Assessing Structural Change

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ABSTRACT *Structural change in Greece examined through changes in the SAM matrixes. The aim is to construct reliable indices that portray the sectoral allocation of national expenditure with respect to multiplier size, multiplier change and expenditure change. This permits the examination of the breakdown of the effects of changes in the composition and decomposition of the SAM matrixes. The analysis is extended to the construction of indices calculating the effects of path change. Finally, we compute all indices concerning both output and price effects as deviations from the mean. Price models based on SAM are simply the counterpart of quantity models. They are a form of a dual analysis of expenditure changes on output. Both are important for policy recommendations. We apply here this model to the recent Greek SAMs (1988-1994). Our main finding is that expenditure is misallocated with respect to multiplier size mainly due to government action. One may attribute this result to the particular structure of the Greek government's fiscal intervention.*

KEYWORDS: *Structural change, government spending, SAM multipliers*

1. Introduction

The purpose of this paper is to trace structural change using SAM matrixes both with respect to quantities (expenditure) as well as to prices (costs) and to show that these two effects are linked together. It might well be that this is the reason why SAM matrixes have not been used extensively to analyze price formation. As D. Roland – Holst and F. Sancho (1995) pointed out the SAM approach to price formation and cost transmission is suitable for cases where prices "are implicitly indexed to commodity prices or cost-of-living effects".

Our principal aim is to examine structural change emanating from the variation of the elements of the multiplier matrix. The analysis is extended to include the differential impact of separate categories of exogenous expenditure (value added), in conjunction with multiplier change. We then apply the results to the method of matrix decomposition (Pyatt, Round, 1979) and path analysis (Defourny et al. 1984), to ascertain changes in the linkages and transmission mechanisms characterising the

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economy. In order to illustrate the applicability of this approach we have used the SAM matrixes for the Greek economy for the years 1988 and 1994.

The paper is organised into three sections. In section 1 we examine structural change from the point of view of quantities produced. This section is organised into four subsections. In the first subsection we decompose the growth rate of income and thus develop four indices that represent the misallocation of expenditure in the basis year, the effect of the weighted change of multipliers of each sector, the misallocation of expenditure vis a vis the multiplier change, and the misallocation of the change in expenditure vis a vis the structure of multiplier growth. Misallocation is understood as the assignment of elements of the exogenous vector to the smaller elements of the vector of indices. In the second subsection these indices are further subdivided so that they correspond to the categories determined by our matrix decomposition. In the third section we examine the last two of these indices with respect to each separate category of exogenous expenditure. Finally we estimate the Herfindahl index for the multipliers of each sector in the two years under examination, in order to ascertain the effect change has on the relative size of the multipliers. Section 2 repeats the analysis in terms of costs. Finally, in the last section we examine the evolution of path multipliers for selected paths.

The SAM matrixes constructed in order to effect the comparison are composed of the Input - Output tables for the years 1988 and 1994, (56x56), augmented by a two agencies respectively. The resulting multiplier matrix is an average propensity matrix. Analysis of marginal propensities awaits further research.

2. Changes and Effects on Output

2.1 Decomposition of the Growth Rate

2.1.1 The income identity may be written as[1]

$$\mathbf{Y} = \mathbf{Mx} = \mathbf{M}\mu + \mathbf{M}\bar{\mathbf{x}} \tag{1}$$

where μ is the mean of the elements of vector **x**, while $\bar{\mathbf{x}}$ is the vector of deviations from the mean of the elements of **x**. This expression can be written as

$$\mathbf{Y} = \mu\mathbf{M}(\mathbf{i} + \mathbf{s}) \tag{2}$$

where i is the vector whose elements are all equal to 1 and **s** is the vector of normalised differences from the mean. We may say that **Mi** and **Ms**, define the structure of the multipliers and that of the impulse respectively.

A change in the income vector may come about in two ways. There may be a change in the exogenous demand vector or there may be a change in the multiplier matrix. Thus

$$\mathbf{Y_1} - \mathbf{Y_0} = \mathbf{M_1x_1} - \mathbf{M_0x_0} \tag{3}$$

[1] Capital Bold letters denote Matrixes, Lowercase bold letters denote column vectors, a prime denotes a line vector, while lowercase letters denote scalars

adding and subtracting $\mathbf{M_1x_0}$ from the right hand side

$$\Delta\mathbf{Y} = \Delta\mathbf{M}\mathbf{y_0} + \mathbf{M_1}\Delta\mathbf{x} \tag{4}$$

where the difference sign denotes matrix subtraction, so that

$$\Delta\mathbf{Y} = \mu_d\mathbf{M_1}(\mathbf{i}+\mathbf{s_d}) + \mu\Delta\mathbf{M_0}(\mathbf{i}+\mathrm{s}) \tag{5}$$

The subscript d indicates the mean and the normalised deviation of the vector representing the differences in the impulses (exogenous expenditure). Forming the diagonal matrix whose elements are those of the vector of endogenous incomes and multiplying the above expression by the inverse of this diagonal matrix we get the vector of growth rates for the endogenous income change. Thus, the vector of the rate of change of endogenous income is

$$\Delta\mathbf{Y}diag.\left(\mathbf{Y}^{-1}\right) = \left\{\mu\mu^{-1}\Delta\mathbf{M}(\mathbf{i}+\mathbf{s}) + \mu_\delta\mu^{-1}\mathbf{M_1}(\mathbf{i}+\mathbf{s}_\mathrm{d})\right\}\left[diag.\left(\mathbf{M}_0\left(\mathbf{i}+\mathbf{s}\right)\right)\right]^{-1} \tag{6}$$

A typical element of the vector g depicting the rates of growth of endogenous income for a particular sector is given by

$$\begin{aligned} g_i = {} & \frac{\sum_j m_{0ij}}{\sum_j m_{0ij} + \sum_j m_{0ij}s_j}\sum_j\left(\frac{m_{0ij}}{\sum_j m_{0ij}}\frac{\Delta m_{ij}}{m_{0ij}}\right) + \\ & \frac{\sum_j m_{0ij}}{\sum_j m_{0ij} + \sum_j m_{0ij}s_j}\sum_j\left(\frac{m_{0ij}}{\sum_j m_{0ij}}\frac{\Delta m_{ij}s_j}{m_{0ij}}\right) + \\ & \frac{\sum_j m_{0ij}}{\sum_j m_{0ij} + \sum_j m_{0ij}s_j}\frac{\mu_d}{\mu}\left\{\frac{\sum_j m_{1ij}}{\sum_j m_{0ij}} + \frac{\sum_j m_{1ij}s_{dj}}{\sum_j m_{0ij}}\right\} \end{aligned} \tag{7}$$

or

$$g_i = k_i\sum_j\theta_{0ij}g_{mij}(1+s_j) + \frac{\mu_d}{\mu}k_i\sum_j\theta_{0i}(g_{mij}+1)(1+s_{dj}) \tag{8}$$

where the two constituent growth rates are the growth rate of income due to a change in the multiplier matrix and a change in the impulse vector respectively. Thus, the growth rate in output gives rise to the calculation of five indices.

1. $\sum_j \theta_{0ij}g_{mij}$, the average weighted rate of change of the multipliers belonging to the line of the base year SAM matrix corresponding to the relevant sector. The shares θ represent the relative size of a particular multiplier relative to the corresponding line of the multiplier matrix.

2. $\sum_j \theta_{0ij} g_{mij} s_j$, the increase in output due to the initial expenditure structure.

3. $(g_m + 1)ds = \sum_j \theta_{0ij}(g_{mij} + 1)ds_j$, the increase in output due to the change in the structure of expenditure, the multiplier structure being kept constant.

4. The growth rate in expenditure.

5. And ki, where

$$k_i = \frac{\sum_j m_{ij}}{\sum_j m_{ij} + \sum_j m_{ij} s_j} \tag{9}$$

is an index of misallocation of spending. Thus for ki larger than one, the second term in the denominator is negative, indicating that the smallest amounts of spending is channeled to the largest multipliers. For ki less than one, the largest spending items correspond to the largest multipliers. If spending was distributed normally across categories, then the second term in the denominator would reduce to 0, and the ratio would be equal to one.

2.1.2 Empirical results. All empirical work in this paper concerns the off diagonal elements of the two SAM's. It is easy to verify that the mathematical results hold for this sub set of multipliers. The reason the diagonal elements were excluded was to emphasize the inter industry effects of structural change. In other words we wish to emphasise the extent to which the purchasing follower vector benefits from the leader vector. (Evenson, 1997).

Examination of table I gives the following results. The ki index, which reflects the original misallocation of expenditure, is less than one for only 7 sectors, three of which belong to the primary sector of the economy, one to the secondary and the rest to the service sectors. Thus, only for these seven sectors expenditure was allocated in tune with the multiplier structure of the sector. It would be more natural to have the large shares of expenditure corresponding to large multipliers.

Column two gives the weighted average of the change in multipliers for each sector. Here a total of 20 sectors exhibited positive indices. Most of these sectors were in the service sectors. Thus, the majority of sectors (roughly two thirds) experienced a decrease in the average size of multipliers. These include most of the traditional large primary and secondary sectors. They also include the institutions and household sectors of the economy.

