Donors and Consignee Sectors of Labour Productivity in Greek Manufacturing (1958-1980)[1]

By
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Abstract

In a situation where donor and consignee sectors of productivity exist, the possibility of inequality between prices and marginal cost may not lead to the reward of the donor sector. However, Wolff's (1979a) proposal for estimation of the contribution of an individual sector to its own productivity change and the effect on other sectors' performance can be improved by incorporating West's (1982) "synergistic effect". The above methodology is applied to Greek manufacturing for the period of 1958–1980, given that the Greek economy operated under a price control regime over the years of investigation. Therefore, prices do not necessarily reflect marginal cost.

1. Introduction

In cases where wages are related to sectoral labour productivity, the possibility of inequality between prices and marginal cost may lead to the less productive being rewarded (Gollop, 1987). In other words, market structure and price determination practice may show productivity changes in sectors other than the originating one. A potentially important implication is the reallocation of resources in a way that would result in the slowdown in performance economy-wide.

It is useful for the policy maker to know the donor and consignee sectors of productivity in order to correct misleading signals given by the price system. Wolff (1979a, 1985) developed a methodology to distinguish between donor and consignee sectors. His model answers the following questions. First, how much each sector's productivity change is due to its own technological change and how much is induced from other sectors. Second, how much of total sectoral productivity is transmitted to other sector. However, West (1982) pointed out that changes in one particular sector's technical coefficients or in the technology of all other sectors result in errors in the multipliers. This "synergistic effect" is not included in Wolff's calculations, producing therefore biased results.

In the following part of this paper the Wolff model is presented incorporating the views expressed by West. This methodology is applied, in the third part, to Greek manufacturing for the period 1958–1980, with the assumption that labour is the only primary input, in the sense of a Leontief-Sraffa model, because of the lack of data concerning sectoral capital stock[2].

Manuscript received May 31, 1993. Revised September 6, 1993.
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[1]The authors are indebted to the anonymous referees for their comments and the suggestions from the editor of this Journal. However any errors are our responsibility.

[2]With the absence of data concerning sectoral capital stock we could not estimate technical progress in terms of total factor productivity or take into account prospects for future gains, the distribution of income effects, etc. However, as the paper deals with the volume of labour needed to produce one unit of final demand, the definitions used are very similar to those used by Seyfried to express vertically integrated labour rentability incorporating

2. The model

By definition, system labour productivity is the change between periods of total labour requirements per unit of sectoral gross output (Gupta and Steedman, 1971; Bulmer-Thomas, 1982; Panethimintakis, 1993) calculated as

$$(\lambda^2) = \lambda^1[I - A]^{-1} \tag{1}$$

and the formula used for ith sector i system labour productivity is

$$p_i = 1/\lambda_i^2$$

(λ^1) is the vector of direct labour use per unit gross output, i.e. the ratio of labour employed (L_j), to sectoral output (X_j), and $[I - A]^{-1}$ is the matrix multiplier. Expression(1) includes the substitution of intermediate inputs for direct labour.

As the additive form is more convenient for decomposition, Wolff proceeds by adopting the following decomposed solution of the matrix multiplier,

$$[I - A]^{-1} = [I] + [A] + [A^2 + A^3 + ...] \tag{2}$$

Define, $[B] = [A^2 + A^3 + ...]$, then form (1) can be written as

$$(\lambda^2) = (\lambda^1) + (\lambda^1)[A] + (\lambda^1)[B] \tag{3}$$

where the diagonal elements of [A] are zero.

The above expression(3) enables us to separate the direct component, denoted as $(\Delta\lambda^{2,D})$, from the indirect one $(\Delta\lambda^{2,I})$. System labour productivity is then defined as the change occurring in total or system labour requirements between two periods,

$$i.e.\ (\Delta\lambda^2) = (\lambda^2)_{t+1} - (\lambda^2)_t \tag{4}$$

where t refers to the base year and 1 is the year-end of the period of investigation.

Substituting (3) into (4) and solving (4), the following decomposable expression can be obtained

$$(\Delta\lambda^2) = (\Delta\lambda^{2,D}) + (\Delta\lambda^{2,I}) \tag{5}$$

The direct component expresses the change in sectoral labour requirements "due to a change in its own labour coefficient and its own technical interindustry coefficients"
(Wolff, 1979a, p.7) determined as

$$(\Delta\lambda^{2,D}) = (\Delta\lambda^1) + (\lambda^1)_{t+1}[\Delta A] \tag{6}$$

On the other hand, the indirect component shows the change exhibited in one sector due to changes prevailing in other sectors and is given as

$$(\Delta\lambda^{2,I}) = (\Delta\lambda^1)[A]_{t+1} + (\lambda^1)_t[\Delta B] + (\Delta\lambda^1)[B]_{t+1} \tag{7}$$

