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The contribution of primary inputs to price formation: An input-output analysis of the Greek economy

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Abstract

Using an input-output model and data from the Symmetric Input-Output Table of the Greek economy for the year 2010, this article estimates the total (direct and indirect) contribution of primary inputs to price formation for the economy as a whole and per category of final demand as well. The main finding is that the cost of imports, and particularly, the imports of industrial commodities, constitutes the main factor in the price formation of sectoral prices as well as of the price indices of private consumption and exports. On the other hand, the price index of government consumption is mainly formed by the wages of sectors related to government activities. These findings seem to be in accordance with the results of the implementation of the internal devaluation policy, which had a relatively higher impact on the improvement of the state budget deficit and a relatively lower impact on the improvement of the performance of the external sector and the decrease of the consumer price index. At the same time, these findings indicate the necessity for the implementation of well-targeted policies of import substitution for industrial products in order to enhance the international competitiveness of the economy.

Keywords: *Economic policy, Greek economy, Input-Output analysis, Prices, Primary inputs.*

JEL classification: *C67, D57, E64*

1. Introduction

The "decomposition" of commodity prices to the direct and indirect requirements in primary inputs plays a central role in the implementation of economic policy. Since 2010, the Greek government has attempted to correct the imbalances of the economy through the application of measures that included significant reductions in government expenditures, increases in taxes and cuts in unit labour costs. This economic policy, known as "internal devaluation strategy", resulted in a significant improvement of the state budget deficit, but it did not have a corresponding positive impact on the improvement of the performance of the external sector and the decrease of the consumer price index.[1] These facts indicate that an investigation of the relationships between the cost of primary inputs and the prices of commodities could offer further insights into the factors that contribute, directly and indirectly, to price formation in the Greek economy.

As is well known, the prices of net products can be decomposed into the costs of the primary inputs that were used in their production. Moreover, into the production of each commodity also enter, directly or indirectly, other commodities as intermediate inputs. Thus, the price of each commodity is formed not only from the costs of the primary inputs of the industry that produces a specific commodity, but also from the costs of the primary inputs of the industries that produce the commodities that are used as intermediate inputs in the production of this commodity. Therefore, the estimation of the contribution of primary inputs to price formation should also take into account the intersectoral relationships in the economy.

The purpose of this article is to estimate the direct and indirect contribution of primary inputs to price formation for the economy as a whole and per category of final demand as well. For this purpose, we use "Input-Output Analysis" as an analytical tool and data from the Symmetric Input-Output Table (SIOT) of the Greek economy for the year 2010.[2]

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– Opinions or value judgments expressed in this article are the authors' own and do not necessarily reflect those of the Centre of Planning and Economic Research.

1. For a thorough analysis of the external sector of the Greek economy in this period as well as its performance in terms of productivity and competitiveness, see Greek National Productivity Board (2019).

2. As far as we know, the last relevant estimation for the Greek economy was that of Garganas and Momferatos (1979) and was based on data from the Input-Output Tables of the year 1970.

The remainder of the paper is structured as follows. Section 2 outlines the analytical framework. Section 3 presents and evaluates the empirical results. Finally, Section 4 concludes.

2. The analytic framework

Consider the price system of the open input-output system of Leontief (1951):[3]

$$\mathbf{p}^{\mathrm{T}}\hat{\mathbf{x}} = \mathbf{p}^{\mathrm{T}}\mathbf{A}\hat{\mathbf{x}} + \mathbf{v}^{\mathrm{T}} \tag{1}$$

Where $\mathbf{p}$ is the $n \times 1$ vector of unit prices of commodities; $\mathbf{x}$ the $n \times 1$ vector of the supply of commodities in the economy; $\mathbf{A}$ the $n \times n$ matrix of technical coefficients; $\mathbf{v}$ the $n \times 1$ vector of primary inputs; the symbol "^" above a vector denotes the diagonal matrix formed by the elements of this vector; "T" denotes the transpose of a matrix-vector; and n is the number of the produced commodities. Moreover, the prices of all commodities are taken to be equal to 1, i.e., $\mathbf{p}^{\mathrm{T}} = [1,1, \ldots, 1]$,; that is to say, the physical unit of measurement of each commodity is that unit which is worth of a monetary unit.[4] Post-multiplying equation (1) by $(\hat{\mathbf{x}})^{-1}$, we obtain:

