European Economic Review 32 (1988) 334–342. North-Holland

A GENERAL EQUILIBRIUM ANALYSIS OF THE 1986 TAX REFORM IN SPAIN*

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1. Introduction

Spain's recent entry into the European Economic Community (EEC) has been accompanied by a number of economic reforms needed to comply with requirements imposed on all member countries. A key ingredient of these reforms has been the introduction on 1 January 1986 of a value-added tax (VAT) on consumption as a substitute for a complex range of indirect taxes, including a turnover tax applied at every stage of the production process. The fiscal reform has posed a number of interesting policy questions. For instance, one common criticism of the new tax system is that its rates have been chosen too high and will further depress the economy, whose official unemployment rate was 22% in 1985. Government officials are very concerned, however, with the effect of the new tax system on public revenues and, in turn, on the substantial deficit of the public sector, which was 8% of GDP in 1985. Another current debate centers on whether the new tax system has a detrimental impact on the capital–labor ratio due to the retention of social security taxes, which are taxes on the use of labor.

In this paper we use an applied general equilibrium model of the Spanish economy to analyze the impacts of the indirect tax reform on relative prices, resource allocation, and income distribution, using the information contained in the social accounting matrix constructed by Kehoe et al. (1985). In the next section we describe the model, placing emphasis on its novel features. In

*We thank the Instituto de Estudios Fiscales for its financial support. We are also grateful for institutional support from CAYCIT Grant No. 2361-83 to the Departamento de Economia, Universidad Autónoma de Barcelona.

0014–2921/88/$3.50

the third section, we analyze the results of four simulations suggested by the tax reform. Finally, in the fourth section, we discuss the lessons learned from these simulations and directions for future research.

2. The model

The model follows in the tradition of Shoven and Whalley [see Shoven and Whalley (1984)]. It differs from standard models of this type in the special treatment that it gives to the foreign sector, labor markets, and the government deficit, three aspects of the Spanish economy that are of vital concern in the context of entry into the EEC. A more detailed description of the model is given by Kehoe et al. (1986).

Each of the twelve production sectors in the model utilizes a nested, constant-returns production function. A list of sectors can be found in table 1. Value added in each sector is produced from the factors of production using a Cobb–Douglas production function. Value added is combined in fixed proportions with intermediate inputs from the other production sectors to produce domestic output. Finally, domestic output is combined with imports from the EEC and imports from the rest of the world (ROW) using a Cobb–Douglas production function. This final nesting represents the well known Armington specification in which domestic and imported products are imperfect substitutes. The goods that households consume have a different aggregation from those that are produced. The nine consumption goods are fixed-proportions combinations of the produced goods.

Each consumer group in the model is distinguished by its base period income level and by the age and the skill level of the household head. The disaggregation by age allows us to incorporate into the model those social security transfers, such as retirement pensions, that depend on age. Consumers derive income from selling their endowments of factors of

Table 1

Consumer groups (household heads).[a]

1. Young, low income	5. Adult, skilled, low income
2. Young, high income	6. Adult, skilled, high income
3. Adult, unskilled, low income	7. Old, low income
4. Adult, unskilled, high income	8. Old, high income

[a]Young: 12–24 years old,
Adult: 25–64 years old,
Old: 65 years old and over,
Unskilled: no university or professional education,
Skilled: university or professional education
Low income: annual income in 1980 of 700,000 pesetas or less,
High income: annual income in 1980 or over 700,000 pesetas.

production. A proportion of consumers are unemployed and receive no labor income, but rather receive from the government unemployment benefits that amount to a proportion of the income they would obtain if employed. The government also pays the consumers retirement pensions, capital and other income transfers, and in-kind health coverage. Consumers also receive transfers from abroad from the EEC and the ROW. All of these transfers vary with relative prices: health coverage varies with the price of medical services, for example, while net transfers from the EEC vary with the relative price of imports from the EEC, the reciprocal of the real exchange rate. Households either spend their income or save it. Savings become demand either for the investment good or for government or foreign bonds, which households consider perfect substitutes. Each consumer group's demand, including that for savings, are the result of maximizing a Cobb–Douglas utility function subject to the budget constraint.

The government purchases exogenously fixed amounts of government services and the investment good. The government receives income from returns on physical capital that it owns and from taxes. There are ad valorem taxes on production, social security taxes paid by employers (which vary with labor usage), tariffs, ad valoren taxes on consumption, and various taxes on consumer income. The government must equate transfer payments plus expenditures with tax revenues plus borrowing. It borrows by issuing bonds that are perfect substitutes for the investment good.