Column three is an index of allocation of expenditure vis a vis the growth pattern of multipliers for each sector. A positive value for this index implies a favorable allocation. This implies that in the case of positive growth rates the initial expenditure allocation was adverse precisely in the case of the sectors which exhibited the largest growth in multipliers. If the growth rates are negative the adversity in allocation consists in assigning the largest share of expenditure to the multipliers exhibiting the largest decline.

Thirty six sectors exhibit negative indexes. Most of these sectors are service sectors. However if one compares column 3 with column 2, for 40 sectors the index in 3 is larger than that in 2. This would seem to imply that the structure of expenditure in the base year mitigated the change in the multiplier structure. This may be due to the initial misallocation of expenditure with respect to the original multiplier structure.

The final column in this table indicates the effect of the change in the pattern of expenditure vis a vis the structure of the rate of change of the multipliers for each sector. This index is positive in the case the largest growth experienced is allocated to the multipliers experiencing the largest growth. Only three sectors have positive valued indexes in this case. **It would seem then that the misalignment of expenditure found in the base year has been reinforced.**

2.2 Matrix decomposition

2.2.1 Matrix decomposition methods allow one to ascertain the degree of interlinkage of each multiplier with the rest of the economy. It is possible to establish to what extent the induced demand resulting from the relationship characterised by a given multiplier is channeled through increases in the induced demand of sectors within the category the original multiplier belongs to (production, factors or institutions), through the induced demand of sectors belonging to the other two remaining categories, or the feedback loop which closes the economic circle. In the case where the main increase in demand occurs in the own sector we talk of an integrated sector, while when the main increase in demand is diverted to the other two categories the relationship is characterised by forward linkages.

Matrix decomposition methods serve to disaggregate SAM multipliers into three components (Pyatt-Round, 1979, Stone, 1981, Panethimitakis, 1991). In order to do so, first the SAM matrix is decomposed into two basic sub-matrixes, each containing different block components of the original matrix. It is then proven that the basic multiplier matrix is the product of three matrixes, each of the last being transformations of the two basic sub-matrixes. The first matrix measures all effects contained within the boundary of the I-O matrix and the household transfer matrix. This is called the transfer effect. The second effect is the open loop effect which concern the interaction between the three basic account categories, production, factors and institutions. The final matrix represents the closed loop effect, where the cumulative feedback from the two previous impulses is measured.

Thus, an exogenous impulse starting in the production account, e.g. an increase in demand for exports, will run it's course within this account, the transfer effect, while at the same time determining the derived impulse on the two other accounts, factors and institutions. The open loop effect will be the result of the derived impulse running it's course through the two other accounts. The impulse for the closed loop is the result of the production account and the derivative results through the open loop effect on the household and factor accounts. The closed loop estimates the feedback effect on the economy as the impulses from the three accounts reenter the economic cycle in a series of dampened cycles. Alternatively impulses initially affecting one of the two other accounts will lead to an open loop effect, setting up the signal for the closed loop.

The SAM matrix is used to relate endogenous incomes to exogenous (autonomous) injections into the economic system. Injections may occur at any of the three categories into which the SAM table is divided. These categories result in a block partition of the table into a three by three block matrix. Following Pyatt and Round we conceive this matrix so as the production (Leontieff) sector i.e. at the lowest right hand corner, while the household transfer matrix occupies the center diagonal element.

Table 1. The structure of the Greek SAM

	Factors of Production	Institutions	Production Activities	Exogenous Accounts
Factors of Production	0	0	A13	X1
Institutions (Hous. + Firms)	A21	A22	0	X2
Production Activities	0	A32	A33	X3
Exogenous Accounts	X'1	X'2	X'3	

Thus, the matrix **A32** is the production to household transfers, **A13** the production to factors transfers, **A21** the household to factors transfers. Matrix **A33** is the Leontieff I-O matrix, while **A22** is the institutional transfer matrix.

The endogenous incomes vector as well as the injection vector may be separated in such a way as to correspond to this three way partition. Thus **x1** may be factor incomes received from abroad, which would initially impact on factor incomes, **x2** would be household incomes received from abroad and **x3** export demand which would initially impact on households and the production account respectively.

The SAM framework leads to the calculation of multipliers which represent the aggregate effect of an injection, **x**, on the endogenous income vector, **y**. Thus the effect of an initial injection is augmented by the derivative effects as the impulse works it's way through the circular path of the economy. We know that Leontief's basic identity is

$$\mathbf{y} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{x} = \mathbf{M}\mathbf{x} \tag{10}$$

Decomposing the matrix allows to trace the various types of injections, as they are determined by the above account **M** they initially impact, and separate their primary effect from the derivative effect or circular effect on endogenous income. The SAM inverse, or the multiplier matrix, can be equivalently expressed as the product of three matrixes.

$$\mathbf{M} = \mathbf{M}_1\mathbf{M}_2\mathbf{M}_3 \tag{11}$$

$\mathbf{M}_1$ captures the circular effect (closed loop effects). $\mathbf{M}_2$ and $\mathbf{M}_3$, the open loop and the transfer effects, prepare the vector by which the closed loop effect matrix will be multiplied. Consider the case where **x3** is the only non null part of the injection vector. (e.g. only exports for services disturb the system). $\mathbf{M}_3\mathbf{x}$ will give the Leontieff results of interindustry demand. This vector will then be premultiplied by matrix $\mathbf{M}_2$ which gives the primary derivative effects on factor incomes and household incomes. The resulting vector is then the total injection into the closed loop (circular system, or feedback system) of the economy.

The exercise may be repeated for injections where the non null elements in the exogenous demand vector correspond either to the factor or the institutional sectors. According to R. Stone (1978) the multiplicative form of matrix decomposition may be manipulated to give an additive form. Thus

$$\mathbf{M} = \mathbf{M}_1\mathbf{M}_2\mathbf{M}_3 = \mathbf{I} + (\mathbf{M}_3 - \mathbf{I}) + (\mathbf{M}_2 - \mathbf{I})\mathbf{M}_3 + (\mathbf{M}_1 - \mathbf{I})\mathbf{M}_2\mathbf{M}_3 \tag{12}$$

it is this latter form that is used in the present analysis.

Matrix decomposition can be extended to the case of comparing the structure of two SAM matrixes. Using matrix decomposition methods, one can explain part of the multipliers change in terms of the relative change of the share of the closed loop effect upon the total multiplier. This would give an indication as to whether the tendency would be for forward linkages or integration to occur.

We now extend the analysis of the previous section to the case where the multiplier matrix is decomposed into other matrixes. We take the additive case and limit ourselves to the case where the matrix is decomposed into two sub matrixes alone, representing the global effect and the "rest". Thus for

$$\overset{*}{\mathbf{M}} = \mathbf{M}_1 + \overset{*}{\mathbf{M}}_2 \tag{13}$$

$$\begin{aligned} g_i = \psi\left\{k_{1i}\sum_j \theta_{1ij} g_{1mij}(1+s_j) + \frac{\mu_d}{\mu} k_{1i}\sum_j \theta_{1ij} g_{1mij}(1+s_{dj})\right\} + \\ (1-\psi)\left\{k_{2i}\sum_j \theta_{2ij} g_{2mij}(1+s_j) + \frac{\mu_d}{\mu} k_{2i}\sum_j \theta_{2ij} g_{2mij}(1+s_{dj})\right\} \end{aligned} \tag{14}$$

where

$$\psi = \frac{\sum_j m_{1ij}(1+s_j)}{\sum (m_{1ij} + m_{2ij})(1+s_j)} \tag{15}$$

and

$$k_{\lambda i} = \frac{\sum_j m_{\lambda ij}}{\sum_j m_{\lambda ij} + \sum_j m_{\lambda ij} s_j} \tag{16}$$

The additional subscript to the multipliers, 1 and 2 indicate the total and global effects respectively.

2.2.2 Empirical results. Examination of table II gives the following insights. The first two columns portray the rate of growth in income due to the interaction among sectors, and the corresponding rate of growth due to the global effect or closed loop effect. The second is a fraction of the first. These columns are given so that the relative importance of the two effects can be ascertained for each sector.

The next two columns compare the initial structural allocation of expenditure for the two types of effect. We see that 29 sectors have an index less than one in the closed loop effect, (up from 7 for the total effect). This implies that the closed loop effect is responsible for a significant part of the initial misallocation of expenditure, at least for a third of the sectors in the economy. Comparing the two columns notice that there are only 9 cases where the index is larger for the closed loop effect than for the total effect, 4 of these cases involve indexes less than one. This observation reinforces the comments made before.

The next two columns exhibit the weighted rate of change of multipliers for each sector and for the total and closed loop effects. For the closed effect there are 20 sectors which exhibit positive multiplier growth, compared with 22 for the total effect. 20 sectors exhibit smaller growth in total multipliers than closed loop ones. Most of the sectors exhibiting greater growth for the total effect belong to the service sector.