$$\mathbf{p}^{\mathrm{T}} = \mathbf{p}^{\mathrm{T}}\mathbf{A} + \boldsymbol{\pi}^{\mathrm{T}} \tag{2}$$

where $\boldsymbol{\pi}^{\mathrm{T}} \equiv [\mathbf{v}^{\mathrm{T}}\ (\hat{\mathbf{x}})^{-1}]$ is the vector of primary inputs per unit of output. Assuming that the system is viable or, equivalently, the Perron-Frobenius eigenvalue, λ_{PF}, is less than 1, the solution of equation (2) is given by:

$$\mathbf{p}^{\mathrm{T}} = \boldsymbol{\pi}^{\mathrm{T}}[\mathbf{I} - \mathbf{A}]^{-1} \tag{3}$$

Thus, the term on the right-hand side of equation (3) gives the vector of total (direct and indirect) requirements in primary inputs necessary to produce one unit of each commodity.

Now we define the $k \times n$ matrix $\mathbf{B} \equiv [b_{ij}]$, where k is the number of categories of primary inputs, n is the number of the sectors in the economy, while each element b_{ij} of this matrix represents the direct requirements in i-th primary input necessary to produce 1 unit of commodity j. Post-multiplying the matrix $\mathbf{B}$ with the 'Leontief Inverse Matrix', $[\mathbf{I} - \mathbf{A}]^{-1}$, we obtain the $k \times n$ matrix, say $\mathbf{C} \equiv [c_{ij}]$, each element of which represents the total (direct and indirect) contribution of the i-th primary input to the price formation of commodity j, while the sum of each column of matrix $\mathbf{C}$ equals 1. In formal terms:

$$\mathbf{C} = \mathbf{B}[\mathbf{I} - \mathbf{A}]^{-1} \tag{4}$$

Thus, matrix $\mathbf{C}$ can be used to estimate the contribution of the different categories of primary inputs to price formation in the economy. Moreover, we can estimate the contribution of primary inputs to price formation per sector of origin of each primary input using the following equations:

$$\mathbf{D} = \hat{\boldsymbol{\pi}}[\mathbf{I} - \mathbf{A}]^{-1} \tag{5}$$

and

$$\mathbf{D}_k = \widehat{\mathbf{c}_k}\,[\mathbf{I} - \mathbf{A}]^{-1} \tag{6}$$

where $\mathbf{D} \equiv [d_{ij}]$ is an $n \times n$ matrix, each element of which represents the total (direct and indirect) contribution of the primary inputs of sector i to price formation of commodity j; $\mathbf{c}_k$ is the vector of the k-th primary input per unit of output; and $\mathbf{D}_k \equiv [d_{ij}^k]$ is the $n \times n$ matrix, each element of which represents the total (direct and indirect) contribution of the k-th primary input of sector i to price formation of commodity j.

In order to estimate the contribution of primary inputs to the formation of the price indices of the different categories of final demand, we have to take into account the weight of each commodity in the different 'baskets' of final demand. For this purpose, we define the $n \times m$ matrix $\mathbf{E} \equiv [e_{ij}]$, where n is the number of produced commodities in the economy; m the number of categories of final demand; and each element, e_{ij}, of the matrix represents the share of commodity i to the j-th category of final demand.[5] We may now estimate the contribution of primary inputs to the formation of the price indices of the different categories of final demand on the basis of the following equation:

$$\mathbf{F} = \mathbf{CE} \tag{7}$$

where $\mathbf{F} \equiv [f_{ij}]$ is a $k \times m$ matrix, each element of which represents the total (direct and indirect) contribution of the i-th primary input to the formation of the price index of the j-th category of final demand.[6] Moreover, if we denote by $\mathbf{e}_j$ the vector derived from matrix $\mathbf{E}$ if

3. See also, e.g., Pasinetti (1977, Chap. 4).

4. This assumption does not affect the results of our analysis. For more details, see Leontief (1986, pp. 22-23) and Miller and Blair (2009, pp. 41-43).

