Reverse Impact Assessment Using a Regional Social Accounting Matrix

Article *in* Environment and Planning A · May 2004

DOI: 10.1068/a36123 · Source: RePEc

2 authors:

Ferran Sancho
Autonomous University of Barcelona

Manuel Alejandro Cardenete
Universidad Loyola Andalucía

Environment and Planning A 2004, volume 36, pages 937 – 945

DOI:10.1068/a36123

Reverse impact assessment using a regional social accounting matrix

Manuel Alejandro Cardenete
Departamento de Economía y Empresa, Universidad Pablo de Olavide, Ctra. Utrera, km. 1, 41013-Sevilla, Spain; e-mail: macarflo@dee.upo.es

Ferran Sancho
Department d'Economia, Universitat Autònoma de Barcelona, 08193-Bellaterra, Spain; e-mail: ferran.sancho@uab.es
Received 14 January 2003; in revised form 15 May 2003

Abstract. Unlike traditional impact analysis, that measures the influence of a sector, or a set of like sectors, on the overall economy, we present in this note a simple reverse procedure that attempts to quantify the impact of activity changes in the overall regional economy over a specific subset of firms. We apply the procedure to a specific enclave of the chemical and basic industry sectors, which has been and still is of special significance for the development of the region. Because we feel that interdependency effects should be adequately captured, we rely on a 1995 regional social accounting matrix (SAM) of Andalusia, Spain, to establish the empirical structural support for the analysis. We proceed by setting up a linear SAM model to obtain extended multipliers, then we decompose them in three categories of effects (direct, indirect, and induced) under different hypotheses about the classification of endogenous and exogenous sectors. The decomposed multipliers are then apportioned to measure and distinguish the effects on the economic enclave. The results are seen to be quite robust to the exogeneity assumptions.

1 Introduction

Impact analysis has a long tradition in different areas of applied economics and particularly in linear economic modeling. Under the assumption of technological linearity it is relatively simple to build large-scale models that capture in an analytically elementary but empirically thorough way the whole range of interdependency effects. These linear models offer a straightforward procedure to gauge how unitary exogenous inflows into sectors, or into a cluster of closely related sectors, exert and transmit their influence to the overall economy. What we attempt to study in this paper is the related but somewhat different question of detecting how exogenous changes in the economy may end up affecting a particular subset of firms within the economy. In traditional impact analysis we would explore the influence field $\Delta E \rightarrow \Delta X$. As an example, ΔE can be thought of as new investment or productive infrastructures or a new economic enclave aiming to promote regional development and ΔX a measure of the resulting additional economic activity. Here we focus instead on the field $\Delta X \rightarrow \Delta E$, where ΔX now stands for a global economic change in the region and ΔE is the effect brought about on a specific enclave. Hence our aim is to capture and decompose this influence field by using the structure of a linear multisectoral model of the social accounting matrix (SAM) variety for the regional economy of Andalusia—a developing region located in the south of the Iberian peninsula.