However, equations (6) and (7) do not estimate direct and indirect effects according to the hypothesis made, i.e. that labour and technical coefficients of an individual sector change

sectoral reinvestment (matrix Γ) as

$$P_i = \frac{1}{L(1 - A\Gamma)^{-1}Y}$$

The reader can notice the similarity between the above formulation, Wolff's definition and our total labour productivity.

over time. According to West, when a direct coefficient changes, the value of the multiplier is affected determining the so-called "error matrix." When there are simultaneous changes of more than one coefficient of a matrix, the total effect cannot be expressed through the error matrix. Combined changes lead to the "synergistic effect." West proved that in cases where the coefficient of only one single column changes between two periods, as our case indicates, and this change of coefficients cannot be expressed by a single proportion, then we need to adapt a simulation method in order to calculate the errors involved through the synergistic effect. In other words, West proposes a new multiplier in the case of Wolff's hypothesis. This multiplier is based on a matrix where the coefficient of only one sector changes between periods t and $t+1$, i.e.

$$\begin{vmatrix} a_{,t+1} & a_{,t} & a_{,t} \\ a_{,t+1} & a_{,t} & a_{,t} \\ a_{,t+1} & a_{,t} & a_{,t} \end{vmatrix} = [\dot{A}]_{t+1} \tag{8}$$

and the new multiplier is denoted as $[I - \dot{A}]^{-1}_{t+1}$. This form differs from the simple multiplier that is used in equations (6) and (7).

It is important to note that even if we decompose according to West the basic matrix used by Wolff, where the latter is expressed with the help of matrix $[\dot{A}]$.i.e.

$$[A]_{t+1} = [\dot{A}]_{t+1} + \left[[A]_{t+1} - [\dot{A}]_{t+1},\right]$$

the result for $(\Delta\lambda^2)$ would not be different from equation (5)–(7). Following the steps of the solution provided by Wolff, the new matrix $[\dot{A}]$ cancels out.

In our case the estimations of donors and consignee sectors and sectoral system productivity are made with the help of simulation in an effort to include the views expressed by West, i.e. the matrix $[A]$ was reconstructed into $[\dot{A}]$ according to the question asked. For example, based on the supposition that the labour and technical coefficients of sector j have changed-while all other sectors' labour and technical coefficients remain unchanged-the labour vector and the matrix [A] for period $t+1$ were reconstructed accordingly. The new vector $(\dot{\lambda})_{t+1}$ included the direct labour coefficient for sector j as it was estimated in period $t+1$, while all other elements of the vector were those of period t. The matrix $[\dot{A}]_{t+1}$, incorporated changes in the technology of the same sector, i.e. included column vector of the matrix for sector j for the period $t+1$, while all other elements refer to period t. Therefore, the calculation of $\Delta\lambda^2_j$ is based on the empirical evidence according to the hypothesis. The exercise was repeated for all sectors. The same methodology is followed when the hypothesis refers to changes prevailing in the coefficients of all other sectors while labour and technological coefficients of sector j are unchanged.

3. Empirical results:Greek Manufacturing 1958–1980

3.1. Effects on system sectoral productivity when only the technology of one sector changes

The reconsideration of Wolff's model was applied to Greek manufacturing decomposed into 16 sectors. Table 1 below describes the average annual change of system sectoral productivity when the technology of only one sector changes. The purpose of this excercise is to establish the effort made by individual sectors to increase their system productivities.

According to Table 1, if technical change occurred only in the food sector between 1958 and 1966 while all the other sectors' technical coefficients were constant, then the annual average change of system productivity in this sector would be 0.86% When we repeated the exercise for the next period (1966–1970), an annual change of 3.87% was estimated, which in the period

Table 1: Annual average growth rate of sectoral system productivity (p^{2D}) when only the technology of each sector changes

	1958-66	1966-70	1970-75	1975-80	1958-70	1970-80
Food	0.86	3.87	6.43	1.85	1.7	3.15
Beverages	3.19	4.62	6.98	-3.52	3.27	0.88
Tobacco	0.6	9.64	12.86	-2.43	3.38	4.06
Textiles-clothing	4.23	8.65	7.85	8.72	5.07	6.89
Footwear-leather	-2.89	11.25	14.09	2.46	1.22	7.46
Wood-furniture	-2.52	9.19	5.68	6.42	1.7	3.97
Paper-publishing	4.08	5.29	1.98	2.11	3.76	1.45
Rubber-plastics	8.17	3.66	5.38	-5.26	6.47	-0.51
Chemicals	8.26	8.02	7.56	-5.69	7.49	-0.23
Cement and other	4.36	7.66	4.96	1.07	4.85	1.86
Metallurgy	7.19	8.14	2.72	-14.68	6.76	-6.32
Metal products	3.4	2.77	0.64	9.2	2.24	4.41
Machinery	4.36	0.63	5.26	-7.21	2.68	-1.11
Electric machinery	6.35	0.76	2.35	12.29	3.59	6.16
Transport equipmetn	5.24	3.83	-0.97	1.66	4.26	0.67
Miscel.manufacturing	1.45	2.48	10.81	-0.37	2.15	3.43

