k_j . As an example the input-output coefficients are obtained from:

$$a_{ij} = SAM(i,j)/X_j \tag{3}$$

where $SAM(i,j)$ and X_j are total intermediate transactions and total output, respectively. Likewise, coefficients for the production factors, labour (l_j) and capital (k_j), have been calculated as:

$$l_j = SAM(labour, j)/X_j \tag{4}$$

$$k_j = SAM(capital, j)/X_j \tag{5}$$

Finally, the different tax rates are calibrated using the following generic expression:

$$TAX_j = Income_j / Taxable\ Base_j \tag{6}$$

Theses rates are effective rather than nominal rates, that is, they reflect the empirically observed income transfer and taxable base as read from the SAM. Production prices or unitary costs, final prices and wages are endogenous. The wage rate is made endogenous using an implicit normalised basket of goods that define weights for final prices similar to those of a consumption price index. The model is calibrated setting an endogenous initial wage that also works as an indicator for aggregate price variations:

$$w = \sum_{j=1}^{25} q_j \alpha_j \tag{7}$$

where α_j is the share of the consumption of each good j over total consumption. A possible justification for incorporating an endogenous wage rate of this kind is that this indicator is a common index of reference for unions in wage negotiations (indexing).

Capital and foreign prices are taken as exogenous and fixed at unitary levels. Moreover foreign goods prices remain unchanged since they correspond to exogenously given world prices. With these and the previous conventions one can show that the database reproduces a simple micro-economic balance. Therefore alternative scenarios when indirect tax rates are modified allow us to evaluate the changes in all prices for all commodities following the adaptation of the economic cost structure to the simulated new fiscal scenarios.

Needles to say the current structure is also fit for studying price behaviour under scenarios other than fiscal ones like those originating in changes in the exogenous price of imports or payments to capital services.

3.4 Welfare and Tax Collection estimates

In addition to the effects on prices, we can also obtain an approximation of the influence that each indirect tax category has on individual welfare of consumers and indirect tax collections. The model contemplates a single representative consumer and we can compute the expenditure change ΔG associated to the cost of a typical basket of consumption goods:

$$\Delta G = (q - q')C \tag{8}$$

where q and q' are vectors that stand for original and after tax simulation final prices and C represent the reference consumption basket. If the difference is positive, we have an improving welfare situation, whereas a negative sign would indicate a worsening of the consumer's welfare. The comparison gives us an estimate of the change in consumer's real income when facing a tax change since this will generate a new set of equilibrium prices. This estimate can be seen to coincide with the well-known compensating variation welfare measure. In our setting the compensating variation CV can be calculated as:

$$CV = q'(C' - C) \tag{9}$$

where C' would be the new level of consumption induced by the tax change. With the help of a few algebraic manipulations and the fact that nominal income stays constant throughout, that is $q'C' - qC = 0$, we can easily show the above assertion:

$$CV = q'(C' - C) + qC - qC = (q - q')C + q'C' - qC = (q - q')C = \Delta G \quad (10)$$

To complement the information at the individual level, we could also obtain regional tax revenue levels as a result of simulated tax policies. As each tax rate is modified and the overall cost structure adjusts to the new fiscal parameters, total tax collections will also change reflecting the new policy. Both ways, whether we focus on the micro or individual welfare impact or on the aggregate or regional tax revenue impact, provide economically sound data and yield useful methods to appraise and design policies.

4. Empirical results

The simplest way to ascertain the impact of each indirect tax on prices is to set, for each tax category, the tax rate to zero. This *de facto* elimination of a tax category will clearly have a lowering effect on final prices since we are actually eliminating the fiscal cost from the price equation and, under competitive conditions, this reduction is passed over to final prices.

An alternative way of presenting the influence of each tax category on prices is through the use of a tax-price elasticity. It has the additional advantage of rendering feasible to evaluate the effects of marginal adjustments in tax rates. As an example we will proceed to calculate the elasticity after a 10 percent increment in each tax rate.

The results following the tax simulation exercises are reported in three tables. Table 2 shows the effects induced on prices by eliminating tax rates one at a time. Table 3 summarises the welfare effects on the representative consumers and relates them to benchmark indirect tax revenues. Table 4 displays average elasticities of prices vis a vis each of the four tax categories.

We can read in Table 2 the effects of the eliminating each tax rate on each one of the productive sectors in Andalusian economy, as well as an aggregate average effect on the price index.