It is well known that in linear multisectoral models multipliers are the key element in measuring detailed, disaggregated economic impact, as the seminal works of Stone (1978), Pyatt and Round (1979), and Defourny and Thorbecke (1984) show. Further developments by Pyatt and Round (1985), Robinson and Roland-Holst (1987), Roland-Holst and Sancho (1995), and Sonis et al (1997) attest to the continuous and innovative use of the methodology. It is standard in multiplier analysis to distinguish between direct, indirect, and induced effects of exogenous inflows. The *direct* effect of an exogenous change measures the immediate impact falling upon the recipient sectors, before adjustments in the production requirements of the other sectors take place. These additional adjustments are termed *indirect* effects. *Induced* effects, as is well known, include the feedback on total output from the income effect on final demand generated by the apportioning to households of new labor and capital incomes. For a given SAM structure and a given endogenous – exogenous account classification there are, in fact, numerous ways of separating the resulting extended multiplier matrix. Each decomposition technique is characterized by singling out and measuring specific pathways within the underlying network of interdependencies; hence the different outcomes they provide for the same numerical SAM and same account classification. A related area of research is that of key sector analysis as initiated by Hirschman (1958) and Rasmussen (1958) and further refined by Cella (1984), Clements (1990), and other authors. This literature aims at identifying key sectors by using some weighted multiplier measures or by way of hypothetical extraction or isolation methods. In both cases multiplier matrices or submatrices play a central role in the definition, detection, and measurement of key economic sectors. There are still, however, unresolved theoretical issues in the key sector literature. Usually, the role of a sector is measured by the difference between initial and hypothetically adjusted (after extraction or elimination of the said sector) equilibrium output levels. But if the economy still operates after the input provided by the sector is somehow put aside, one can but wonder why profit-maximizing firms would have used that input to begin with. If the input is required, it cannot be dispensed with—for then production cannot keep on operating. If, on the other hand, it can be dispensed with (even hypothetically) then a revealed preference type of argument indicates that no profit-maximizing firm would choose to use that costlier technique (at the given set of prices). To avoid these difficulties, we opt here for taking an officially designated economic enclave (the Chemical and Basic Industries Association: AIQBH(1)) and proceed to use a 1995 regional SAM of Andalusia to study the three-fold impact (direct, indirect, and induced) of exogenous final inflows upon its activity. The SAM approach is a natural methodological setup for this analysis because a SAM captures, for a given period and level of disaggregation, the complete flow of incomes in the economy but also contains an input – output table as a production subset. As mentioned before, we somehow reverse the traditional methodology that focuses on measuring overall changes due to specific sectoral changes (like new final demand). In this line of analysis, we propose a simple way to ascertain the interaction between the enclave and the rest of the regional economy that may shed some additional light on the underlying linkages between the regional economy and one of its presumably key developing economic clusters.

For the record, the AIQBH group includes firms belonging to sectors such as petroleum refineries, electricity, building materials, basic chemistry, metal products, and paper and wood products. AIQBH was sponsored and funded by the central government in the 1970s as an attempt to infuse a long-stagnant agricultural region with new industrial vigor. After a period of infant industry protection, the enclave managed to gain economic viability and it is now a fully private enterprise with a very strong economic role in the region. The enclave generates about 26% of provincial GDP and about 9% of total provincial employment. Of its gross income, 38% is export generated and 23% corresponds to sales to the rest of Spain, with the remaining 39% being intraregion sales, which shows an apparently well-balanced sales structure. Finally, AIQBH's industrial activity represents about 70% of the province's industrial

(1) Asociación de Industrias Químicas y Básicas de Huelva.

activity and 39% of total regional industrial activity [all data for 1995 and taken from AIQBH (1996)]. In a sense, the AIQBH enclave is a good, and surprisingly successful given the overall experience, example of an industrial policy sometimes criticized for being too interventionist.

This paper is divided into four further parts. Section 2 briefly sketches the multiplier methodology and database used. In section 3 we introduce the impact indicators and in section 4 present the empirical results. We close the paper with a section that summarizes the results and points out the limitations of the analysis.

2 Basic tools and data

The SAM of Andalusia yields a compact, disaggregated representation of all value transactions taking place in the base period. We have used a recent update to 1995 of a previous SAM (SAMAND95) built by Cardenete (1998). The SAM has been compiled by combining the regional input–output table and available regional accounts. It contains thirty-seven accounts of which twenty five are production sectors. The remaining accounts include two primary factors (labor and capital), plus the standard consumption, savings/investment, government, and external accounts. Lack of information prevented the differentiation of several representative consumers. This restriction, however, does not affect the proposal below because we do not attempt to capture any distributional impact.

Using the SAM we select two modeling options. The first is the standard input–output model for which a Leontief inverse $\mathbf{M}^{\mathrm{L}}$ is calculated:

$$\mathbf{M}^{\mathrm{L}} = (\mathbf{I} - \mathbf{A})^{-1}, \tag{1}$$

where $\mathbf{A}$ stands for the matrix of direct technical coefficients and its dimension coincides with the number of productive sectors in the economy. The second option postulates an enlarged linear model where the endogenous sectors include the production sectors as well as the two primary factor (labor and capital) accounts and final demand accounts. The inclusion of these accounts is an attempt to incorporate the feedbacks that, originating from exogenous inflows, first affect activity levels, then expand into additional factorial incomes, and finally revert into additional final demand so that the feedback mechanisms can roll over again.