Source: Estimations of p^{2D} according th the formula $\frac{1}{\lambda_t^2+(\Delta\lambda^{2D})_t} - \frac{1}{\lambda_t^2}$, using the previously defined $[\hat{A}]$.

1970–1975 reached a level of 6.43%. In the following period 1975–1980 the growth rate was reduced to 1.85%.

The reader will notice that a number of traditional industries such as textiles, footwear, chemical products and wood-furniture are performing satisfactorily. However, Table 1 will convince us that during the period 1958–1975 the "friendly" and non competitive proentry to the EEC environment allowed investment to be carried out and consequently marked the participation of sectoral improvement of system sectoral productivity. The following years (1975–1980) were a period of crisis for Greek industry. The slowdown of output together with the labour market rigidities negatively affected the evolution of technical change. A negative contribution to their system productivities are exhibited by beverages, tobacco, elastics-plastics, chemicals, metallurgy and machinery; avery low contribution is seen in the food sector, non metallic products, transport equipment and miscellaneous products.

3.2. Effects on system sectoral productivity when the technology of all other sectors changes

The changes observed in sectoral system productivity, as defined above, are the compound result of changes in technology oriented from the stated sector and from other sectors through interindustry relations. In this section we have estimated (Table 2) the annual rate of change in sectoral system productivity when the technology of a specific sector does not alter while the technical coefficients of all other sectors change over time. The estimations follow the methodology described in section 2.

Referring to the previous example of the food sector in the period 1958–1966, Table 2 reveals that a change in the technology of all other sectors resulted in a rise of system productivity of this sector by 6.25%, although the effort mede by the same sector affected its system productivity by only 0.86(annual growth rate).

Table 2 shows a satisfactory stable performance of system productivity of all sectors for the period 1958–1975. In effect, almost every sector benefitted through interindustry relations, i.e.

Table 2: Annual average growth rate of sectoral system productivity (p^{2I}) when the technology of all other sectors changes

	1958-66	1966-70	1970-75	1975-80	1958-70	1970-80
Food	6.25	6.41	6.31	-4.92	6.32	2.73
Beverages	6.17	6.11	6.41	-6.07	6.24	2.65
Tobacco	5.86	6.62	6.83	-10.62	5.85	3.03
Textiles-clothing	3.53	3.46	3.67	-8.45	3.32	1.2
Footwear-leather	3.35	3.03	2.5	-13.53	3.36	0.92
Wood-furniture	4.38	3.83	2.05	-4.73	4.19	0.64
Paper-publishing	1.62	2.3	2.6	-4.08	1.38	0.3
Rubber-plastics	3.19	5.76	4.21	-6.42	2.87	0.94
Chemicals	3.76	5.33	5.02	-10.53	3.49	0.24
Cement and other	2.73	2.71	1.89	-10.08	2.17	-1.75
Metallurgy	3.97	3.81	6.78	-10.9	3.21	-1.31
Metal products	4.64	3.27	2.88	-7.08	3.71	-1.38
Machinery	3.66	2.73	1.92	-6.93	2.93	-0.19
Electric machinery	3.86	3.95	4.13	-6.77	3.11	-0.25
Transport equipmetn	2.61	1.69	1.77	-1.41	2.36	-0.06
Miscel.manufacturing	5.36	4.19	1.81	-9.94	4.44	0.35

Source: Estimations of p^{2I} according to the formula $\frac{1}{\lambda_t^2+(\Delta\lambda^{2I})_t} - \frac{1}{\lambda_t^2}$, using the reconstracted matrix $[\dot{A}]$.

from changes in technology that occurred in other sectors. The strengthening of interindustry relations through time gave a strong "indirect effect" that seems to determine the evolution of productivity in the whole economy. To this extent the "macro" effect dominates the "micro" effect.

In the period 1975–1980 the negative sectoral performance in direct productivity was converted into huge losses of system productivity via the multiplier, as Table 2 indicates. During this period, the loss in system productivity in the food sector, due to the negative performance of all other sectors, was estimated at the level of -4.92% per annum. The negative performance was 6.07% for beverages, 10.62% for tobacco -10.62% and -8.45% for textiles.