5. Thus, the sum of each column of matrix **E** equals 1.

6. Thus, the sum of each column of matrix **F** equals 1.

we extract its *j*-th column, then the contribution of the primary inputs to the formation of the different price indices per sector of origin of each primary input can be estimated by the following equation:

$$\mathbf{f}_k^j = \mathbf{D}_k \mathbf{e}_j \quad (8)$$

where $\mathbf{f}_k^j \equiv [\mathbf{f}_i^{k,j}]$ is an $n \times 1$ vector, each element of which represents the total (direct and indirect) contribution of the *k*-th primary input of sector *i* to the formation of the price index of the *j*-th category of final demand. Finally, by summing the contributions of the different primary inputs of each sector to the formation of the price index of each category of final demand, we can estimate the total contribution of each sector to the formation of the price index of each category of final demand. In formal terms:

$$\mathbf{g}_j = \sum \mathbf{f}_k^j \quad (9)$$

where $\mathbf{g}_j \equiv [\mathbf{g}_i^j]$ is an $n \times 1$ vector, each element of which represents the total (direct and indirect) contribution of the primary inputs of sector *i* to the formation of the price index of the *j*-th category of final demand.

In what follows, we present the findings of the application of the previous analysis to the SIOT of the Greek economy for the year 2010.

3. Empirical application in the Greek economy

The SIOT of the Greek economy for the year 2010 describes 64 commodities/sectors and is available via the website of the Hellenic Statistical Authority, www.statistics.gr.[7] From this table we can identify seven categories of primary inputs, i.e.: 1) Net taxes, 2) Wages, 3) Employers' contributions, 4) Other net taxes on production, 5) Depreciations, 6) Profits, 7) Imports.[8] Moreover, in the SIOT of the Greek economy we can identify eight categories of final demand, i.e.: 1) Private consumption, 2) Final consumption of NPISH, 3) Government consumption, 4) Gross fixed capital formation, 5) Changes in valuables, 6) Changes in inventories, 7) Exports intra EU, 8) Exports extra EU.

3.1. The contribution of primary inputs to price formation

We begin with the estimation of the matrix **C** of the Greek economy (see equation (4)), which gives the direct and indirect contribution of primary inputs to price formation. According to what we noted above, the dimensions of the matrix **C** for the Greek economy will be 7×64. The results of our estimations are presented in Figures 1-2 and in Table 1. Figure 1 gives a visual representation of the values of the elements in this matrix: near zero (zero) values are shown in a shade of grey (as white), while negative (positive) values tend to be bluish (orangish).[9] The rows in this figure describe the primary inputs in the order (1-7) given above, while the columns describe the 64 sectors of the economy in the order (1-64) given in Table A1 in the Appendix of this article. The sectors 1-4 belong to 'Primary production'. The sectors 5-27 belong to 'Industry'. The sectors 28-64 belong to 'Services'. Figure 2 gives the distribution chart of the values of the matrix **C**. More specifically, the columns of the chart give the range of values for each primary input, while the lines that appear in these columns give the respective quartiles of 75%, 50% and 25%. Finally, Table 1 gives the respective statistics of this matrix, i.e., the maximum (max) and minimum (min) values for each primary input, the median, and the quantiles of 75% and 25% of the respective values.

From Figures 1-2, Table 1 and the associated numerical results, it follows that imports, profits and wages have the largest contribution in price formation. It is also deduced that imports have a relatively large contribution in the price formation of industrial commodities. More specifically, the average contribution of imports in the price formation of industrial commodities is about 50%.

Next, we estimate the 64×64 matrix **D** of the Greek economy, i.e., the direct and indirect contribution of primary inputs to price formation per sector of origin of each primary input. Figure 3 gives a visual representation of the values of the elements in this matrix, while Figure 4 gives the respective distribution chart of the values in the matrix. From these figures and the associated numerical results, it follows that the primary inputs of the Service sectors have a relatively small

7. The described sectors in the SIOT of the Greek economy are reported in Table A1 in the Appendix to this article.

8. Considering the imports as a primary input means that the total output of each sector also includes the imported goods and services that are considered as part of the total supply of each sector (see also Gargarnas and Momferatos, 1979, p. 29).