Let $\mathbf{A}_m$ be the enlarged squared matrix of direct propensities computed from the SAM. The inverse multiplier matrix $\mathbf{M}^{\mathrm{S}}$ calculated as

$$\mathbf{M}^{\mathrm{S}} = (\mathbf{I} - \mathbf{A}_m)^{-1} \tag{2}$$

will measure the direct, indirect, and induced effects of the incorporated endogenous links. The matrix $\mathbf{M}^{\mathrm{S}}$ reduces to the Leontief inverse $\mathbf{M}^{\mathrm{L}}$ when the dimension m of the matrix $\mathbf{A}_m$ matches the number of production sectors. To perform the impact analysis we need matrix $\mathbf{M}^{\mathrm{S}}$ to be reduced to conform to the dimension of matrix $\mathbf{M}^{\mathrm{L}}$.

The difference between the multiplier matrices, $\mathbf{M}^{\mathrm{S}}$ and $\mathbf{M}^{\mathrm{L}}$, measures the *induced* effect due to the added endogeneity, and the *direct* and *indirect* effects are measured by $\mathbf{M}^{\mathrm{L}}$. They all can be distinguished by using the following three components:

$$\text{direct effect:} \quad \mathbf{M}_1 = \mathbf{I} + \mathbf{A}, \tag{3}$$

$$\text{indirect effect:} \quad \mathbf{M}_2 = \mathbf{M}^{\mathrm{L}} - \mathbf{I} - \mathbf{A}, \tag{4}$$

$$\text{induced effect:} \quad \mathbf{M}_3 = \mathbf{M}^{\mathrm{S}} - \mathbf{M}^{\mathrm{L}}, \tag{5}$$

because it is always the case that

$$\mathbf{M}^{\mathrm{S}} = (\mathbf{M}^{\mathrm{S}} - \mathbf{M}^{\mathrm{L}}) + (\mathbf{I} + \mathbf{A}) + (\mathbf{M}^{\mathrm{L}} - \mathbf{I} - \mathbf{A}). \tag{6}$$

Notice that this decomposition follows more closely the criteria laid out by Jensen and West (1980) for Leontief type-I and type-II multipliers than the more common multiplicative or additive multiplier decompositions. Unlike them, however, we consolidate what Jensen and West term initial and first-round effects into a single composite direct effect. The general assumptions under which extended multipliers can be calculated and have an economic interpretation can be found in the seminal work of Pyatt and Round (1979).

3 Impact indicators

To ascertain how the output of the AIQBH firms reacts and adapts to the changing external environment we first need to define some indicators that capture the overall effect generated upon the firms by, say, a change in final demand. Second, we then may use the multiplier information—using the above distinction of direct, indirect, and induced effects—to single out for each indicator the threefold decomposition. Needless to say, other matrix-decomposition types, such as those of Pyatt and Round (1979), Robinson and Roland-Holst (1987), or Sonis et al (1997), could be used in what follows. Our choice is justified in its simplicity and its resemblance to the more classical multiplier interpretation (see Jensen and West, 1980).

An implicit assumption is that of technological homogeneity between enclave and nonenclave firms within the chemical and basic industry sectors. They may differ by size or location but not by their technical characteristics. This allows us to adopt sector-wide homogeneous coefficients that are therefore applicable to all of the enclave firms. Let us now consider coefficients α_k that measure the share of output of AIQBH firms in sector k over total output in sector k. Then we can define the combined gross output effect on the AIQBH sectors resulting from an exogenous inflow initiated in production sector j ($j = 1, 2, ..., 25$) by

$$O_j = \sum_{k \in K} M_{kj}^{\mathrm{S}} \alpha_k \,, \tag{7}$$

where K is the subset of production sectors belonging to the AIQBH group and M_{kj}^{S} is the incremental gross output in sector k necessary to accommodate a unit increase in the exogenous inflow accruing to sector j. The decomposition of the matrix multiplier, $\mathbf{M}^{\mathrm{S}} = \mathbf{M}_1 + \mathbf{M}_2 + \mathbf{M}_3$, permits us likewise to obtain a three-figure indicator of O_j, one figure for each component matrix.