The absolute level of exports to the EEC and to the ROW are exogenously fixed. The composition of exports to each region varies, however, according to a Cobb–Douglas production function. Since the levels of imports vary endogenously with relative prices and activity levels, there are external deficits or surpluses. These deficits or surpluses are handled in the same way as the government deficit.

The concept of equilibrium in our model is the standard Walrasian one, except that we allow positive excess supply in the labor markets. In equilibrium, producers maximize after-tax profits, consumers maximize utility, government tax revenues equal tax payments, and demands equal supplies in all nonlabor markets. In our simulations we use two alternative specifications for the labor markets. Either unemployment rates are fixed at their base levels and the real wages adjust, or the real wages are downwardly rigid in terms of different price indices and unemployment rates adjust.

To make the model described above operational, numerical values must be assigned to all parameters. We use the microconsistent data base assembled by Kehoe et al. (1985) to calibrate the model. The values of some parameters are easily obtained from the data base and the restrictions imposed on functional forms. The remaining parameters are calibrated so that the model replicates the values of variables in the benchmark year, in this case 1980. We should stress that the reliance on fixed-proportions and Cobb–Douglas

functions in the specification of the model is due solely to data limitations: the model can easily accommodate more flexible functional forms.

3. Simulations

In this section we analyze the results of four comparative statics experiments. In the first, we introduce the VAT into a model with flexible real wages. In the second, we introduce the same tax system into a model with fixed real wages. Both simulations suggest that the new tax system has, relative to the old system, a detrimental effect on the economy and, particularly, on consumer welfare. The third and fourth simulations assess the causes of this result. In the third, we consider an alternative tax system in which VAT rates are proportionally lower. In the fourth, we consider a system in which social security tax (SST) rates paid by employers are lower. Both the third and the fourth simulations utilize the specification where real wages are flexible and unemployment rates are fixed.

The results of these simulations are summarized in tables 2–5. Let us first consider the first two simulations. Table 2 indicates that the VAT drives up the prices of most consumption goods compared to the prices of factors in production. The changes in relative prices are by no means uniform. The price of tobacco and alcoholic beverages goes up substantially, for example, while that of transportation goes down. Notice too that the price of capital falls relative to the wage rates. In the second simulation each wage rate remains fixed in terms of a different price index. This keeps the wages from falling relative to prices of consumption goods. The differential between the price of capital and the wages rates is, therefore, even bigger. The overall pattern of price changes is, however, similar. Notice too that the relative prices of the production sectors remain fairly constant.

The activity levels of five of the production sectors fall if real wages are flexible; eight fall if they are rigid. Notice that, although the quantitative effects are different, the pattern of changes is similar: if we rank sectors by activity levels, we get similar orderings in both simulations. We should point out, however, the increase in the level of investment due to the lower price of the investment good and the reduction in the government deficit. The largest increases in activity levels take place in the automobile industry, due to the fall in the price of transportation on the consumption side, and in construction, due to the increase in investment. Notice, however, that the activity level of transportation does not change significantly: its output is used as an intermediate input by many other sectors, not just in consumption demand.

Notice that, if real wages are rigid, unemployment rates rise significantly. This has a negative impact on the government deficit since unemployment benefits are higher. The higher level of the government deficit is reflected in a lower level of private investment. Not surprisingly, because unemployment

Table 2
Market prices (Benchmark = 1).[a]

Sector	VAT Flexible wages	VAT Rigid wages	Reduced VAT	Reduced SST
Production sectors				
1. Agriculture and Fishing	0.9904	0.9856	0.9915	0.9676
2. Energy	0.9825	0.9811	0.9828	0.9529
3. Basic Industry	0.9865	0.9873	0.9863	0.9534
4. Machinery	0.9772	0.9807	0.9763	0.9406
5. Automobile Industry	0.9885	0.9927	0.9874	0.9501
6. Food Products	0.9896	0.9875	0.9900	0.9627
7. Other Manufacturing	0.9805	0.9804	0.9804	0.9471
8. Construction	0.9811	0.9860	0.9799	0.9493
9. Commerce	0.9892	0.9876	0.9895	0.9670
10. Transportation	0.9933	0.9924	0.9934	0.9697
11. Services	0.9826	0.9814	0.9828	0.9651
12. Government Services	1.0023	1.0149	0.9994	0.9605
Nonconsumption demand sectors				
13. Investment	0.9808	0.9850	0.9797	0.9484
14. Commerce with the EEC	0.9842	0.9848	0.9840	0.9528
15. Commerce with the ROW	0.9837	0.9842	0.9835	0.9530
Consumption demand sectors				
16. Food and Nonalcoholic Beverages	1.0456	1.0433	1.0281	1.0198
17. Tobacco and Alcoholic Beverages	1.1205	1.1183	1.0474	1.0912
18. Clothing	1.1027	1.1023	1.0663	1.0674
19. Housing	1.0228	1.0218	1.0094	1.0029
20. Household Articles	1.0821	1.0826	1.0504	1.0479
21. Medical Services	1.0107	1.0105	1.0025	0.9856
22. Transportation	0.9548	0.9554	0.9109	0.9276
23. Recreational Services	0.9876	0.9882	0.9703	0.9587
24. Other Services	1.0252	1.0240	1.0032	1.0011
Factors of production				
25. Unskilled Labor	1.0091	1.0273	1.0047	1.0279
26. Skilled Labor	1.0045	1.0260	1.0029	1.0225
27. Capital and Other Factors	0.9906	0.9716	0.9952	0.9710