This analysis demonstrates very clearly that sectoral performance depends heavily on the performance of the economy and vice versa. In a period of economic crisis with falling demand in the domestic market and abroad, the poor performance of an individual sector is spread in multiple ways to all other sectors.

3.3. Donor and consignee sectors in cases where technology change occurs in only one sector

The following Tables 3–6 show the annual rate of growth of sectoral system productivity due to the technological change in one sector only at different time periods. Reading down the columns we distinguish the donor sectors, while the consignee sectors are presented horizontally. The elements of the main diagonal of the matrix represent the performance in productivity of the corresponding sector due to its own effort. The estimation of sectoral system productivity presupposes the existence of the synergistic effect according to West. It is obvious that this effect can (over)underestimate the level of sectoral productivity according to the direction of changes that take place when compared with the simple definition-calculation of system productivity of Tables 1 and 2.

Table 3: Donor and consignee sectors in cases where technology change occurs in only one sector

Period:1958–1966

Sector	3.F	4.B	5.T	6.T-C	7.F-L	8.W-F	9.P-P	10.R-P	11.C	12.C-O	13.M	14.MP	15.M	16.EM	17.TE	18.MM
1 Agriculture	5.61	5.37	5.32	2.51	2.14	2.81	0.22	1.04	1.6	0.28	0.36	0.3	0.34	0.26	0.47	2.78
2 Mining	0.07	0.08	0.04	0.07	0.07	0.09	0.15	0.14	0.41	1.23	0.86	0.37	0.23	0.26	0.27	0.26
3 Food	0.86	0.08	0.03	0.02	0.33	0.02	0.01	0.02	0.12	0.01	0.01	0.01	0.02	0.01	0.01	0.03
4 Beverages	0.02	3.19	0.02	0.01	0.01	0.01	0	0.01	0.02	0	0	0	0	0	0	0.01
5 Tobacco	0.02	0.02	0.6	0.01	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0.01
6 Textiles-clothing	0.1	0.05	0.04	4.23	0.15	0.21	0.03	0.46	0.09	0.05	0.05	0.06	0.07	0.05	0.11	0.05
7 Footwear-leather	0.02	0.02	0.02	0.01	-2.89	0	0	0	0.01	0	0	0	-0.02	0	0	0
8 Wood-furniture	0.02	0.01	0.02	0.01	0	-2.52	-0.050	0	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	-0.17	0
9 Paper-printing	0.03	0.03	0.06	0.03	0.02	0.03	4.08	0.05	0.06	0.03	0.15	0.08	0.06	0.04	0.06	0.05
10 Rubber-plastics	0.03	0.03	0.03	0.02	0.05	0.04	0.03	8.17	0.05	0.07	0.11	0.12	0.41	0.29	0.26	0.04
11 Chemicals	0.13	0.18	0.12	0.22	0.25	0.28	0.26	0.81	8.26	0.25	0.35	0.38	0.25	0.31	0.24	0.42
12 Cement and other	0.03	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.04	4.36	0.04	0.02	0.02	0.06	0.02	0.03
13 Metallurgy	0.03	0.03	0.03	0.03	0.02	0.13	0.05	0.06	0.04	0.06	7.2	1.6	0.72	0.71	0.46	0.45
14 Metal products	0.04	0.03	0.03	0.03	0.03	0.15	0.06	0.03	0.05	0.05	0.07	3.4	0.22	0.36	0.22	0.05
15 Machinery	0.04	0.04	0.04	0.04	0.02	0.04	0.05	0.04	0.05	0.06	0.39	0.14	4.36	0.28	0.04	0.07
16 Elect:machinery	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.09	6.35	0.02	0.02
17 Transport equipm.	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.06	0.04	0.02	0.05	0.02	5.25	0.02
18 Miscel.manufacturing	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.05	0.02	0.02	0.01	0.02	1.45
19 Constructions	0.02	0.02	0.02	0.01	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0.01
20 Electr-gas-water	0.03	0.03	0.03	0.04	0.03	0.05	0.07	0.04	0.06	0.1	0.15	0.09	0.06	0.06	0.06	0.04
21 Transportation	0.08	0.06	0.05	0.05	0.07	0.12	0.09	0.09	0.29	0.09	0.36	0.19	0.19	0.17	0.12	0.12
22 Communications	0.03	0.03	0.03	0.03	0.02	0.03	0.07	0.02	0.03	0.02	0.05	0.04	0.03	0.03	0.02	0.03
23 Trade	0.06	0.07	0.08	0.22	0.15	0.18	0.21	0.15	0.2	0.09	0.17	0.17	0.06	0.13	0.13	0.12
24 Banking-insurance	0.07	0.08	0.09	0.15	0.05	0.12	0.16	0.08	0.2	0.24	0.32	0.44	0.38	0.29	0.1	0.19
25 Othere services	0.05	0.02	0.05	0.08	0.06	0.06	0.21	0.13	0.32	0.09	0.2	0.17	0.14	0.21	0.09	0.09
26 Housing	0.02	0.02	0.02	0.01	0.01	0.01	0	0	0.01	0	0.06	0	0	0	0	0.01
27 Public services	0.03	0.03	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	0.02	0.03	0.02	0.01	0.02

Source: The above estimations refer to the average annual change of system productivity of all sectors when the technology and the direct labour coefficient of a particular sector change. Therefore, each row has calculated separately according to the text.