Columns 7 and 8 compare the original allocation of expenditure with respect to multiplier growth. Here the closed effect displays 40 negative entries, mostly in the services and primary sector, compared to 36 for the total effect, mostly in the services sector. The closed effect indices are smaller than the total ones for 25 cases. This indicates a misallocation of expenditure that is on average more important for the closed loop effect.

Columns 9 and 10 compare the allocation of the change in the structure of exogenous expenditure with respect to the multiplier structure of the final year, by sector and for the total and closed loop effect. While only three sectors have a positive sign to their indices for the total effect, 22 do so for the closed loop effect. This result is reinforced by the fact that 54 sectors have larger indices for the closed loop effect than for the total effect. It would seem then that the closed loop effect mitigates the misallocation of growth of expenditure experienced in the two other stages.

2.3 The Effect of the Composition of Exogenous Expenditure

2.3.1 Figures for exogenous expenditure for Greece are available in four categories. Exports, Investment, Government Consumption and Stock Adjustment. Each category would contribute to what we have called in this paper expenditure misallocation. In order to examine this effect we calculate three indices for each category of expenditure both for total and global multipliers. The normalised deviations of expenditure are related as follows

$$s_j = \frac{\mu_1}{\mu} s_{1j} + \ldots + \frac{\mu_n}{\mu} s_{nj} = \sum_n \xi_n s_{nj} \qquad (17)$$

thus the index ki, which is an indicator of the initial misallocation of expenditure may be written as,

$$k_i = \frac{\sum_j m_{ij}}{\sum_j m_{ij} + \sum_j m_{ij} s_j} = \frac{\sum_j m_{ij}}{\sum_j m_{ij} + \sum_n \xi_n \sum_j m_{ij} s_{nj}} \qquad (18)$$

We use the expression on the right hand side of the denominator of the last fraction as an index for comparing the effects of different categories of expenditure on the index ki. If this magnitude is positive, ki is less than unity and vice versa. Thus if any of the component deviation indexes are smaller than the aggregate index, then this would indicate that the particular category of expenditure is misallocated relative to the other categories with regard to the multiplier structure. The effects of each category of expenditure in the case of multiplier change or growth of expenditure may be captured by calculation of indices similar to those calculated to examine the corresponding effects for total and global multipliers. Thus we have

$$\sum_j \theta_{ij} g_{ij}(1+s_j) = \sum_j \theta_{ij} g_{ij}(1+\xi_1 s_{1j} + ... + \xi_n s_{nj}) \qquad (19)$$

and,

$$\sum_j \theta_{ij} g_{ij}(1+s_{dj}) = \sum_j \theta_{ij} g_{ij}(1+\xi_1 s_{1dj} + ... + \xi_n s_{ndj}) \qquad (20)$$

2.3.2 Empirical Results. Table III presents two of the indices calculated previously, for each category of exogenous expenditure. The categories of expenditure are General Government, Exports, Investment and Stock Creation. The indices calculated are the allocation of initial expenditure with respect to the change in the multipliers and the allocation of the change in expenditure with respect to the multiplier growth structure. These indices were calculated for the total and the closed loop effects.

The following table indicates the number of cases where the aggregate index is larger than each category's index. The decimals in small case are the shares of aggregate output represented by each set of sectors. The decimals under the category headings are shares of exogenous expenditure.

Table 2. Indices for output

	Gov. cons. (0,28)	Exports (0,33)	Investment (0,38)	Stocks (0,001)
$g_m s$ tot	38 (0,84)	25 (0,34)	25 (0,22)	19 (0,25)
$(g_m+1)ds$ tot	59 (1,00)	15 (0,25)	30 (0,42)	52 (0,95)
$g_m s$ cl	38 (0,44)	16 (0,25)	24 (0,36)	13 (0,45)
$(g_m+1)ds$ cl	51 (0,75)	22 (0,41)	14 (0,36)	58 (0,98)

From the above it seems that the category of expenditure that is allocated best with respect to the multiplier change is stock creation, both for the total and the closed loop effect. Stocks on the other hand are the worst performers as far as the final distribution of multipliers is concerned. Exports seem to perform better with respect all four indices, while investment is a close second. The worst performance is observed in the case of government consumption. Note, however, that of the four categories the two, investment and stocks are highly seasonal, so that the year of calculation may also affect the results.

2.4 The Herfindahl index.

In order to get some indication as to the nature of the multiplier change between 1988 and 1994, the Herfindahl concentration index was calculated for each sector. The results are presented in table IV. It is clear that there is an increase in the concentration of the distribution of the relative size of multipliers in all sectors. This implies that small multipliers decreased either in relative or in absolute terms vis a vis the larger multipliers. This in turn indicates a certain concentration in the market each sector supplies.

3. Changes and Effects on Costs and Prices.

3.1 Decomposition of the growth rate in Prices.

3.1.1 Under certain assumptions, the SAM framework may be used to calculate equilibrium prices. If there is no scarcity, the prices calculated based on the SAM relationships express the minimum price necessary to cover all expenditure. Exogenous expenditure includes indirect taxes and duties, subsidies and imports. In a similar fashion to income generation, a change in exogenous costs will have a multiplicative effect on prices (Roland – Host, Sancho, 1995). Thus, the analysis presented in section 1, holds in the case of prices, the only difference being that the multiplier matrix is transposed and that the exogenous vector is now composed of cost elements, rather than expenditure. Hence,

$$\mathbf{P} = \mathbf{M'v} = \mathbf{M}\mu + \mathbf{M\bar{v}} \tag{21}$$

where μ is now the mean of the exogenous cost vector, so that,

$$\mathbf{P} = \mu\mathbf{M'(i + s)} \tag{22}$$

Using the same means of proof as in the previous section, the growth rate in prices due to a change in the multiplier matrix and a change in the exogenous cost vector is given by,

$$g_j = k_j \sum_i \theta_{0ij} g_{mij} (1 + s_i) + \frac{\mu_d}{\mu} k_j \sum_i \theta_{0ij} (g_{mij} + 1)(1 + s_{di}) \tag{23}$$

3.1.2 Empirical results. Table V gives the results for the decomposition of the growth rate of the cost multipliers. The ki index, the initial allocation index is higher than one in 41 sectors, indicating that the highest levels of exogenous costs are associated with the smallest multipliers.

Column two gives the weighted average of the change in multipliers for each sector. Seven sectors exhibit positive indices. In terms of cost multipliers there seems to have occurred a widespread decrease, indicating a smaller average propensity to increase costs.

Column three is the index of allocation of exogenous costs vis a vis the growth pattern of multipliers. Twenty sectors have a positive index, indicating an allocation in tune with the largest increases (smallest decreases) in multipliers. Thus for two thirds of the sectors the largest increase in the capacity to transmit costs occurred where exogenous costs were smallest.

Column four indicates the effect of the change in the pattern of exogenous costs vis a vis the multiplier growth structure for the final year under consideration. 57 sectors exhibit a positive value for this index, indicating that exogenous costs rose more rapidly the higher the value of the multiplier growth, in virtually all sectors.

3.2 Matrix Decomposition and Cost

3.2.1 Matrix decomposition results presented for income analysis, hold for cost analysis as well. (Roland – Host, Sancho, 1995) Thus the total effect can be decomposed into three separate effects, that of the transfer, the open and closed loop effects. If we allow for two effects that of the closed loop effect and the "rest", and we apply the decomposition method to the growth problem for prices we get

$$g_j = \psi\left\{k_{1j}\sum_{\mathbf{i}}\theta_{1ij}g_{1mij}(1+s_i)+\frac{\mu_d}{\mu}k_{1j}\sum_{\mathbf{i}}\theta_{1ij}g_{1mij}(1+s_j)\right\}+ \\ (1-\psi)\left\{k_{2j}\sum_{\mathbf{i}}\theta_{2ij}g_{2mij}(1+s_i)+\frac{\mu_d}{\mu}k_{2j}\sum_{\mathbf{i}}\theta_{2ij}g_{2mij}(1+s_j)\right\} \tag{24}$$

3.2.2 Empirical results. Table VI gives the results for the matrix decomposition section. The first two columns give the growth rates for prices for the total and global effects. The second pair of columns give the initial structure off the allocation of exogenous costs. 58 sectors have an index larger than one for the closed loop multipliers. compared to 41 in the case of the total effect. Thus, costs seem to be even more effectively transmitted by the feedback mechanism, than by the initial impact. The fact that 42 sectors have a higher index for the closed loop than the total effect reinforces this observation.

The third pair of columns show the weighted rate of change of the multipliers for each sector, for the two effects. Five sectors have a positive index for the closed loop, compared with 7 for the total effect. For 8 sectors the closed loop index is higher than the total index. Thus the decrease in the multipliers is even more accentuated in the case of the feedback effect.

The fourth pair of columns compare the initial allocation of exogenous costs with respect to the change in the multiplier growth. Only 5 sectors exhibit positive indices for the closed loop effect, compared to 20 in the case of the total effect, but 26 of the former are larger than the latter. Thus the feedback multipliers seem to have changed even more sharply in order to disassociate themselves from the exogenous cost structure.