We observe that the elimination of the “Ad Valorem Excise Tax” increases the prices of all productive sectors (an average of 5.6 percent). The reason is that this tax category includes different types of subsidies (negative taxes) as recorded in the input-output table of Andalusia. In fact, reading the corresponding row of the SAM, which uses the input-output table as a key constructing element, one concludes that most sectors receive subsidies showing a high component of subsidised economy in the Andalusian region. In numbers, eliminating all excise taxes (positive and negative) the agricultural price would rise by about 4.6 percent, and so on.

Table 2: Elimination of Taxes: Effects on the Final Prices

Recipient sector	(a)	(b)	(c)	(d)	(e)
1. Agriculture	1.046	0.996	0.910	0.965	0.915
2. Cattle & Forestry	1.072	0.993	0.891	0.959	0.909
3. Fishing	1.022	0.995	0.935	0.946	0.899
4. Extractives	1.072	0.941	0.982	0.987	0.976
5. Refineries	1.019	0.975	0.969	0.957	0.921
6. Electricity	1.065	0.989	0.949	0.928	0.925
7. Natural gas	1.141	0.968	0.943	0.896	0.931
8. Water	1.075	0.993	0.830	0919	0814
9. Mining, iron & steel ind.	1.030	0.987	0.976	0.988	0.971
10. Building materials	1.032	0.988	0.926	0.966	0.912
11. Chemicals	1.046	0.992	0.978	0.957	0.971
12. Metal products	1.027	0.992	0.955	0.975	0.948
13. Machinery	1.043	0.988	0.983	0.969	0.982
14. Automobiles	1.107	0.988	0.974	0.912	0.971
15. Other transport. equip.	1.077	0.974	0.889	0.953	0.887
16. Food products	1.127	0.978	0.923	0.939	0.953
17. Textiles and Leather	1.108	0.989	0.954	0.914	0.954
18. Wood products	1.044	0.995	0.960	0.960	0.956
19. Other manufactures	1.084	0.991	0.943	0.926	0.937
20. Construction	1.086	0.992	0.861	.0.902	0.836
21. Commerce	1.030	0.995	0.884	0.950	0.860
22. Transportation & Commun.	1.073	0.995	0.901	0.906	0.871
23. Other services	1.032	0.994	0.800	0.931	0.764
24. Commercial services	1.067	0.998	0.941	0.932	0.934
25. Non commercial services	1.029	0.994	0.801	0951	0.783
Price Index	1.056	0.992	0.903	0.940	0.888

Source: Simulation output from database SAMAND95.
a) Consumption prices without “Ad Valorem Excise Tax“.
b) Consumption prices without "Tariffs".
c) Consumption prices without “Social Security Tax paid by employers"
d) Consumption prices without “VAT".
e) Consumption prices without indirect taxes.

In contrast, eliminating the “Social Security Tax paid by employers" would have the greatest impact in reducing sectoral prices. The consumer prices index would fall to 0.903, about a significant 10 percent reduction on prices. A general comment is therefore the substantial impact of this tax on the (lack of) competitiveness of the regional economy. The remaining columns are likewise interpreted and we omit further comments here.

Going to Table 3 we can read the estimated effects of each tax in the welfare of consumers. A reduction in commodity prices will mean a decrease in the necessary expenditure to purchase the same consumption bundle (fixed initial utility). Looking at the welfare index we observe that it is positive under the elimination of every tax except the “Ad Valorem Excise Tax” for the obvious reasons that have been commented above.

Once again the elimination of the “Social Security Tax paid by employers", other things being kept constant, would increase welfare the most. The money metric benefit is estimated at about 611 thousand millions of pesetas (which can be shown to be about 6.15 percent of Andalusia’s GDP). For this labour tax, benchmark revenue is about twice as large as the estimated individual benefit. Therefore, in any policy evaluation the “gain” for consumers of the elimination of this tax could and should be weighted with the induced “loss” that would affect the Treasury. This loss would be partly compensated by the increased revenues from other indirect taxes that would follow from lower prices and increased demand. Since we are not considering in the present input-output framework quantity adjustments, we cannot report these changes here. Given the linearity assumption that pervades the analysis, Table 3 also yields simple ways to approximate the impact of tax reductions. For instance, a 50 percent reduction in the current labour tax would yield approximately half the effects reported in Table 3. If specific figures are needed or required, however, the numerical computer version of the model can be run and new simulation data obtained at will.