9. Negative values can appear in our analysis either because of negative net taxes or negative profits.

FIGURE 1
Representation of the matrix of the total contribution of primary inputs

FIGURE 2
Distribution chart of the values of the matrix of the total contribution of primary inputs

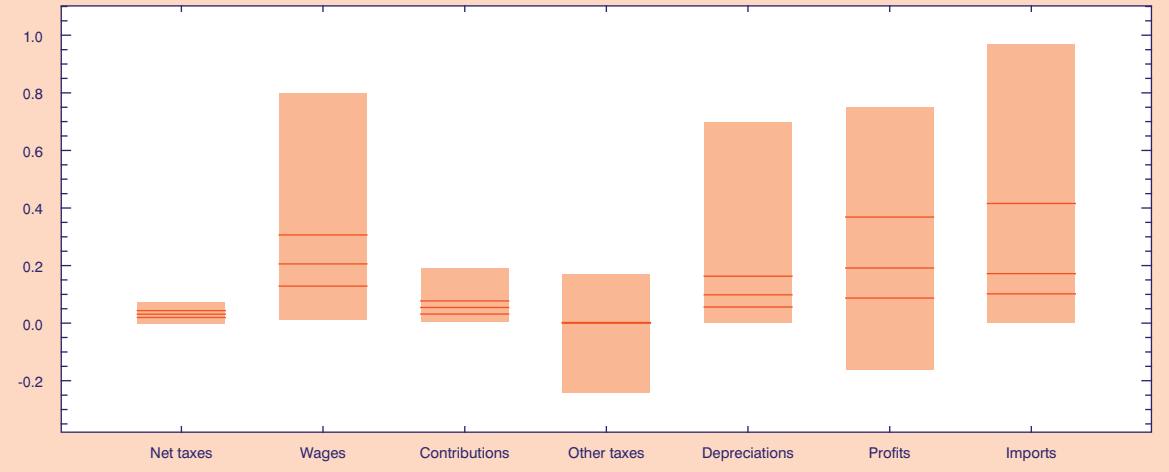


TABLE 1 Statistics of the matrix of the total contribution of primary inputs

	Max	75%	Median	25%	Min
Net taxes	0.0731028	0.0435577	0.031321	0.0197834	0
Wages	0.799503	0.306184	0.205894	0.128691	0.0138826
Employers' contributions	0.192242	0.0771973	0.054641	0.0314547	0.00508657
Other net taxes on production	0.16946	0.00243222	0.000978926	0.000294503	-0.244185
Depreciations	0.696803	0.163242	0.0984419	0.0562308	0
Profits	0.749131	0.368411	0.191619	0.0872264	-0.162395
Imports	0.967458	0.415785	0.172093	0.101617	0

FIGURE 3
Representation of the matrix of the total contribution of primary inputs per sector of origin

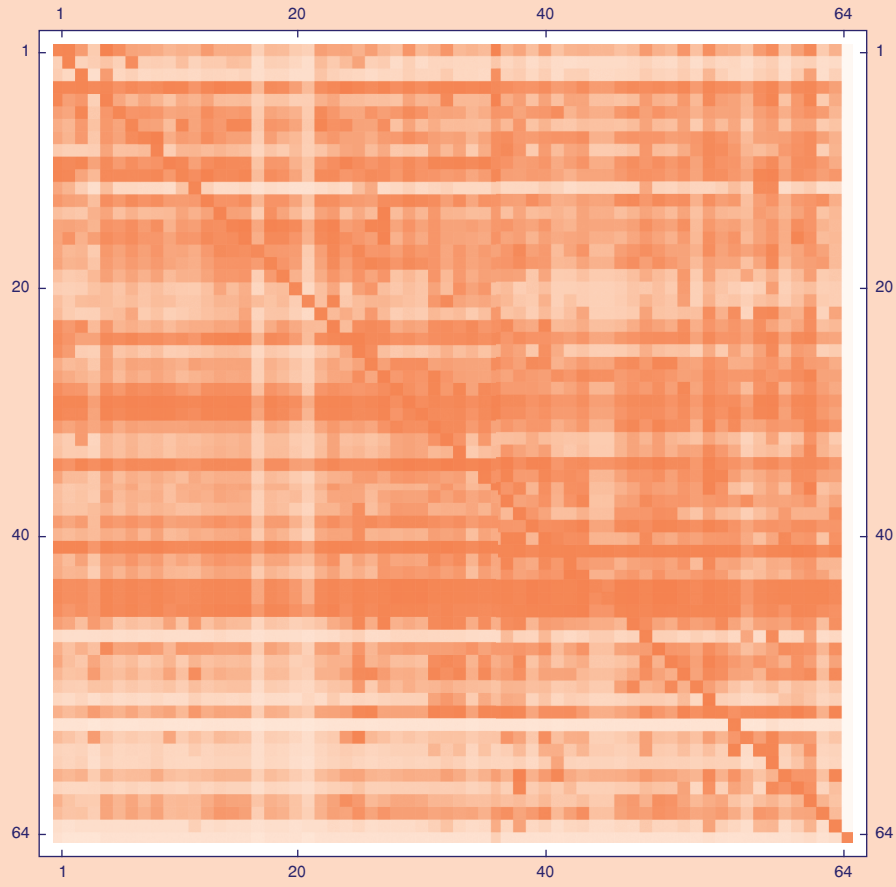


FIGURE 4
Distribution chart of the values of the matrix of the total contribution of primary inputs per sector of origin