The final pair of columns compare the change in the allocation of exogenous expenditure, with respect to the final multiplier structure. We found that 59 sectors have positive indices for the closed loop effect, compared to 57 for the total effect. It was estimated that 41 of the first group of indices are larger than the corresponding indices in the second category. Again the impact seems to be larger in the former case, while the feedback effect seems to play an important part in growth due to this effect.

3.3 The effect of the composition of the exogenous cost vector.

3.3.1 The extension of the analysis to the examination of the effects of the composition of the exogenous cost vector on price growth is straightforward. We have that

$$\sum_i \theta_{ij}g_{ij}(1+s_i)=\sum_i \theta_{ij}g_{ij}(1+\xi_1 s_{1i}+....+\xi_n s_{ni}) \tag{25}$$

and

$$\sum_i \theta_{ij} g_{ij} (1 + s_{ij}) = \sum_i \theta_{ij} g_{ij} (1 + \xi_1 s_{1\delta i} + ... + \xi_n s_{ndi}) \quad (26)$$

this of course is the same result as above only applied to the transpose of the multiplier matrix and the mean and deviation from the mean are those of the exogenous cost vector, instead of the exogenous expenditure vector.

3.3.2 Empirical results. Table VII contains the comparison of the total index to the corresponding index for each category of exogenous costs for two indices, and for the total and closed loop effect. The table entries indicate the number of sectors for which the total index is larger than the category index. The exogenous cost categories are, other indirect taxes, VAT, Subsidies, Duty Tax and Imports. The two indices used are the allocation of initial exogenous cost with respect to the change in the multipliers and the change of exogenous cost with respect to multiplier growth.

Table 3. Indices for prices (costs).

	Oth. Ind. Tax	VAT	Subsidies	Duty Tax	Imports
	(0,22)	(0,20)	(-0,11)	(0,006)	(0,68)
$g_m s$ tot	8 (0,18)	53 (0,83)	52 (0,82)	34 (0,63)	11 (0,23)
$(g_m+1)ds$ tot	60 (1,00)	6 (0,20)	34 (0,65)	59 (0,81)	13 (0,28)
$g_m s$ cl	1 (0,08)	56 (0,84)	58 (0,92)	42 (0,78)	2 (0,09)
$(g_m+1)ds$ cl	60 (1,00)	2 (0,08)	1 (0,02)	57 (0,78)	58 (0,92)

It seems that Duty taxes are the worst performers overall, while Imports with the exception of the fourth line are the best. VAT performs well in the change of own composition vs final distribution of multipliers category, which is exactly the opposite in the multiplier change vs original own distribution. The other categories exhibit the opposite results in terms of the two categories of indices. (results for subsidies are the reverse of those portrayed, since subsidies are negative entries.)

3.4 Herfindahl index.

The Herfindahl index for the cost multipliers is considerably higher on average than the corresponding index for output multipliers. The change in the index over the period is towards increased concentration in about half of the sectors observed. The indices corresponding to the closed loop effect are again roughly of the same size across sectors, while a small increase is observed in the concentration over the period for about two thirds of the sectors.

4. Path Analysis

4.1 Path analysis is carried out at a more disagreggate level of analysis than that of matrix decomposition. Path analysis used by Detourny-Thorbecke, 1984 for SAM allows one to trace diffusion effects in the economy. Thus, each multiplier may be decomposed into a number of different paths or conduits linking the two poles represented by the coordinates of the multiplier, the initial pole being the column index while the destination pole being the row index. Thus induced demand impacting the initial pole will initiate a series of parallel chain reactions, i.e. create demand sequentially for a series of sectors, each ending in the destination pole. The sum of the effects of these chain reactions, that is the sum of the effect of all possible conduits linking the two extreme poles is equal to the SAM multiplier.

The contribution to induced demand of each path is in turn decomposed into two effects. The direct effect is the transmission along the poles forming the chain between the two extreme poles. The indirect effect being that of all loops staring from and ending in one of the intermediary poles. These indirect effects represent a positive feedback effect on the direct transmission of impulses between the two extreme poles.

To understand the relationship between the paths and the multiplier, recall that the element of an inverse matrix (which is a SAM multiplier) is equal to the quotient of the principal minor of the corresponding element of the original matrix, divided by the determinant of the matrix. A path on the other hand is determined by the two coordinates (poles) of each element and consists of a chain of positive elements of the original SAM matrix linking these poles. The chain is determined by the commonality of the last and the first subscript of succeeding elements. This chain is termed a sequence of arcs. Paths can thus be classified according to the number of steps (arcs) they contain. The direct effect of the path is the product of all elements of the original SAM matrix determined by the path coordinates. However it is possible that loops or chains linking elements of the chain other than the poles exist. These feedback loops will reinforce the diffusion along each particular path. The sum of these effects is termed the path multiplier and is equal to the cofactor corresponding to the sequence of primary elements i.e. the determinant of the matrix resulting from the elimination of all rows and columns corresponding to direct path coordinates, divided by the determinant of the matrix. The total path effect is the product of the direct effect and the path multiplier. Thus, it can be seen that the path effect is in fact part of the calculation of the multiplier i.e. part of the expansion by principal components. The sum of all paths result in the multiplier.

The two methods described, matrix decomposition and path analysis, are complementary, and do not form a logical sequence of one another. Comparing the two methods of analysing the multipliers, consider a path that has all it's poles within the production matrix. One may be tempted to argue that this path forms part of the transfer multiplier. This is not so for two reasons. First, the global multiplier represents in this case the product of the transfer and the closed loop effect. Each path is a part of the total effect. Furthermore, it would be in most cases impossible to devise a method to separate these two effects using path level. This is because the indirect effect represented by the path multiplier, may spill over to the factor or/and the household accounts (poles). This is evident for paths that cross the block boundaries at least once. Keeping in mind that each multiplier is composed by more than one path, it is obvious that it is impossible to classify paths along the lines of the matrix decomposition method.

However, consider the multiplier structural change index

$$\sum_j \frac{\Delta m_{ij}}{\sum_j m_{ij}} = \sum_j \theta_{ij} g_{mij} \tag{27}$$

consider also that each multiplier is the sum of all paths joining the coordinates defining it,

$$m_{ij} = \sum_k P_{kij} \tag{28}$$

and

$$\Delta m_{ij} = \sum_k \Delta P_{kij} \tag{29}$$

so that

$$g_{mij} = \frac{\sum_k \Delta P_{kij}}{\sum_k P_{kij}} = \sum_k \frac{P_{kij}}{\sum_k P_{kij}} \frac{\Delta P_{kij}}{P_{kij}} = \sum_k \nu_{kij} g_{Pkij} \tag{30}$$

the structural index then may be written as

$$\sum_j \theta_{ij} g_{mij} = \sum_j \theta_{ij} \left(\sum_k \nu_{kij} g_{Pkij} \right) = \sum_k \sum_j \theta_{ij} \nu_{kij} g_{Pkij} \tag{31}$$

The second sum in the expression on the right hand side of the identity above (31) indicates the change in the importance of each level of path (two step, three step, …) in the performance of a sector as a whole. It is this index that is calculated bellow.

4.2 Empirical results. Table VIII(a) contains the number of paths found by sector for the two, three and four step paths. These figures are given for both the initial and final year of the analysis. Table VIII(a) refers to the output and Table VIII(a) to the cost SAM. The bulk of multipliers are two step multipliers and their number is fairly constant across the period under consideration.

Table VIII(b) gives the weighted average of the two, three and four step multipliers for each sector.

Inspection of Table VIII (b) gives the following results. For output, only about a third of sectors (22) did multiplier growth outpace growth in the two step path multipliers. The figure is roughly the same for the three and four step multipliers, 23 and 21 respectively. Only 16 sectors exhibit positive growth for the two step multipliers, while the figure for the three and four step paths is 24 and 29. (overall multiplier weighted growth is positive for only 20 sectors).

For Price, only 11 sectors exhibit larger growth in the overall multipliers compared to the two step paths, while the corresponding figure is 9 and 8 for the three and four step paths. 26 sectors exhibit positive growth at the two step stage while for the three and four step level the figures are 14 and 11. (7 sectors exhibit positive weighted multiplier growth.)

We see that in general multiplier growth lags behind the growth in the multipliers of the low ranked paths. Indeed in many cases the direction of growth is inverted in the two cases, with the path multiplier diverging considerably from the overall multipliers. This indicates that the reduction in the weighted average of the multipliers for each sector is due primarily to the weakening of the broader links to the economy. This may be due to the increased standardisation and opening of markets, where small orders may now be serviced from central locations as well or better than local ones.

5. Conclusions: optimum allocation of expenditure?

In this paper we have attempted to examine the effects of allocation of expenditure on the changing structure of the Greek economy for the period 1988 - 1994, by analysing the growth rate of output and prices based on relationships derived from the relevant SAM matrixes. The growth rate due to the off diagonal elements of the matrixes was initially broken into four indexes. The first index, ki, indicates the initial alignment of exogenous expenditure or costs with respect to the multiplier structure of each sector of economic activity (lines or columns of the inverse of the SAM matrix). The second index is a weighted average of the rate of growth of the multipliers. The third is an index relating the initial distribution of the exogenous vector to the distribution of the rate of change of the multipliers. Finally, the fourth component of growth in output was seen to be an index that compares the distribution of each sector's multiplier growth, with the change in the structure of the exogenous vector.