Table 4: Donor and consignee sectors in cases where technology change occurs in only one sector

Period:1966–1970

Sectors	3.F	4.B	5.T	6.T-C	7.F-L	8.W-F	9.P-P	10.R-P	11.C	12.C-O	13.M	14.MP	15.M	16.EM	17.TE	18.MM
1 Agriculture	6	5.05	6.18	3.06	1.68	3.01	0.84	1.41	2.54	0.57	0.96	0.52	0.42	0.7	0.37	2.6
2 Mining	0.04	0.04	0.03	0.03	0.02	0.03	0.07	0.08	0.19	0.53	0.86	0.2	0.13	0.2	0.09	0.05
3 Food	3.88	0.66	0.13	0.09	1.06	0.08	0.1	0.24	1.07	0.07	0.41	0.12	0.07	0.11	0.04	0.1
4 Beverages	0.03	4.62	0.03	0.02	0.01	0.02	0.01	0.03	0.14	0.01	0.01	0.01	0	0.01	0	0.02
5 Tobacco	0.03	0.02	9.63	0.02	0.01	0.02	0	0.01	0.01	0	0.01	0	0	0	0	0.01
6 Textiles-clothing	0.13	0.06	0.08	8.65	0.13	0.28	0.12	1.71	0.35	0.05	0.12	0.17	0.09	0.17	0.1	0.49
7 Footwear-leather	0.03	0.02	0.03	0.02	11.25	0.02	0.01	0.03	0.01	0	0.01	0.01	0	0	0	0.01
8 Wood-furniture	0.03	0.03	0.03	0.02	0.01	9.19	0.02	0.05	0.04	0.06	0.13	0.07	0.06	0.56	0.15	0.08
9 Paper-printing	0.04	0.04	0.05	0.03	0.02	0.04	5.29	0.12	0.18	0.16	0.08	0.08	0.07	0.11	0.03	0.11
10 Rubber-plastics	0.03	0.03	0.03	0.02	0.01	0.03	0.03	3.65	0.04	0.02	0.02	0.03	0.04	0.07	0.03	0.04
11 Chemicals	0.06	0.06	0.06	0.11	0.08	0.07	0.31	1.41	8.02	0.22	0.16	0.2	0.08	0.3	0.09	0.21
12 Cement and other	0.03	0.05	0.03	0.02	0.01	0.02	0.01	0.03	0.07	7.65	0.07	0.03	0.02	0.08	0.03	0.05
13 Metallurgy	0.03	0.03	0.03	0.02	0.01	0.04	0.03	0.04	0.08	0.04	8.12	1.16	0.66	0.8	0.29	0.14
14 Metal products	0.03	0.03	0.03	0.02	0.01	0.03	0.03	0.03	0.05	0.03	0.28	2.77	0.24	0.12	0.13	0.06
15 Machinery	0.03	0.03	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.03	0.01	0.64	0.02	0.02	0.02
16 Elect.machinery	0.03	0.02	0.03	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0	0.01	0.77	0.01	0.01
17 Transport equipm.	0.03	0.03	0.03	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	3.84	0.02
18 Miscel.manufacturing	0.03	0.02	0.03	0.02	0.01	0.02	0.01	0.01	0.01	0	0.01	0	0	0	0	2.49
19 Constructions	0.03	0.03	0.03	0.02	0.01	0.02	0.02	0.03	0.06	0.04	0.05	0.03	0.03	0.03	0.06	0.02
20 Electr-gas-water	0.03	0.03	0.03	0.02	0.01	0.03	0.05	0.06	0.08	0.11	0.25	0.09	0.05	0.07	0.03	0.03
21 Transportation	0.09	0.11	0.09	0.1	0.08	0.14	0.39	0.47	0.33	0.65	0.62	0.52	0.51	0.55	0.24	0.2
22 Communications	0.03	0.03	0.03	0.02	0.01	0.02	0.06	0.05	0.05	0.05	0.08	0.05	0.05	0.06	0.03	0.03
23 Trade	0.07	0.09	0.07	0.12	0.13	0.17	0.56	0.44	0.43	0.36	0.81	0.6	0.6	0.78	0.28	0.18
24 Banking-insurance	0.01	-0.01	-0.02	-0.05	-0.01	-0.03	-0.2	-0.24	-0.26	-0.19	-0.92	-0.36	-0.27	-0.5	-0.16	-0.05
25 Ptjer servoces	0.03	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.04	0.02	0.02	0.03	0.03	0.04	0.01	0.02
26 Housing	0.03	0.02	0.03	0.02	0.01	0.02	0	0.01	0.01	0	0.01	0	0	0	0	0.01
27 Public services	0.01	0.01	0.01	0.01	0	0.01	0	0	0	0	-0.01	0	0	0	0	0.01