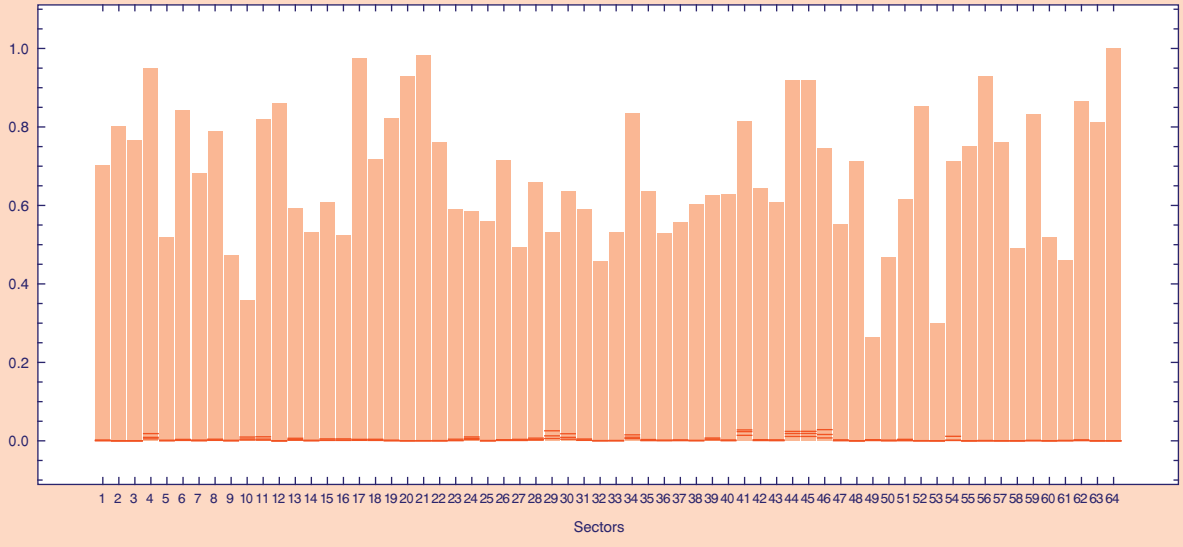


FIGURE 5
Representation of the matrix of the total contribution of imports per sector of origin