To complement the above analysis, we now briefly turn to assess the weight of each tax category using the tax-price elasticity. We define an average elasticity that provides additional information on the response of prices before tax variations. Formally,

$$\varepsilon = \left(\Delta w/w\right)/\left(\Delta t_j/t_j\right) \qquad t_j = t_1, t_2, \cdots, t_{25} \tag{11}$$

where w is the price index and t_j is the tax rate for each category and good. Table 4 shows the numerical results under a 10 percent increase of each tax rate. We confirm once more that “Social Security Tax paid by employers" has the largest impact as measured by its average elasticity (0.109).

5. Concluding Remarks

We have developed in this paper a simple linear price model for the Andalusian economy of 1995. The applied model has been built from the extracted input-output subset of a SAM (SAMAND95). We have analysed the incidence of indirect taxes on aspects such as prices, consumers’ welfare, and tax revenues showing the utility of using a multisectoral model that incorporates detailed economic interdependence and yields a way to quantify the effects of tax policies.

The exercises intend to show the role and weight that indirect taxes play in the economy. The elimination of taxes should be seen as an experimental limit procedure that allows us to assess the full impact of a given tax. Real world policies, however, will shy away from such drastic measures. On a more practical level, fiscal competence in Spain rests mainly on the central government. The tax experiments outlined in this paper should therefore be interpreted as performed by the level of government that holds actual fiscal competence. A rationale for the exercises is to find out how national tax rates may have differential effects depending on the regions of application.

Table 3: Elimination of Taxes: Effects in Welfare of Consumers

Tax	Benchmark Tax Revenue	Welfare Index
Ad Valorem Excise Tax	-520.351 m.m. ptas.	-350.849 m.m. ptas.
Tariffs	97.693 m.m. ptas.	50.080 m.m. ptas.
Social Security paid by employers	1.190.033 m.m. ptas.	611.764 m.m. ptas.
VAT	597.476 m.m. ptas.	376.410 m.m. ptas.

Source: Simulation output from SAMAND95 database

Table 4: Tax-price Elasticities as Measured by a 10 Percent Increase in Rates

Tax	Average Elasticity
Ad Valorem Excise Tax	0.070
Tariffs	0.008
Social Security paid by employers	0.109
VAT	0.062

Source: Simulation output from SAMAND95 database

Moreover, in the context of power transfer towards regional governments that has characterised the Spanish decentralisation process in the last twenty years, any economic tool that provides detailed information on the regional effects of policies is surely a welcome addition to the economist toolkit.

If a specific message should be singled out from the results, this is that “Social Security Tax paid by employers" turns out to be the most inflationary tax in the sense that exerts the largest influence on prices. Also, this tax significantly affects the welfare of consumers and could provide a possible explanation for the lack of competitiveness of the Andalusian region. This result reinforces those obtained in studies carried out for the whole national economy.

However, the fiscal policy debate in Spain, and by extension in her integrating regions, has focused in the reform of income taxation. A major nationwide income tax reform aiming at reducing direct tax rates took place in 1999. A new, less pronounced, income tax reduction is now again in the works. In the meantime, a reform of the acutely distortionary indirect tax system has been forgotten and neglected for years. The government has been compensating its direct tax income loss by increasing a variety of indirect tributes and excise taxes, further promoting efficiency losses. Given the empirical evidence on the burden exerted by the indirect tax system and, in particular, by labour taxes levied by the Social Security system, we feel the moment has arrived to face the fiscal fact that the share of indirect taxes on total government tax income is perhaps disproportionate and excessive. A major restructuring of the tax basket is clearly due. A first step in this direction could consist in lowering the "Social Security Tax paid by Employers". A net reduction in tax rates is justifiable given the present state of surplus of the Social Security System. Such a reduction could promote price competitiveness –crucial for an open economy like the Andalusian one– and boost employment levels both at the national and regional levels, an added and welcome bonus for the economy of Andalusia in which unemployment levels are among the highest in Spain. A second step in this direction could contemplate an additional labour tax reduction balanced with a budget neutral increase in value-added taxes. A final, more thought provoking step, would advocate a rebalancing of the global tax basket by lowering labour taxes and increasing direct income tax rates. This option runs counter present fiscal policies and would not be favoured by the dominant political views. Our advise, however, is based solely on the evidence that indirect taxation is creating a major distortionary effect on the regional economy.

From an analytical perspective, a desirable extension of this work should go along the lines of using a true general equilibrium model that would account for further and better-modelled interdependencies and structural connections between the production side, the consumption side and the government. From the viewpoint of having a first but detailed approximation, however, the applied input-output framework yields a set of results that are methodologically well understood and pinpoint the short-term reaction of the economy before more complex adaptive behaviour takes over. An applied general equilibrium analysis would therefore complement the present one since it would yield longer-term evaluations to policy measures.

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