A complementary way of looking at the problem consists in measuring the impact upon the first within each of the K chemical and basic industry sectors of a unitary expansion in final demand. For the sake of simplicity we will consider that the unitary increase is apportioned among all twenty-five productive sectors according to the share of each sector on benchmark final demand. Therefore let β_j denote the share of each productive sector's final output over total final output. Then we can measure the impact of a unitary expansion of final demand on the firms of AIQBH belonging to sector i, $i \in K$, by

$$D_i = \sum_{j=1}^{25} M_{ij}^{\mathrm{S}} \alpha_i \beta_j \,. \tag{8}$$

As with equation (7), indicator D_i can be decomposed into its direct, indirect, and induced components by using the component matrices $\mathbf{M}_1$, $\mathbf{M}_2$, and $\mathbf{M}_3$, respectively. Data for determining the α_i and β_j coefficients have been obtained from AIQBH's annual report (1996).

4 Empirical results

We use the SAM for Andalusia to compute multipliers under three scenarios. In the first scenario the distinction between endogenous and exogenous sectors is the standard one in the literature. Endogenous sectors include production activities, primary factors, and consumption. The results of using the multipliers for obtaining indicator O_j appear in table 1(a) (over). In the second scenario, following Robinson and Roland-Holst (1987), we add a new layer of endogeneity by including the savings/investment account within the endogenous sectors. This has the effect of adding explanatory capacity in the circular flow of income. The results appear in table 1(b). In the third scenario we substitute the capital account for the external account and rerun the calculations. This procedure takes care of inflow changes that, although originating externally, may have an effect on cluster firms through the external account. Table 1(c) reports these results. In like manner, tables 2(a), 2(b), and 2(c) (over) present the decomposition for our second impact indicator D_i.

Looking at table 1(a) we observe that the largest impact on the AIQBH industries arises from unit exogenous inflows into sector 12 (metal products). This result agrees with the fact that this is one of the leading sectors of the cluster of AIQBH industries. In fact, the largest effects correspond, in general but not always, to exogenous inflows accruing to the sectors where AIQBH is present [in descending order: 5 (refineries), 11 (chemicals), 18 (wood products), 20 (construction), 6 (electricity), and 10 (building materials)]. Here the exception is the construction sector that generates a larger effect on the AIQBH industries than sectors such as electricity and building materials where the AIQBH industries are well represented. The analysis hence reveals the quantitative value of the underlying links between construction and building materials.

Similar results are observed when we enlarge the set of endogenous accounts by way of including the capital account (savings/investment) in the endogenous class. The more encompassing endogeneity gives rise, as expected, to higher multiplier values as we can see in table 1(b). The *leading* sectors are, however, the same as in the previous exercise showing that impact results are quite robust to the chosen levels of endogeneity. The same considerations apply to the *least inducing* sectors. Sectors 13 (machinery), 4 (extractives), and 14 (automobiles) yield in both cases the smallest impact on the AIQBH industries. The fact that these results are robust suggests that the existence of feeble links between the basic industries in the AIQBH cluster and some of the manufacturing industries in the region may be quite structural because they are observed under both scenarios. This points out the general need of assessing results under alternative scenarios whenever possible. This we do in table 1(c) where we introduce the external account in place of the capital account within the set of endogenous accounts. The general observation is that multiplier values rise quite substantially revealing that the structure of the enclave in the regional economy is more responsive to this closure rule. Still, the five leading sectors coincide with those of the previous exercises.

From an aggregate perspective, however, tables 1(a) and 1(b) show a shift in the distribution of weights among the three distinct effects. In the standard endogeneity case of table 1(a) the largest weight is that of the direct effects (73.57% of total effect) whereas induced effects (with a share of 17.26%) outweigh aggregate indirect effects (with only a 9.17% of total effect). When we include the capital account as an endogenous sector, we can observe in the aggregate results of table 1(b) there is a shift towards larger overall induced effects, but this should nonetheless be expected from the enlargement of the endogenous sectors. This observation turns out to be even more dramatic when we consider the results in table 1(c) where induced effects now prevail in absolute value over combined direct and indirect effects. This shows again a higher structural dependency of the enclave on the interdependency effects of the external account. Beyond the figure of direct sales to exports (38% as reported previously),

Table 1. Decomposition of impact indicator O_j on AIQBH (Chemical and Basic Industries Association) firms (source: simulation output from SAMAND95 database).