Source: See table 3

Table 5: Donor and consignee sectors in cases where technology occurs in only one sector

Period: 1970–1975

Sectors	3.F	4.B	5.T	6.T-C	7.F-L	8.W-F	9.P-P	10.R-P	11.C	12.C-O	13.M	14.MP	15.M	16.EM	17.TE	18.MM
1 Agriculture	5.25	4.1	5.05	1.88	0.94	1.13	0.24	0.33	0.79	0.13	0.2	0.1	0.07	0.17	0.09	0.64
2 Mining	0.07	0.06	0.06	0.03	0.02	0.02	0.02	0.07	0.01	0.1	0.15	0.04	0.02	0.04	0.02	0.02
3 Food	6.43	0.95	0.16	0.09	1.07	0.05	0.05	0.13	0.63	0.03	0.14	0.04	0.02	0.05	0.02	0.05
4 Beverages	0.06	6.98	0.06	0.03	0.01	0.02	0.01	0.01	0.05	0	0	0	0	0	0	0.01
5 Tobacco	0.06	0.05	12.85	0.02	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0.01
6 Textiles-clothing	0.13	0.07	0.09	7.86	0.06	0.08	0.03	0.42	0.1	0.02	0.06	0.03	0.02	0.04	0.02	0.1
7 Footwear-leather	0.06	0.05	0.06	0.06	14.09	0.02	0.01	0.04	0.01	0	0	0	0	0	0	0.01
8 Wood-furniture	0.07	0.06	0.06	0.03	0.02	5.68	0.01	0.04	0.03	0.04	0.07	0.04	0.03	0.32	0.1	0.06
9 Paper-printing	0.08	0.07	0.1	0.05	0.03	0.03	1.98	0.07	0.15	0.08	0.04	0.03	0.02	0.05	0.02	0.06
10 Rubber-plastics	0.08	0.07	0.07	0.05	0.04	0.05	0.06	5.38	0.09	0.02	0.02	0.03	0.04	0.1	0.04	0.06
11 Chemicals	0.13	0.15	0.12	0.23	0.16	0.09	0.27	1.19	7.57	0.17	0.12	0.12	0.05	0.2	0.07	0.2
12 Cement and other	0.07	0.12	0.06	0.03	0.02	0.02	0.01	0.03	0.08	4.97	0.07	0.03	0.01	0.05	0.02	0.04
13 Metallurgy	0.07	0.06	0.06	0.03	0.02	0.04	0.02	0.03	0.07	0.02	2.73	0.52	0.27	0.38	0.17	0.1
14 Metal products	0.07	0.05	0.06	0.03	0.01	0.02	0.01	0.01	0.03	0.01	0.07	0.62	0.05	0.03	0.04	0.03
15 Machinery	0.08	0.08	0.08	0.07	0.03	0.04	0.11	0.07	0.09	0.14	0.15	0.08	5.25	0.1	0.15	0.03
16 Elect.machinery	0.06	0.05	0.06	0.03	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.02	2.34	0.03	0.01
17 Transport equipm.	0.06	0.04	0.06	0.02	0.01	0.01	0	0	0	-0.01	-0.01	-0.01	-0.01	-0.01	-0.98	0
18 Miscel.manufacturing	0.07	0.06	0.06	0.03	0.01	0.02	0.04	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	10.8
19 Constructions	0.06	0.05	0.06	0.02	0.01	0.01	0	0	0	0	0	0	0	0	-0.01	0.01
20 Electr-gas-water	0.09	0.08	0.08	0.09	0.04	0.06	0.13	0.14	0.23	0.21	0.47	0.18	0.09	0.13	0.7	0.07
21 Transportation	0	-0.05	0	-0.06	-0.05	-0.05	-0.14	-0.17	-0.14	-0.18	-0.17	-0.18	-0.12	-0.14	-0.08	-0.06
22 Communications	0.07	0.06	0.07	0.04	0.02	0.02	0.04	0.04	0.04	0.03	0.05	0.03	0.02	0.03	0.02	0.02
23 Trade	0.17	0.2	0.16	0.28	0.22	0.18	0.41	0.35	0.44	0.23	0.47	0.32	0.28	0.43	0.19	0.15
24 Banking-insurance	0.35	0.65	0.83	0.87	0.29	0.4	1.26	1.48	2.09	0.86	4.3	1.55	1.01	2.14	0.83	0.4
25 Ptjer servoces	0.07	0.09	0.1	0.06	0.03	0.03	0.07	0.08	0.11	0.05	0.09	0.06	0.05	0.08	0.04	0.04
26 Housing	0.06	0.05	0.06	0.02	0.01	0.01	0	0	0.1	0	0	0	0	0	0	0.01
27 Public services	0.05	0.04	0.05	0.02	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0.01