The analysis was then applied to the matrix decomposition method in order to separate the initial impact from the feedback effect of the three last indexes. Finally, the analysis was also applied to the path analysis method, the purpose here being to calculate the cumulative impact of paths of the same rank on each sectors multiplier growth index.

In the following table a comparison is made between the results obtained for the analysis of output and price growth. The figures in decimal format are the cumulative shares of aggregate production and aggregate value added (in the case of prices) represented by the sectors comprising the groups directly above.

Table 4. Comparison of output and price results.

	Output				Price			
	ki >1	g_m >0	$g_m s$ >0	$(g_m+1)ds$ >0	ki >1	g_m >0	$g_m s$ >0	$(g_m+1)ds$ >0
Tot	53 (0,87)	20 (0,58)	24 (0,18)	3 (0,10)	41 (0,59)	7 (0,10)	20 (0,42)	57 (0,90)
Cl	31 (0,73)	20 (0,43)	20 (0,33)	22 (0,24)	58 (0,90)	5 (0,10)	5 (0,24)	59 (0,92)
cl>tot	9 (0,18)	20 (0,43)	25 (0,51)	54 (0,75)	42 (0,74)	8 (0,05)	26 (0,32)	41 (0,63)

Comparing the ki columns we see that the initial misallocation of the exogenous vectors compared to the original multiplier structure is important for both output and price transmission. The difference being that the immediate effect seems to have a larger impact for output growth, while in the case of cost transmission the closed loop or feedback effect seems to be relatively more important.

Multiplier change is relatively more important for output, with the closed loop effect taking a secondary role in both cases. **This is due to the fact that multipliers shrank in value over the relevant period.**

The initial allocation of the exogenous vectors with respect to multiplier growth seems to be more evenly balanced in the two cases, the feedback effect in the case of cost transmission seemingly losing some of it's importance over time due to this particular influence.

The change in the allocation of the exogenous vectors with respect to the final multiplier structure seems to have an impact through the closed loop effect in the case of output while through both effects in the case of prices. This may be due to the effect of the increase in the relative importance of the service sector.

The influence of the distribution of the various components of the exogenous vectors indicate that on the side of output, Government consumption has the most retarding effect on growth, while both exports and investment are directed towards the highest multipliers in most sectors. On the side of costs, Imports are the least growth enchancing component in terms of distribution. Thus the less "inflationary". Indeed, it is the direct impact of imports that has this effect, while the feedback effect seems to increase price growth, at least in the combined influence of the distribution of growth of imports and the final structure of the multipliers. Subsidies, have a retarding effect on price growth, but their distribution could improve this effect. Finally, we note the compensating effect of VAT and other indirect Taxes. The former tend to increase price growth through the combination of multiplier change and the structure of initial exogenous costs, while retarding price growth through the combination of the change in the distribution of exogenous costs and the structure of the multipliers for the final year. The opposite holds for the latter. The worst culprit in cost diffusion is the duty taxes.

Finally, we note that there is a tendency for multipliers to decrease over the period examined, while there is a tendency for the distribution of multipliers to become more concentrated in both in terms of output and cost diffusion. This tendency is more pronounced for the case of output, while the concentration levels for costs remain substantially higher than those of output.

The decrease in the smallest multipliers may explain the observed reduction in the contribution of higher order paths to the SAM multipliers. This concentration of the multiplier effect through shorter paths may be due to the elimination of small scale local comparative advantage, through the opening of the market and increases in the efficiency of information flows due to technical progress.

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Appendix

The following tables includes the findings of all results for output multipliers according to the text (Tables 1,2 and 3) and the calculations of the Herfindahl Indices for all sectors (Table 4). Analytical tables for Prices and Paths could not be included in this appendix.

Table I. Output, multiplier changes indices.

	Ki	g_m	g_m*s	(g_m+1)*ds
1 *AGRICULTURE,HUNTING AND RELATED SERVICE ACTIVITIES*	0.90	-0.26	0.00	0.12
2 *PRODUCTS OF FORESTRY: LOGGING RELATED SERVICES*	0.80	-0.54	-0.11	0.14
3 *FISH AND OTHER FISHING PRODUCTS*	0.86	-0.25	-0.03	0.19
4 *MINING OF COAL AND LIGNITE; EXTRACTION OF PEAT*	1.07	-0.08	0.03	-0.12
5 *EXTRACTION OF CRUDE OIL AND NATURAL GAS*	1.05	-0.35	0.01	-0.08
6 *MINING OF METAL ORES*	1.13	0.12	0.05	-0.23
7 *OTHER MINING AND QUARRING PRODUCTS*	1.08	-0.47	0.04	-0.09
8 *MANUFACTURE OF FOOD PRODUCTS AND BEVERAGES*	1.06	-0.20	-0.01	-0.11
9 *TOBACCO PRODUCTS*	1.06	0.36	-0.01	-0.10
10 *MANUFACTURE OF TEXTILES*	1.06	-0.43	0.01	-0.05
11 *MANUFACTURE OF CLOTHES PROCESS AND DYEING OF FUR*	1.10	-0.03	0.00	-0.11
12 *MANUFACTURE OF TANNING AND DRESSING OF LEATHER*	1.04	-0.24	0.00	-0.06
13 *WOOD AND WOOD PRODUCTS*	1.22	-0.28	0.07	-0.16
14 *PULP, PAPER AND PAPER PRODUCTS*	1.01	-0.27	-0.03	-0.09
15 *PUBLISHING PRINTING AND PEPRODUCTION OF PECORDED MEDIA*	1.04	0.18	0.06	-0.10
16 *MANUFACTURE OF COKE: REFINED PETROLEUM PRODUCTS*	1.10	0.11	-0.02	-0.16
17 *MANUAFACTURE OF CHEMICALS AND CHEMICAL PRODUCTS*	0.96	-0.22	-0.07	-0.06
18 *MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS*	1.05	-0.16	-0.04	-0.12
19 *MANUFACTURE OF OTHER NON-METALIC MINERAL PRODUCTS*	1.03	-0.26	0.02	-0.07
20 *BASIC METALS AND FABRICATED METAL PRODUCTS*	1.38	-0.35	0.11	-0.21
21 *FABRICATED METAL PRODUCTS EXCEPT MACHINERY & EQUIPMENT*	1.19	-0.21	0.04	-0.16
22 *MACHINERY AND EQUIPMENT*	1.21	-0.31	0.03	-0.17
23 *OFFICE MACHINERY AND COMPUTERS*	1.34	-0.33	0.12	-0.18
24 *ELECTRICAL MACHINERY AND APPARATUS*	1.18	-0.17	-0.01	-0.23
25 *RADIO,TELEVISION AND COMMUNICATION EQUIPMENT & APPARATUS*	1.03	-0.51	0.02	-0.04
26 *MEDICAL PRECISION AND OPTICLE INSTRUM. ,WATCHES & CLOCKS*	1.07	0.00	0.00	-0.15
27 *MOTOR VEHICLES TRAILERS AND SEMI-TRAILERS*	1.03	-0.11	-0.03	-0.10
28 *OTHER TRANSPORT EQUIPMENT*	1.35	-0.04	0.04	-0.28
29 *FURNITURE*	1.07	-0.11	0.00	-0.11
30 *RECYCLING*	1.33	-0.29	0.00	-0.30
31 *ELECTRICITY ,GAS,STEAM AND HOT WATER*	1.11	-0.20	0.06	-0.07
32 *COLLECTION,PUREFLICATION AND DISTRIBUTION OF WATER*	1.04	0.08	-0.04	-0.13
33 *CONSTRUCTION WORK*	1.45	-0.12	0.05	-0.27
34 *WHOLE SALE AND RETAIL SALE*	1.06	-0.02	-0.02	-0.10
35 *HOTEL AND RESTAURANT SERVICES*	1.08	0.19	-0.04	-0.18
36 *TRANSPORTS*	1.09	-0.23	0.03	-0.08
37 *WATER TRANSPORT SERVICES*	0.97	-0.11	-0.05	-0.05
38 *AIR TRANSPORT SERVICES*	1.06	-0.32	0.03	-0.04
39 *SUPPORTING AND AUXILIARY TRASNPORT SERVICES*	1.19	-0.11	0.12	-0.14
40 *POST AND TELECOMMUNICATIONS*	1.09	0.34	-0.03	-0.17
41 *FINANCIAL INTERMEDIATION SERVICES*	1.09	-0.05	0.00	-0.14
42 *INSURANCE AND PENSION FUNDING SERVICES*	1.01	0.16	-0.04	-0.10
43 *SERVICES AUXILIARY TO FINANCIAL INTERMEDIATION*	0.84	0.26	-0.03	-0.03
44 *REAL ESTATE SERVICES*	1.03	0.08	-0.01	-0.08
45 *RENTING SERVICES OF MACHINERY AND EQUIPMENT*	1.52	0.00	0.03	-0.40
46 *COMPUTER AND RELATED SERVICES*	1.81	0.16	0.07	-0.45
47 *RESEARCH AND DEVELOPMENT SERVICES*	2.05	0.04	0.11	-0.49
48 *OTHER BUSINESS SERVICES*	1.05	0.18	-0.06	-0.15
49 *PUBLIC ADMINISTRATION AND DEFENCE SERVICES*	1.17	0.89	-0.14	-0.37
50 *EDUCATION*	1.09	0.21	-0.01	-0.15
51 *HEALTH AND SOCIAL WORK SERVICES*	1.08	0.45	-0.04	-0.18
52 *SEWAGE AND REFUSE DISPOSAL SERVICES SANITATION*	1.10	0.24	-0.06	-0.22
53 *MEMBERSHIP ORGANIZATION SERVICES N.E.C.*	1.04	-0.01	-0.01	-0.08