[a] $0.5038p_{25}+0.0124p_{26}+0.4838p_{27}=1$.

rates are higher and activity levels lower, consumers are worse off if wages are rigid. This is reflected in the percentage changes in utility indices. The Cobb Douglas indirect utility functions can be thought of as real income indices. Notice that consumers are worse off, whether wages are flexible or rigid, under the new tax system than they are in the benchmark. The welfare reduction is regressive if wages are flexible but progressive if wages are rigid. This is because a substantial fraction of the income of high income consumers comes from the ownership of capital.

Table 3

Activity levels (Benchmark = 1).

Sector	VAT Flexible wages	VAT Rigid wages	Reduced VAT	Reduced SST
Production sectors				
1. Agriculture and Fishing	0.9644	0.9580	0.9775	0.9813
2. Energy	1.0013	0.9804	1.0030	1.0021
3. Basic Industry	1.0345	0.9921	1.0147	1.0131
4. Machinery	1.0480	1.0056	1.0280	1.0263
5. Automobile Industry	1.0456	1.0279	1.0679	1.0545
6. Food Products	0.9609	0.9554	0.9764	0.9794
7. Other Manufacturing	0.9748	0.9576	0.9830	0.9832
8. Construction	1.1267	1.0339	1.0621	1.0569
9. Commerce	0.9842	0.9712	0.9973	0.9981
10. Transportation	1.0038	0.9871	1.0136	1.0111
11. Services	0.9912	0.9794	0.9980	1.0015
12. Government Services	1.0000	1.0000	1.0000	1.0000
Nonconsumption demand sectors				
13. Investment	1.1447	1.0410	1.0708	1.0646
14. Commerce with the EEC	1.0000	1.0000	1.0000	1.0000
15. Commerce with the ROW	1.0000	1.0000	1.0000	1.0000

Table 4

Aggregate indicators.

Indicator	Benchmark	VAT Flexible wages	VAT Rigid wages	Reduced VAT	Reduced SST
Unemployment (%)					
unskilled	10.00	10.00	13.34	10.00	10.00
skilled	5.00	5.00	7.11	5.00	5.00
Tax Revenues/GDP (%)	9.58	11.13	10.14	9.81	8.91
net indirect	14.15	15.85	15.88	14.39	13.42
net direct	−4.57	−4.71	−5.74	−4.58	−4.51
Gov Expenditures/GDP (%)	13.40	13.11	13.55	13.31	12.94
Government Deficit/GDP (%)	2.01	0.22	1.65	1.70	2.26
Private Consumption/GDP (%)	72.58	71.34	72.21	72.39	73.18
Private Investment/GDP (%)	19.34	21.54	19.88	20.36	19.80
EEC Trade Deficit/GDP (%)	−0.33	2.17	0.04	0.17	0.15
ROW Trade Deficit/GDP (%)	5.65	5.78	5.61	5.89	5.78
GDP (billions of pesetas)[a]	15.18	15.49	15.20	15.23	15.06
% GDP change		2.06	0.13	0.32	−0.77

[a] $0.5038p_{25} + 0.0124p_{26} + 0.4838p_{27} = 1$.

Table 5

Percentage changes in consumer utility indices.

Consumer	VAT Flexible wages	VAT Rigid wages	Reduced VAT	Reduced SST
Young, low income	−2.0050	−2.3057	−0.1051	+1.7194
Young, high income	−1.4648	−2.7440	+0.4730	+0.8517
Adult, unskilled, low	−2.0642	−2.3598	−0.2373	+1.3792
Adult, unskilled, high	−1.4960	−2.7354	+0.2954	+0.5257
Adult, skilled, low	−2.5211	−2.8127	−0.1849	+0.2707
Adult, skilled, high	−1.8888	−3.4748	+0.1854	−1.0775
Old, low income	−1.0259	−1.2274	−0.9230	−0.8914
Old, high income	−0.9576	−2.0257	+0.0271	−0.4103

To explore the reasons for the welfare reductions in the two VAT simulations, we perform two additional simulations, one in which we reduce VAT rates uniformly by 30%, the other in which we reduce SST rates by 30%. In the first simulation the aggregate indicators and the utility indices are very similar to their levels in the benchmark equilibrium. Notice, however, that the (small) changes in welfare are regressive. The most significant increase in activity levels occurs in investment because of the fall in the government deficit and the increases in the trade deficit.