Source: See table 3

Table 6: Donor and consignee sectors in cases where technology change occurs in only one sector

Period: 1975–1980

Sectors	3.F	4.B	5.T	6.T-C	7.F-L	8.W-F	9.P-P	10.R-P	11.C	12.C-O	13.M	14.MP	15.M	16.EM	17.TE	18.MM
1 Agriculture	0.76	0.47	0.67	0.15	0.11	0.04	0.01	0.01	0.04	0	0.01	0	0	0.01	0	0.02
2 Mining	-0.58	-1.08	-0.27	-0.75	-0.52	-0.21	-0.94	-1	-5.15	-5.6	-7.04	-3.05	-1.16	-2.24	-1.36	0.53
3 Food	1.85	0.22	0.07	0.02	0.25	0	0	0.01	0.06	0	0.01	0	0	0	0	0
4 Beverages	0.07	-3.51	0.06	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0
5 Tobacco	0.07	0.04	-2.43	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0
6 Textiles-clothing	0.12	0.06	0.08	8.74	0.03	0.01	0.01	0.1	0.02	0.01	0.04	0.01	0.01	0.01	0.01	0.01
7 Footwear-leather	0.07	0.04	0.06	0.03	2.43	0	0	0	0	0	0	0	0	0	0	0
8 Wood-furniture	0.08	0.09	0.07	0.04	0.02	6.42	0.01	0.04	0.03	0.04	0.09	0.05	0.03	0.34	0.16	0.06
9 Paper-printing	0.11	0.08	0.16	0.06	0.03	0.01	2.1	0.04	0.13	0.05	0.03	0.03	0.02	0.04	0.01	0.04
10 Rubber-plastics	0.01	0.01	0.04	-0.05	-0.08	-0.03	-0.07	-5.26	-0.09	-0.01	-0.02	-0.03	-0.03	-0.11	-0.04	-0.04
11 Chemicals	-0.01	-0.07	0	-0.18	-0.2	-0.2	-0.17	-0.56	-5.69	-0.08	-0.07	-0.08	-0.02	-0.11	-0.05	-0.08
12 Cement and other	0.07	0.09	0.06	0.01	0.01	0.01	0	0.01	0.04	1.06	0.04	0.01	0	0.02	0.01	0.01
13 Metallurgy	-0.01	-0.01	0.03	-0.06	-0.05	-0.11	-0.08	-0.11	-0.38	-0.07	-4.68	-3.66	-1.39	-2.38	-1.33	-0.46
14 Metal products	0.15	0.07	0.08	0.08	0.05	0.04	0.06	0.06	0.15	0.03	0.54	9.21	0.35	0.24	0.41	0.12
15 Machinery	0.02	-0.02	0.01	-0.07	-0.03	-0.01	-0.13	-0.08	-0.09	-0.11	-0.16	-0.09	-7.22	-0.1	-0.18	-0.01
16 Elect.machinery	0.09	0.07	0.07	0.04	0.03	0.01	0.02	0.08	0.07	0.05	0.04	0.05	0.1	12.29	0.19	0.02
17 Transport equipm.	0.08	0.06	0.07	0.03	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	1.65	0.01
18 Miscel.manufacturing	0.07	0.04	0.06	0.01	0.01	0	0	0	0	0	0	0	0	0	0	-0.38
19 Constructions	0.06	0.03	0.05	0	0	0	0	-0.01	-0.02	-0.01	-0.01	-0.01	0	0.01	-0.22	0
20 Electr-gas-water	0.02	-0.01	0.03	-0.09	-0.08	-0.01	-0.1	-0.09	-0.17	-0.11	-0.3	-0.12	-0.04	-0.08	-0.05	-0.03
21 Transportation	-0.06	-0.14	-0.07	-0.18	-0.11	-0.03	-0.13	-0.13	-0.13	-0.1	-0.14	-0.12	-0.07	-0.12	-0.07	-0.04
22 Communications	0.08	0.06	0.08	0.03	0.02	0.01	0.02	0.02	0.03	0.01	0.03	0.02	0.01	0.02	0.01	0.01
23 Trade	-0.27	-0.34	-0.24	-0.94	-0.6	-0.13	-0.5	-0.38	-0.5	-0.17	-0.46	-0.38	-0.24	-0.45	-0.24	-0.11
24 Banking-insurance	-0.01	-0.11	-0.18	-0.15	-0.06	-0.02	-0.16	-0.17	-0.24	-0.07	-0.38	-0.17	-0.08	-0.22	-0.1	-0.02
25 Ptjer servoces	0.19	0.34	0.42	0.29	0.13	0.05	0.24	0.28	0.37	0.12	0.3	0.22	0.14	0.29	0.14	0.07
26 Housing	0.07	0.04	0.06	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0
27 Public services	0.07	0.04	0.06	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0