***54** RECREATIONAL ,CULTURAL AND SPORTING SERVICES*	0.98	0.41	-0.05	-0.11
***55** OTHER SERVICES N.E.C.*	1.05	0.05	-0.02	-0.11
***56** DOMESTIC SERVICES*	1.04	-0.15	-0.01	-0.08
***57** WAGES*	1.17	-0.04	0.00	-0.20
***58** CAPITAL*	1.07	-0.04	-0.01	-0.11
***59** HOUSEHOLDS*	1.05	-0.08	-0.01	-0.09
***60** FIRMS*	1.04	0.03	-0.03	-0.11

Table II. Output total and closed loop multiplier indices.

	g_y	g_y cl	ki tot	ki cl	g_m tot	g_m cl	$g_m s$ tot	$g_m s$ cl	$(g_m+1)ds$ tot	$(g_m+1)ds$ cl
1	0.79	0.56	0.90	0.96	-0.26	-0.27	0.00	0.00	0.12	0.06
2	0.11	-0.15	0.80	0.93	-0.54	-0.70	-0.11	-0.05	0.14	0.03
3	0.82	0.63	0.86	0.94	-0.25	-0.26	-0.03	-0.01	0.19	0.07
4	1.09	0.40	1.07	0.97	-0.08	-0.14	0.03	-0.02	-0.12	0.00
5	0.44	0.20	1.05	0.97	-0.35	-0.38	0.01	-0.02	-0.08	-0.01
6	1.52	0.20	1.13	0.87	0.12	-0.16	0.05	-0.01	-0.23	0.14
7	0.15	0.03	1.08	0.92	-0.47	-0.52	0.04	-0.07	-0.09	0.02
8	0.77	0.71	1.06	1.03	-0.20	-0.20	-0.01	-0.01	-0.11	-0.08
9	2.17	2.16	1.06	1.01	0.36	0.36	-0.01	0.01	-0.10	-0.04
10	0.29	0.25	1.06	1.05	-0.43	-0.43	0.01	0.01	-0.05	-0.04
11	1.21	1.20	1.10	1.04	-0.03	-0.03	0.00	0.00	-0.11	-0.07
12	0.71	0.70	1.04	0.98	-0.24	-0.24	0.00	-0.01	-0.06	-0.02
13	0.64	0.31	1.22	0.93	-0.28	-0.35	0.07	0.00	-0.16	0.05
14	0.55	0.31	1.01	1.08	-0.27	-0.24	-0.03	0.01	-0.09	-0.06
15	1.75	0.90	1.04	0.96	0.18	0.03	0.06	0.03	-0.10	0.03
16	1.49	0.84	1.10	1.06	0.11	0.03	-0.02	0.01	-0.16	-0.03
17	0.62	0.47	0.96	0.98	-0.22	-0.19	-0.07	-0.04	-0.06	-0.02
18	0.80	0.45	1.05	0.94	-0.16	-0.20	-0.04	-0.05	-0.12	0.00
19	0.68	0.41	1.03	1.04	-0.26	-0.29	0.02	0.02	-0.07	-0.05
20	0.47	0.16	1.38	1.09	-0.35	-0.38	0.11	0.04	-0.21	-0.02
21	0.79	0.46	1.19	0.92	-0.21	-0.22	0.04	0.00	-0.16	0.08
22	0.51	0.34	1.21	1.10	-0.31	-0.34	0.03	0.04	-0.17	-0.05
23	0.59	0.38	1.34	1.01	-0.33	-0.30	0.12	0.01	-0.18	-0.05
24	0.73	0.29	1.18	0.94	-0.17	-0.28	-0.01	-0.03	-0.23	0.03
25	0.11	0.05	1.03	1.00	-0.51	-0.54	0.02	0.00	-0.04	-0.02
26	1.20	0.79	1.07	1.02	0.00	0.08	0.00	0.01	-0.15	-0.01
27	0.94	0.74	1.03	0.90	-0.11	-0.12	-0.03	-0.05	-0.10	0.03
28	1.23	0.57	1.35	0.99	-0.04	-0.11	0.04	-0.02	-0.28	-0.01
29	0.98	0.83	1.07	1.04	-0.11	-0.07	0.00	-0.02	-0.11	-0.09
30	0.35	0.09	1.33	0.90	-0.29	-0.45	0.00	-0.06	-0.30	0.04
31	0.94	0.58	1.11	0.96	-0.20	-0.19	0.06	0.01	-0.07	0.05
32	1.37	1.08	1.04	0.95	0.08	0.13	-0.04	-0.02	-0.13	0.00
33	1.07	0.71	1.45	1.42	-0.12	-0.07	0.05	0.01	-0.27	-0.26
34	1.19	0.70	1.06	0.89	-0.02	-0.05	-0.02	0.01	-0.10	0.14
35	1.62	1.53	1.08	1.05	0.19	0.19	-0.04	-0.03	-0.18	-0.13
36	0.78	0.51	1.09	1.02	-0.23	-0.23	0.03	0.00	-0.08	-0.04
37	0.92	0.76	0.97	1.01	-0.11	-0.10	-0.05	0.01	-0.05	0.00
38	0.60	0.41	1.06	0.94	-0.32	-0.30	0.03	-0.02	-0.04	0.03
39	1.21	0.32	1.19	0.98	-0.11	-0.20	0.12	-0.03	-0.14	-0.06
40	2.03	1.06	1.09	1.04	0.34	0.29	-0.03	-0.04	-0.17	-0.09
41	1.11	0.48	1.09	1.00	-0.05	-0.15	0.00	-0.01	-0.14	0.00
42	1.55	1.14	1.01	0.95	0.16	0.10	-0.04	-0.04	-0.10	0.00
43	1.57	0.51	0.84	1.03	0.26	0.84	-0.03	-0.07	-0.03	-0.16
44	1.45	1.13	1.03	1.01	0.08	0.08	-0.01	-0.01	-0.08	-0.06
45	1.26	0.34	1.52	0.95	0.00	-0.23	0.03	0.02	-0.40	0.06

46	2.12	0.82	1.81	1.06	0.16	0.26	0.07	-0.01	-0.45	-0.11
47	1.81	0.28	2.05	0.95	0.04	-0.18	0.11	0.00	-0.49	0.06
48	1.57	0.84	1.05	1.01	0.18	0.24	-0.06	0.00	-0.15	0.04
49	3.25	3.23	1.17	1.12	0.89	0.88	-0.14	-0.10	-0.37	-0.30
50	1.77	1.65	1.09	1.07	0.21	0.22	-0.01	0.00	-0.15	-0.12
51	2.28	2.24	1.08	1.04	0.45	0.45	-0.04	-0.02	-0.18	-0.11
52	1.71	0.81	1.10	1.04	0.24	0.14	-0.06	0.02	-0.22	-0.02
53	1.25	0.94	1.04	1.06	-0.01	0.18	-0.01	-0.03	-0.08	-0.09
54	2.04	1.27	0.98	0.97	0.41	0.13	-0.05	-0.04	-0.11	-0.03
55	1.33	1.24	1.05	1.00	0.05	0.04	-0.02	-0.02	-0.11	-0.06
56	0.90	0.88	1.04	1.02	-0.15	-0.16	-0.01	-0.01	-0.08	-0.06
57	1.15	0.45	1.17	0.94	-0.04	-0.06	0.00	0.00	-0.20	0.03
58	1.16	0.62	1.07	1.04	-0.04	-0.05	-0.01	0.00	-0.11	-0.05
59	1.07	0.42	1.05	1.05	-0.08	-0.10	-0.01	-0.01	-0.09	-0.09
60	1.28	0.67	1.04	1.00	0.03	0.02	-0.03	-0.03	-0.11	-0.06

Table III(a). Output, multiplier index by sector.