Recipient sector	Direct (%)	Indirect (%)	Induced (%)	Total
(a) *Standard endogeneity (28 sectors)*				
1 Agriculture	44.12	14.71	41.18	0.0238
2 Cattle and forestry	26.57	28.50	44.93	0.0207
3 Fishing	40.45	17.42	42.13	0.0178
4 Extractives	41.67	22.92	35.42	0.0048
5 Refineries	93.83	2.77	3.40	0.2058
6 Electricity	59.88	16.52	23.60	0.0399
7 Natural gas	17.07	23.58	59.35	0.0123
8 Water	26.27	21.20	52.53	0.0217
9 Mining, iron and steel industries	26.51	28.92	44.58	0.0083
10 Building materials	58.87	17.73	23.40	0.0282
11 Chemicals	95.83	2.23	1.94	0.1390
12 Metal products	97.17	0.97	1.86	0.2154
13 Machinery	38.89	19.44	41.67	0.0036
14 Automobiles	31.37	15.69	52.94	0.0051
15 Other transportation equipment	21.05	21.05	57.89	0.0114
16 Food products	21.46	39.02	39.51	0.0205
17 Textiles and leather	20.83	27.78	51.39	0.0072
18 Wood products	91.68	4.63	3.68	0.0950
19 Other manufactures	61.54	21.46	17.00	0.0247
20 Construction	51.41	24.42	24.16	0.0389
21 Commerce	14.74	20.53	64.74	0.0190
22 Transportation and communications	43.08	19.23	37.69	0.0260
23 Other services	26.70	20.39	52.91	0.0206
24 Commercial services	10.44	7.69	81.87	0.0182
25 Noncommercial services	9.41	15.88	74.71	0.0170
Aggregate effects	73.57	9.17	17.26	1.0389
(b) *Enlarged endogeneity (29 sectors): capital account*				
1 Agriculture	29.75	9.92	60.34	0.0353
2 Cattle and forestry	17.30	18.55	64.15	0.0318
3 Fishing	26.87	11.57	61.57	0.0268
4 Extractives	28.99	15.94	55.07	0.0069
5 Refineries	90.19	2.66	7.15	0.2141
6 Electricity	46.77	12.90	40.32	0.0434
7 Natural gas	10.00	13.81	76.19	0.0210
8 Water	16.19	13.07	70.74	0.0352
9 Mining, iron and steel industries	17.19	18.75	64.06	0.0128
10 Building materials	46.11	13.89	40.00	0.0360
11 Chemicals	93.67	2.18	4.15	0.1422
12 Metal products	95.09	0.95	3.95	0.2201
13 Machinery	26.42	13.21	60.38	0.0053
14 Automobiles	19.51	9.76	70.73	0.0082
15 Other transportation equipment	12.44	12.44	75.13	0.0193
16 Food products	14.67	26.67	58.67	0.0300
17 Textiles and leather	13.04	17.39	69.57	0.0115
18 Wood products	87.80	4.44	7.76	0.0992
19 Other manufactures	51.18	17.85	30.98	0.0297
20 Construction	40.00	19.00	41.00	0.0500
21 Commerce	8.36	11.64	80.00	0.0335
22 Transportation and communications	29.79	13.30	56.91	0.0376
23 Other services	16.37	12.50	71.13	0.0336
24 Commercial services	5.31	3.91	90.78	0.0358
25 Noncommercial services	5.00	8.44	86.56	0.0320
Aggregate effects	61.09	7.61	31.32	1.2513

Table 1. (continued).

Recipient sector	Direct (%)	Indirect (%)	Induced (%)	Total
(c) *Enlarged endogeneity (29 sectors): external account*				
1 Agriculture	12.14	4.05	83.81	0.0865
2 Cattle and forestry	6.46	6.93	86.60	0.0851
3 Fishing	8.23	3.54	88.23	0.0875
4 Extractives	1.92	1.05	97.03	0.1043
5 Refineries	67.84	2.00	30.15	0.2846
6 Electricity	19.47	5.37	75.16	0.1043
7 Natural gas	2.44	3.37	94.20	0.0862
8 Water	8.14	6.57	85.30	0.0700
9 Mining, iron and steel industries	2.21	2.41	95.38	0.0996
10 Building materials	16.08	4.84	79.08	0.1033
11 Chemicals	56.87	1.32	41.81	0.2342
12 Metal products	68.95	0.69	30.36	0.3036
13 Machinery	1.34	0.67	97.99	0.1046
14 Automobiles	1.59	0.80	97.61	0.1006
15 Other transportation equipment	2.83	2.83	94.34	0.0848
16 Food products	4.67	8.49	86.84	0.0943
17 Textiles and leather	1.54	2.06	96.40	0.0973
18 Wood products	46.89	2.37	50.74	0.1858
19 Other manufactures	13.68	4.77	81.55	0.1111
20 Construction	20.76	9.86	69.38	0.0964
21 Commerce	4.19	5.83	89.98	0.0669
22 Transportation and communications	13.18	5.88	80.94	0.0850
23 Other services	8.29	6.33	85.38	0.0663
24 Commercial services	3.01	2.22	94.77	0.0631
25 Noncommercial services	2.75	4.65	92.60	0.0581
Aggregate effects	26.69	3.33	69.98	2.8632