Source: See table 3

Table 3: Period 1958–1966

In the first line of Table 1 we observe technical changes that occurred in agriculture resulting in promotion of the system productivity of the food sector by 5.61% annually. During this period the food sector improved its system productivity by only 0.86%.

Table 3 shows that during this period agriculture was the main donor sector of productivity economy-wide and particularly in the manufacturing sectors. The contribution of agriculture to the improvement of system productivity in beverages was as high as 53.37% (or 5.32%/9.36%), while its contribution to food reached the level of 78.09%. Agriculture also has a very high participation in the formation of system productivity in tobacco (76.66%) and in textile products (29.7%). It is worth noticing the positive contributions of agriculture to footwear (+2.14%)and wood-furniture (+2.81%), at a time when the efforts of thses sectors to improve their productivities had a negative effect. According to Table 3, technical changes in each one of the above sectors contributed negatively to their own system productivity by -2.89% and -2.52% respectively.

As far as other donor sectors are concerned, chemical products seem to have a positive effect on the system productivity of rubber-plastics, while productivity improvement in metallurgy positively affected metal products.

Table 4: Period 1966–1970

During this period improvements in the productivity of agriculture continue to affect many of the industrial sectors positively as they derive most of their imputs directly or indirectly from agriculture (food, beverages, tabacco, textiles, footwear and wood-furniture). In this period the trend for high growth rates of system productivity continues. Textiles, clothing, electricity, transportation and trade seem to be important donor sectors.

Table 5: Period 1970–1975

Agriculture continues to play an important role. At the same time, the evolution of new sectors and the investment undertaken seem to heve contributed to the good performance of their system productivities. There is enough evidence to state that during this period a noticeable switch took place: the donor sectors reduced their importance in the determination of sectoral system productivity in favour of their own technical improvements.

Table 6: Period 1975–1980

Greek manufacturing had already entered a period of crisis with falling output and profits, "sustained" employment, no investment and sustained subsidies with growing financing from the banking system. In such an environment negative economic indicators were to be expected. During this period, minerals, chemicals, metallurgy, transportation, trade and the banking sector all exhibited negative performance in productivity. Given the sectoral differences in performance, some sectors seem to be heavily affected by the negative performance of other sectors.

4. Conclusions

One of the main targets of economic policy today is to balance labour productivity increases with money wage increases in order to keep labour cost per unit of output constant. This presupposes some guidelines for individual sectors for maintaining price stability, i.e. prices should fall in cases where sectoral productivity exceeds the average and vice versa. This paper argues that the combination of system labour productivity analysis with the estimation of donor sectors will be helpful to the policy maker in assessing how the performance of the economy is affected in cases of market distortions.

Greek manufacturing seems to be a good example for analysing donor and consignee sectors of productivity, as market prices do not necessarily reflect marginal cost. The long tradition of price control, the oligopolistic structure of some important parts of the market and the state-

owned (or controled) firms in a variety of industrial sectors has led to a situation where the formulation of prices, for the period of investigation, was far from the levels that would have been determined in a competitive environment (L.Athanasiou, 1984 and G. Alogoskoufis, 1986). Direct or indirect subsidies used to be an integral part of economic policy. This is why the government today undertakes specific measures towards liveralization and privatization of the economy.

The effort undertaken by the government to reward sectoral productivity increases in order to improve the competitive position economy-wide may end up in rewarding the consignee sectors. In the long-run the implicit re-allocation of resources that will follow will deprive the economy of the primary source of productivity improvement. The labour released would be the most productive, thus creating further disequilibrium conditions between supply, demand and inflation. Evidently these developments narrow the production possibility frontier of the economy. Nonetheless, the donor-consignee phenomenon is not there just to defend past performances. Along with the liberalization efforts it could also serve the long-run objectives of the new development strategy for the Greek economy. As the cost structure changes the study of the phenomenon could indicate substitutes for the traditional donor sectors.

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