If SST rates are reduced, relative production prices change significantly: production sectors have different labor intensities and bear different labor tax burdens. Notice that five of the eight households experience increases in welfare. The two old groups have retirement pensions, which are fixed, as a major fraction of income and do not benefit from the fall in the price of investment since they save little. Notice that the changes in welfare are progressive. Also notice, however, the relatively small increase in the level of investment.

4. Discussion of results

The advantage of applied general equilibrium models over other quantitative models is that they are grounded in a well understood theory of individual maximization. This greatly helps us to organize our thinking about economic phenomena (although some would claim that it imposes an intellectual straightjacket) and to communicate this thinking to others. It also allows us to compare, in quantitative terms, the relative importance of different, and often opposing, effects of economic policy, particularly on individual welfare. How seriously, though, are we to take the results, such as those presented in the previous section, of these models? In this section we discuss the lessons to be learned from these results.

Our most obvious finding is that official VAT rates are too high. The results of third simulation indicate that the rates selected by the government are about 30% above those that would have maintained the benchmark levels of aggregate indicators and of households' welfare. A problem with this interpretation is that the benchmark tax rates are those calibrated from the benchmark data set; they implicitly take tax evasion into account. VAT rates, in contrast, are the official rates. Our results could therefore be interpreted as indicating that the values of crucial variables could be maintained if evasion of VAT is about 30%, at least if such evasion is evenly spread across sectors and households. More data needs to be collected and more theoretical and empirical work needs to be done on evasion before this issue can be decided.

Another obvious finding is that the level of private investment is sensitive to tax changes. One could argue that the welfare reductions due to the VAT are misleading: an increase in investment could lead to higher levels of growth that would more than offset the current fall in consumption. To evaluate this argument, however, we would require an explicitly dynamic model. Unfortunately, there are major theoretical difficulties that stand in the way of such a model. In a model in which consumers and producers solve intertemporal maximization problems, equilibrium in any given period depends on expectations of future endogenous variables, such as prices and unemployment rates. In overlapping generations models, even with realistic parameter values, it seems that equilibria can be extremely sensitive to expectations about the very distant future. This sensitivity is closely related to the well known indeterminacy of equilibrium in models with infinite numbers of consumers and goods. See Kehoe and Levine (1985, 1987) for a discussion of these issues. These problems do not occur if we model the consumption sector as consisting of a finite number of infinitely lived consumers. A possible justification for this procedure is Barro's (1974) argument that finitely lived consumers who leave bequests to their offspring or make gifts to their progenitors form infinitely lived families that act like individual consumers. (Notice that such a specification would have very strong implications for the effects of deficits!) The importance of such bequests is currently a subject of much controversy in empirical public finance. It should be stressed, however, that models with a mixture of overlapping generations consumers and infinitely lived consumers can still have all of the indeterminacy problems of overlapping generations models [see Muller and Woodford (1985)]. This is an area that requires much more work, both theoretical and empirical. It will probably be a major area for research for years to come.

Yet another obvious finding is that any analysis of the Spanish fiscal system needs to put emphasis on the social security system. Reductions in SST rates lead to significant increases in economic welfare. To fully evaluate this finding we would need to develop a better demographic specification of

household behavior, which would again lead to a dynamic model, and to develop a more sophisticated treatment of labor markets.

Other questions are raised by our findings that also point to directions for future research: How important is the change in the tariff structure that Spain is slowly implementing over the period 1986–92? In the previous section we found, for example, that the automobile industry expands as a result of the VAT. What will happen to the automobile industry as a result of increased competition from producers in other EEC countries? To answer these questions a more sophisticated specification of the foreign sector (which requires more data) is needed. Another question is, how important is migration in evaluating the effects of taxes on labor markets and consumer welfare? A related question is, how do effects of policies differ across regions? These are matters of great concern in Spain. They too require a more sophisticated model to answer them.

Our discussion above indicates that one of the most important products of a general equilibrium modeling exercise is that it points out the important areas for future research. The authors also believe, however, that the results are valuable on their own. Indeed, several of the issues raised in this paper have recently been the subjects of hot debate among trade unions, business, and the government: Are VAT rates too high? How important are flexible labor markets in allowing Spain to benefit from the entry to the EEC? How should the social security system be reformed? An applied general equilibrium model provides the ideal tool for analyzing these issues and for leading to better informed debate.

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