the analysis suggests a greater vulnerability than anticipated to the external account influence.

To complement the above analysis, we now briefly turn to assess the impact on the AIQBH industries of a unitary increase in final demand apportioned among sectors according to benchmark final demand weights. Tables 2(a), 2(b), and 2(c) show the numerical results again under the same scenarios. Sectors 5 (refineries), 11 (chemicals), and 12 (metal products) receive the most stimuli on their output in all three scenarios although sector 12 (metal products) is not in this case the leading sector as it was in the previous analysis. The order is not preserved, however, when we consider the endogenous external account case with sector 11 (chemicals) now being the top receiving sector. The level of robustness in the results, and the possibility of tracing them to the distinct role played by the external account, provide a sounder knowledge and a better understanding of the underlying structure of the AIQBH cluster of firms, as well as of its role in the regional economy of Andalusia.

5 Concluding remarks

We have studied in this paper how to use the rich multiplier information that can be obtained from a SAM in order to appraise the impact of exogenous final demand changes on specific firms of specific sectors. Applying the decomposition of total multipliers into their direct, indirect, and induced parts on our two impact indicators we have been able to visualize better and quantify the role that the regional economy

Table 2. Decomposition of output effect D_j on AIQBH (Chemical and Basic Industries Association) firms (source: simulation output from SAMAND95 database).

AIQBH firms in sectors	Direct (%)	Indirect (%)	Induced (%)	Total
(a) *Standard endogeneity (28 sectors)*				
5 Refineries	60.94	12.50	26.56	0.0128
6 Electricity	4.55	4.55	90.91	0.0044
10 Building materials	66.67	33.33	0.00	0.0003
11 Chemicals	50.98	15.69	33.33	0.0102
12 Metal products	70.91	12.73	16.36	0.0055
18 Wood products	48.39	16.13	35.48	0.0031
Aggregate effects	51.79	12.95	35.26	0.0328
(b) *Enlarged endogeneity (29 sectors): capital account*				
5 Refineries	42.31	16.03	41.67	0.0156
6 Electricity	20.00	20.00	60.00	0.0010
10 Building materials	12.50	68.75	18.75	0.0016
11 Chemicals	42.98	13.22	43.80	0.0121
12 Metal products	35.14	6.31	58.56	0.0111
18 Wood products	36.59	12.20	51.22	0.0041
Aggregate effects	38.68	14.51	46.81	0.0455
(c) *Enlarged endogeneity (29 sectors): external account*				
5 Refineries	50.25	9.80	39.95	0.0398
6 Electricity	52.56	19.53	27.91	0.0215
10 Building materials	31.68	2.67	65.65	0.0262
11 Chemicals	37.40	9.35	53.26	0.0599
12 Metal products	25.75	2.36	71.89	0.0466
18 Wood products	50.42	7.08	42.50	0.0240
Aggregate effects	39.50	7.89	52.61	0.2180

exerts over the specific AIQBH subset of firms. The technique we use is admittedly very simple, but easily implementable, and fits well within the standard homogeneity assumptions of the SAM model. The quantitative information that we obtain allows us to single out the most and least responsive sectors in the face of exogenous changes under a triple approach with regard to endogeneity. Different endogeneity picks up different influence circuits as the results here show. Interdependency through the external account seems to play, for instance, a more pivotal role than interdependency through the capital account, suggesting a greater potential vulnerability of the enclave to external-account-transmitted fluctuations in final demand.