	g_ms tot	g_ms gc	g_ms x	g_ms I	g_ms st	(g_m+1)ds tot	(g_m+1)ds gc	(g_m+1)ds x	(g_m+1)ds I	(g_m+1)ds st
1	0.00	-0.04	-0.04	0.06	0.07	0.12	0.23	0.38	-0.18	0.51
2	-0.11	-0.12	0.05	-0.07	0.18	0.14	0.04	-0.22	-0.21	-0.72
3	-0.03	-0.03	-0.02	-0.05	0.10	0.19	0.18	-0.02	0.01	-0.16
4	0.03	0.02	0.03	-0.02	0.00	-0.12	-0.51	-0.25	-0.34	-0.64
5	0.01	0.14	0.03	0.11	0.14	-0.08	-0.31	-0.07	-0.16	-0.58
6	0.05	-0.17	-0.24	-0.15	-0.28	-0.23	-0.92	-0.64	-0.82	-0.47
7	0.04	0.21	0.14	0.26	0.29	-0.09	-0.33	-0.20	-0.25	-0.42
8	-0.01	0.01	0.03	-0.04	0.08	-0.11	-0.30	-0.11	0.01	-0.62
9	-0.01	-0.13	0.03	0.00	-0.09	-0.10	-0.44	0.02	0.02	-2.77
10	0.01	0.13	0.02	0.03	0.19	-0.05	-0.21	0.00	-0.04	-0.28
11	0.00	-0.02	0.01	0.01	0.03	-0.11	-0.33	-0.07	0.02	-0.72
12	0.00	0.05	0.00	0.00	0.08	-0.06	-0.26	0.04	0.02	-0.50
13	0.07	0.11	-0.09	0.04	0.13	-0.16	-0.42	-0.16	-0.26	-0.41
14	-0.03	0.15	0.01	-0.15	0.14	-0.09	-0.31	-0.09	-0.17	-0.42
15	0.06	-0.18	-0.11	-0.21	-0.24	-0.10	-0.64	-0.32	-0.36	-1.20
16	-0.02	-0.14	-0.01	0.04	0.01	-0.16	-0.45	-0.05	-0.14	-0.74
17	-0.07	-0.04	0.01	0.03	0.06	-0.06	-0.24	-0.04	-0.04	-0.02
18	-0.04	0.00	-0.03	-0.02	0.03	-0.12	-0.31	-0.02	-0.11	-0.42
19	0.02	0.00	0.03	0.06	0.11	-0.07	-0.32	-0.13	-0.13	-0.68
20	0.11	0.19	-0.02	0.19	0.24	-0.21	-0.42	-0.20	-0.34	-0.22
21	0.04	0.08	-0.11	0.06	-0.25	-0.16	-0.38	-0.09	-0.23	-0.38
22	0.03	0.10	0.01	0.07	0.09	-0.17	-0.30	-0.01	-0.25	0.23
23	0.12	0.18	0.12	0.13	0.25	-0.18	-0.37	-0.20	-0.27	-0.32
24	-0.01	0.02	-0.04	0.08	-0.01	-0.23	-0.51	-0.16	-0.39	0.06
25	0.02	0.12	0.00	0.03	0.15	-0.04	-0.12	0.00	-0.04	-0.35
26	0.00	-0.01	-0.02	0.06	0.06	-0.15	-0.56	-0.30	-0.38	-0.78
27	-0.03	-0.02	0.03	0.00	0.05	-0.10	-0.24	-0.02	-0.13	-0.68
28	0.04	-0.08	0.00	0.00	0.01	-0.28	-0.53	-0.33	-0.40	-0.40
29	0.00	0.03	0.03	0.00	0.04	-0.11	-0.33	0.00	-0.06	-0.60
30	0.00	0.13	0.04	0.12	0.12	-0.30	-0.54	-0.26	-0.48	-0.18
31	0.06	-0.01	0.03	0.05	0.12	-0.07	-0.26	0.02	-0.04	-0.55
32	-0.04	-0.12	0.02	-0.02	-0.06	-0.13	-0.39	0.04	-0.11	-0.70
33	0.05	0.02	0.02	0.10	0.12	-0.27	-0.37	-0.01	-0.52	-0.60
34	-0.02	0.03	-0.02	0.00	0.02	-0.10	-0.29	0.00	-0.09	-0.73
35	-0.04	-0.10	0.00	0.02	-0.03	-0.18	-0.43	-0.18	-0.02	-0.81
36	0.03	-0.07	0.01	0.08	0.06	-0.08	-0.23	-0.03	-0.04	-0.55
37	-0.05	-0.14	0.03	0.02	0.05	-0.05	-0.21	-0.01	-0.02	-0.71

38	0.03	0.04	-0.07	0.01	0.04	-0.04	-0.18	0.00	-0.03	-0.45
39	0.12	-0.03	-0.01	-0.01	0.05	-0.14	-0.54	-0.40	-0.42	-0.88
40	-0.03	-0.10	0.05	-0.04	-0.11	-0.17	-0.49	-0.06	-0.13	-0.88
41	0.00	0.00	-0.05	0.00	0.06	-0.14	-0.39	-0.02	-0.18	-0.57
42	-0.04	-0.12	-0.01	-0.05	-0.02	-0.10	-0.32	-0.03	-0.08	-0.89
43	-0.03	-0.07	0.02	-0.01	-0.07	-0.03	-0.86	-0.69	-0.69	-1.65
44	-0.01	-0.06	0.03	0.01	-0.01	-0.08	-0.35	0.06	0.00	-0.89
45	0.03	-0.05	-0.08	-0.04	-0.07	-0.40	-0.76	-0.16	-0.62	0.80
46	0.07	-0.26	-0.04	-0.06	-0.15	-0.45	-0.79	-0.09	-0.67	1.28
47	0.11	-0.08	-0.11	-0.07	-0.19	-0.49	-0.92	-0.59	-0.85	0.27
48	-0.06	-0.16	0.11	-0.10	0.02	-0.15	-0.47	-0.03	-0.14	-0.78
49	-0.14	-0.68	0.11	-0.03	-0.21	-0.37	-1.37	0.06	-0.01	-1.52
50	-0.01	-0.15	0.04	-0.01	-0.06	-0.15	-0.62	0.01	-0.01	-0.98
51	-0.04	-0.27	0.09	-0.04	-0.09	-0.18	-0.69	0.05	-0.03	-1.12
52	-0.06	-0.07	-0.13	-0.07	-0.12	-0.22	-0.56	-0.18	-0.29	-0.78
53	-0.01	-0.08	0.07	-0.07	0.09	-0.08	-0.29	-0.01	-0.03	-0.82
54	-0.05	-0.15	-0.12	-0.09	-0.27	-0.11	-0.54	-0.13	-0.17	-1.29
55	-0.02	-0.10	0.04	0.00	0.00	-0.11	-0.43	0.02	-0.05	-0.73
56	-0.01	-0.03	0.02	-0.03	0.07	-0.08	-0.32	0.03	0.00	-0.70
57	0.00	-0.01	0.01	0.02	0.03	-0.20	-0.55	0.00	-0.19	-0.53
58	-0.01	-0.06	-0.02	0.00	0.01	-0.11	-0.39	0.04	-0.01	-0.77
59	-0.01	-0.06	0.03	-0.03	0.05	-0.09	-0.35	0.03	-0.01	-0.77
60	-0.03	-0.07	0.02	0.01	0.01	-0.11	-0.40	0.03	-0.01	-0.72

Table III(b). Output, multiplier index by sector. Closed loop.