Industrial policy in Spain, as in many other countries, has been directed to a large extent to support economic enclaves in some of its neediest regions in order to create an industrial base that could help to improve their economic prospects. An empirical appraisal of the links between an economy and its enclaves could thus provide better information to continue, redesign, or simply discontinue this type of policy. In our case, it would be interesting, and indeed necessary, to complement the work presented here with an analysis of the impact that the AIQBH firms have on the Andalusian economy. This would close the circuit ($\Delta E \rightarrow \Delta X \rightarrow \Delta E$) and would yield more complete insights. The problem is that the information required to do this analysis (sectoral disaggregation of final and intermediate sales by AIQBH firms) is reserved and not publicly available. The economic methodology is, however, available and ready for whenever data turn out to be available.

Finally, the usual conceptual and data restrictions apply and should be made explicit. The SAM presupposes a rigid production and consumption technology that assumes away any price-sensitive adaptability to a changing environment. This limitation is well known and unavoidable if we choose to use a SAM model. However, we can always interpret the results as short-term, fixed-price adjustments within the initial economic structure. Using unitary changes in final demand and apportioning them among sectors by final demand weights is of course a proxy for average real-world changes that are seldom available at the detailed sectoral level of a SAM or input–output table. Ex-post exercises can be performed when new tabular data are published, but unfortunately the current publication lag is about four years for this kind of data. However, performing these ex-post exercises, whenever possible, could offer a reality check, or validation, for this and other kinds of multisectoral analysis. Quality of available empirical data, on the other hand, is always one of the usual suspects. In our case, the regional SAM has been built using official data (regional input–output table and regional accounts) and only minor adjustments to purge the row of secondary productions of the input–output table have been performed.

Acknowledgements. Both authors wish to thank the support of Network Grant XT2000-33. The first author thanks research project IEA-99 and centrA. The second author is also grateful to CREA and to research projects SEC2000-390 and SGR2001-164. The referees' very helpful suggestions for improving the paper in form and content are gratefully acknowledged. We also thank the referees and Geoffrey J D Hewings for pointing out and facilitating a few relevant references we were not aware of. The usual disclaimer applies.

References

AIQBH, 1996 *Evaluación de los Efectos Derivados de la Actividad de las Industrias de AIQBH en el Sistema Económico Onubense en 1995* [An evaluation of the effects on the economy of Huelva of AIQBH's industrial activities in 1995] Asociación de Industrias Químicas y Básicas de Huelva, Huelva

Cardenete M A, 1998, "Una matriz de contabilidad social para la economía Andaluza: 1990" [A social accounting matrix for the economy of Andalusia, 1990] *Revista de Estudios Regionales* **52**(3) 137–152

Cella G, 1984, "The input–output measurement of interindustry linkages" *Oxford Bulletin of Economics and Statistics* **46**(1) 73–84

Clements B D, 1990, "On the decomposition and normalization of interindustry linkages" *Economics Letters* number 33, 337–340

Defourny J, Thorbecke E, 1984, "Structural path analysis and multiplier decomposition within a social accounting framework" *Economic Journal* **94** 111–136

Hirschman A O, 1958 *The Strategy of Economic Development* (Yale University Press, New Haven, CT)

Jensen R C, West G R, 1980, "Some reflections on input–output multipliers" *Annals of Regional Science* **14**(2) 77–89

Pyatt G, Round J, 1979, "Accounting and fixed price multipliers in a social accounting framework" *Economic Journal* **89** 850–873

Pyatt G, Round J, 1985 *Social Accounting Matrices: A Basis for Planning* (World Bank, Washington, DC)

Rasmussen P N, 1958 *Studies in Intersectorial Relations* (North-Holland, Amsterdam)

Robinson S, Roland-Holst D W, 1987, "Modelling structural adjustments in the United States economy: macroeconomics in the social accounting framework", WP 440, Department of Agricultural and Resource Economics, University of California, Berkeley, CA

Roland-Holst D W, Sancho F, 1995, "Modelling prices in a SAM structure" *The Review of Economics and Statistics* **77** 361–371

Sonis M, Hewings G, Sulistyowati S, 1997, "Block structural path analysis: applications to structural changes in the Indonesian economy" *Economic Systems Research* **9** 265–280

Stone R, 1978, "The disaggregation of the household sector in the national accounts", paper reprinted in 1985 in *Social Accounting Matrices: A Basis for Planning* G Pyatt, J Round (World Bank, Washington, DC) chapter 8