	g_ms cl	g_ms gc	g_ms x	g_ms l	g_ms st	(g_m+1)ds cl	(g_m+1)ds gc	(g_m+1)ds x	(g_m+1)ds l	(g_m+1)ds st
1	0.00	-0.09	0.02	0.03	0.11	0.06	0.37	-0.07	-0.09	-0.78
2	-0.05	-0.17	0.02	-0.14	0.33	0.03	0.09	-0.02	0.03	-0.07
3	-0.01	-0.04	-0.01	-0.07	0.10	0.07	0.22	-0.05	0.07	-0.20
4	-0.02	-0.02	0.01	0.04	0.03	0.00	-0.04	0.03	0.18	-1.18
5	-0.02	0.04	-0.01	0.05	0.09	-0.01	-0.15	0.01	0.04	-0.93
6	-0.01	-0.03	0.01	0.05	0.04	0.14	-0.04	-0.03	0.18	-0.51
7	-0.07	-0.04	-0.02	-0.04	0.10	0.02	-0.02	0.03	0.10	-0.30
8	-0.01	0.00	0.02	-0.06	0.09	-0.08	-0.25	-0.05	0.08	-0.90
9	0.01	-0.12	0.04	0.02	-0.08	-0.04	-0.39	0.03	0.09	-3.00
10	0.01	0.08	0.00	-0.04	0.13	-0.04	-0.13	0.08	0.07	0.01
11	0.00	-0.03	0.01	0.00	0.03	-0.07	-0.30	-0.05	0.07	-1.01
12	-0.01	0.04	0.00	-0.01	0.08	-0.02	-0.23	0.05	0.06	-0.57
13	0.00	0.03	-0.03	-0.06	0.11	0.05	-0.08	0.10	0.09	-0.91
14	0.01	0.07	-0.02	-0.06	0.10	-0.06	-0.20	0.13	0.05	-0.50
15	0.03	-0.01	0.03	-0.06	0.01	0.03	-0.26	-0.06	0.17	-0.63
16	0.01	-0.10	0.00	0.01	0.02	-0.03	-0.12	-0.10	0.04	-0.87
17	-0.04	0.01	-0.01	0.00	0.05	-0.02	-0.09	0.04	0.04	0.02
18	-0.05	0.01	0.01	-0.03	0.08	0.00	-0.27	0.00	0.38	-0.86
19	0.02	0.07	0.00	0.04	0.12	-0.05	-0.15	0.05	0.04	-1.09
20	0.04	-0.03	0.04	-0.12	0.12	-0.02	-0.01	-0.07	0.28	-1.13
21	0.00	-0.06	-0.01	0.00	0.10	0.08	0.03	0.03	-0.07	-0.51
22	0.04	0.01	-0.01	0.09	0.10	-0.05	-0.04	0.03	-0.18	-0.51
23	0.01	0.15	-0.01	-0.08	0.06	-0.05	-0.33	0.01	0.06	-1.04
24	-0.03	0.07	0.00	0.03	0.14	0.03	-0.26	-0.01	0.16	-0.66
25	0.00	0.13	-0.06	0.02	0.11	-0.02	-0.13	0.06	-0.04	-0.20
26	0.01	-0.01	0.01	0.04	0.01	-0.01	-0.21	-0.01	0.08	-0.18
27	-0.05	-0.04	0.01	-0.01	0.04	0.03	-0.25	0.06	0.06	-0.69
28	-0.02	-0.13	0.02	0.04	0.05	-0.01	-0.08	-0.02	0.17	-0.31
29	-0.02	0.00	0.04	-0.04	0.04	-0.09	-0.27	-0.09	0.08	-1.23

30	-0.06	-0.05	-0.04	-0.11	0.14	0.04	0.00	0.01	*0.02*	*-0.35*
31	0.01	0.01	0.01	-0.07	0.06	0.05	-0.25	0.04	*0.11*	*-0.43*
32	-0.02	-0.13	0.01	0.02	-0.05	0.00	-0.37	-0.03	*0.13*	*-1.04*
33	0.01	0.01	0.02	0.06	0.06	-0.26	-0.22	0.08	*-0.48*	*-0.82*
34	0.01	0.10	0.00	-0.02	0.03	0.14	0.24	-0.02	*0.23*	*-1.04*
35	-0.03	-0.09	-0.01	0.04	-0.04	-0.13	-0.36	-0.16	*0.08*	*-1.03*
36	0.00	-0.12	0.02	0.03	0.07	-0.04	-0.25	-0.01	*0.21*	*-0.79*
37	0.01	-0.10	0.03	0.04	0.04	0.00	-0.11	-0.09	*0.21*	*-0.37*
38	-0.02	-0.06	0.00	0.00	0.09	0.03	0.00	0.03	*0.06*	*-0.38*
39	-0.03	-0.10	0.02	0.02	0.07	-0.06	-0.06	-0.08	*-0.07*	*-0.88*
40	-0.04	0.02	0.03	0.01	-0.07	-0.09	-0.13	0.12	*0.04*	*-1.29*
41	-0.01	-0.03	-0.02	0.06	0.06	0.00	0.10	-0.02	*-0.09*	*-1.06*
42	-0.04	-0.10	0.03	-0.02	-0.02	0.00	-0.31	0.08	*-0.20*	*-1.59*
43	-0.07	-0.04	0.14	0.09	-0.09	-0.16	-0.16	0.24	*0.22*	*-2.00*
44	-0.01	-0.03	0.03	-0.03	-0.01	-0.06	-0.25	0.12	*-0.28*	*-1.42*
45	0.02	0.07	-0.05	0.00	0.05	0.06	-0.14	-0.01	*-0.09*	*-0.76*
46	-0.01	-0.06	0.02	-0.02	-0.09	-0.11	-0.31	-0.05	*0.13*	*-2.03*
47	0.00	-0.07	0.01	-0.01	0.05	0.06	-0.03	-0.05	*0.20*	*-0.62*
48	0.00	-0.07	0.06	0.02	-0.04	0.04	-0.28	0.15	*0.18*	*-0.75*
49	-0.10	-0.67	0.16	0.02	-0.14	-0.30	-1.34	0.14	*0.09*	*-1.47*
50	0.00	-0.16	0.04	-0.01	-0.05	-0.12	-0.59	0.07	*0.07*	*-1.32*
51	-0.02	-0.25	0.12	-0.01	-0.06	-0.11	-0.64	0.15	*0.07*	*-1.26*
52	0.02	0.01	0.03	0.15	-0.04	-0.02	-0.30	0.01	*0.49*	*-0.75*
53	-0.03	-0.12	0.00	-0.05	-0.03	-0.09	-0.43	-0.04	*0.16*	*-0.69*
54	-0.04	-0.13	0.02	-0.02	-0.02	-0.03	-0.50	0.04	*0.02*	*-1.06*
55	-0.02	-0.11	0.04	0.00	0.00	-0.06	-0.36	0.09	*0.05*	*-0.85*
56	-0.01	-0.04	0.02	-0.03	0.06	-0.06	-0.29	0.07	*0.04*	*-0.67*
57	0.00	-0.01	0.02	-0.02	0.03	0.03	-0.34	-0.01	*-0.07*	*-0.75*
58	0.00	-0.03	-0.02	-0.04	0.02	-0.05	-0.31	0.08	*0.04*	*-1.15*
59	-0.01	-0.05	0.02	-0.03	0.05	-0.09	-0.34	0.03	*-0.01*	*-0.75*
60	-0.03	-0.05	0.00	-0.02	-0.01	-0.06	-0.35	0.02	*-0.01*	*-0.81*

Table IV. Herfindahl Indices.

	HQ tot 88	**HQ tot 94**	**HQ cl 88**	**HQ cl 94**	**HP tot 88**	**HP tot 94**	**HP cl 88**	**HP cl 94**
1	235	237	193	196	1526	1486	946	938
2	621	1925	193	196	1327	1257	878	878
3	214	221	193	196	1158	1187	883	883
4	803	979	193	196	1125	1161	878	879
5	500	457	190	193	1364	1296	886	884
6	1915	2838	193	196	1157	1185	876	877
7	1083	1477	193	196	1177	1118	877	878
8	199	203	193	196	1242	1208	957	955
9	191	194	193	195	1184	1191	889	897
10	239	246	193	196	1160	1167	912	901
11	191	195	193	196	1147	1131	910	913
12	191	195	193	196	1164	1189	891	890
13	558	614	193	196	1123	1108	879	880
14	467	400	193	196	1135	1146	888	887
15	520	979	193	196	1010	1026	884	886
16	226	241	191	194	1144	1103	907	912
17	209	212	192	195	1145	1124	914	911
18	213	221	193	196	1065	1062	885	885
19	384	495	193	196	1029	1039	883	883
20	663	777	193	195	1039	974	881	881
21	317	371	193	196	1065	1032	882	883
22	263	284	192	195	1016	1065	883	882

23	570	628	191	194	1267	1304	876	877
24	445	585	192	195	976	983	879	879
25	194	196	192	195	1095	1034	881	880
26	1040	946	191	194	1169	1210	877	879
27	204	204	191	194	1183	1268	889	890
28	602	668	193	196	1129	1275	877	879
29	213	209	193	196	1113	1145	892	893
30	964	1119	193	196	1589	1653	876	877
31	225	208	193	196	1247	1214	893	892
32	210	214	193	196	1107	1177	878	880
33	234	226	193	196	1013	1042	886	887
34	195	197	193	196	1412	1431	952	954
35	194	199	193	196	1244	1273	919	931
36	195	197	193	196	1222	1181	894	893
37	196	199	193	196	1080	1092	878	880
38	197	197	193	196	1110	1051	880	880
39	1000	1569	193	196	1313	1288	879	880
40	232	221	193	196	1407	1456	885	890
41	242	252	192	195	1824	1633	890	891
42	195	212	193	196	1071	1065	880	882
43	5109	3341	193	196	1331	1383	877	879
44	190	193	193	196	1698	1757	939	948
45	559	724	193	196	1321	1314	877	878
46	926	639	193	196	1242	1249	876	877
47	1316	1794	193	196	1094	1040	876	835
48	254	224	193	196	1408	1287	887	893
49	191	195	193	196	1266	1222	878	881
50	198	198	192	195	1389	1410	884	888
51	193	197	193	196	1299	1327	894	905
52	298	349	193	196	1310	1323	877	879
53	200	192	193	195	1334	1379	877	879
54	209	320	193	196	1358	1322	888	892
55	204	208	193	196	1305	1381	880	882
56	191	194	192	195	1545	1549	877	878
57	258	250	192	195	1758	1759	1758	1782
58	197	198	192	196	1744	1741	1658	1651
59	191	194	191	194	789	807	812	847
60	197	198	190	194	1728	1738	1728	1738