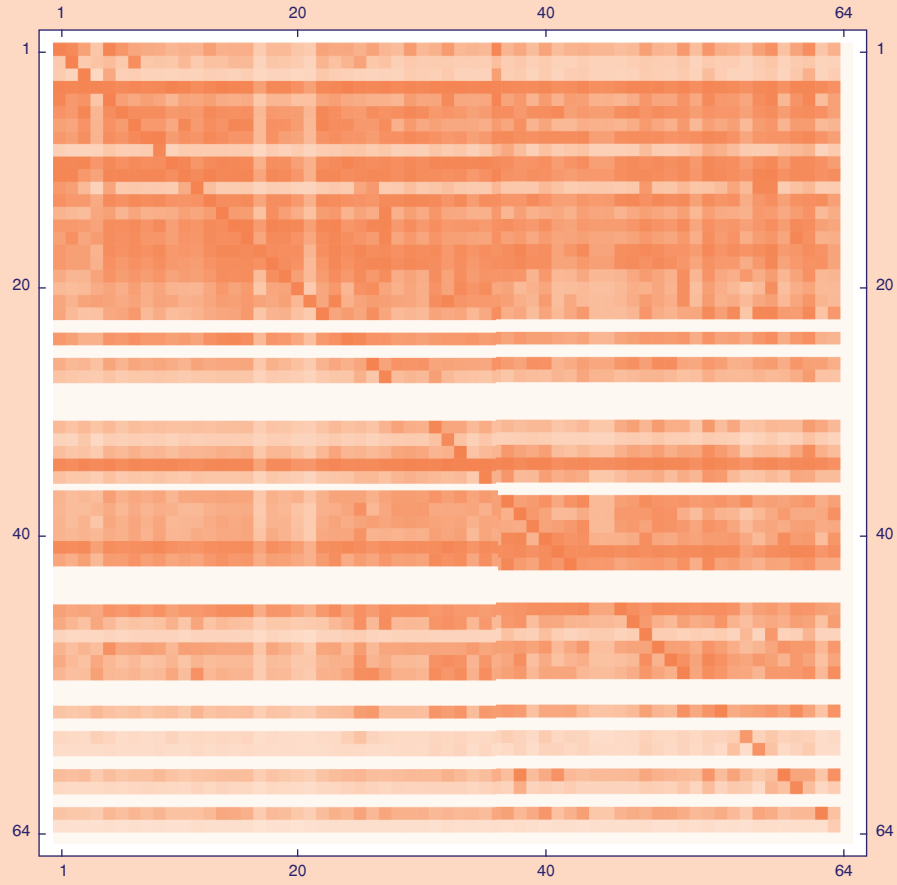
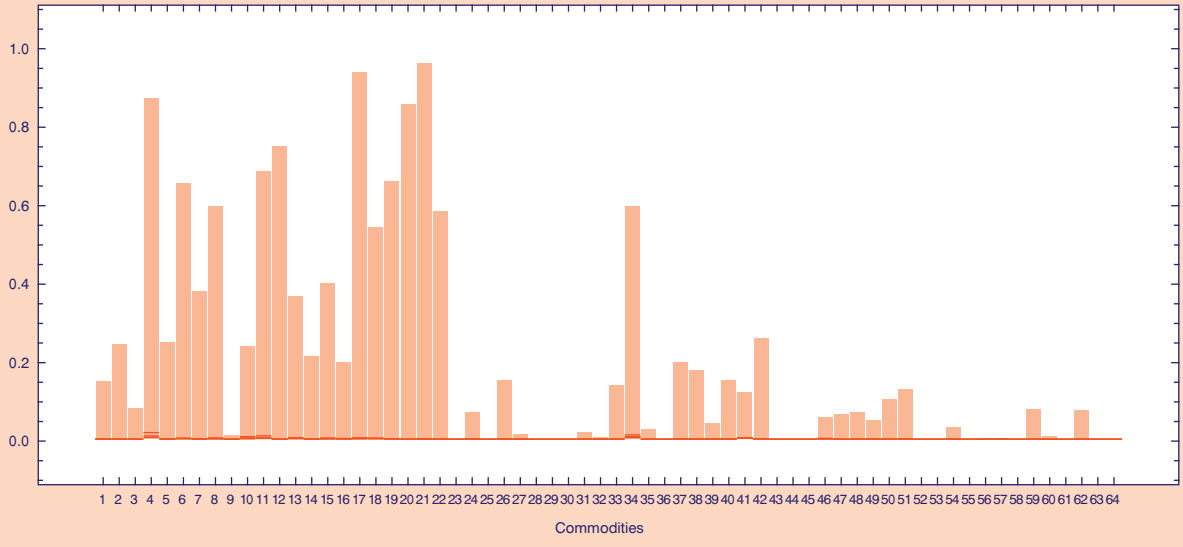


FIGURE 6
Distribution chart of the values of the matrix of the total contribution of imports per sector of origin



contribution to the price formation of industrial commodities.

Moreover, we estimate the matrices $\mathbf{D}_k$ of the Greek economy (see equation (6)), i.e., the direct and indirect contribution of primary inputs to price formation per sector of origin for each primary input. Figure 5 above gives a visual representation of the values of the elements of the $\mathbf{D}_k$ for the case of imports, while Figure 6 gives the respective distribution chart of the values in the matrix.[10]

From these figures and the associated numerical results, it follows that the imports of industrial commodities have a relatively larger contribution to the price formation of most of the commodities of the economy. As a matter of fact, Figure 6 above demonstrates that, in many cases, the imports of a single industrial commodity forms more than half of the price of some commodities.

It must be obvious that the above findings, which have been presented in brief through the matrix and distribution charts, represent a large number of quantitative estimates that could be taken into account by economic policy authorities in the formulation of sectoral policies.

3.2. The contribution of primary inputs to the formation of the price indices of final demand

In what follows, we estimate the matrix **F** for the Greek economy (see equation (7)), i.e., the total (direct and indirect) contribution of primary inputs to the formation of price indices of the different categories of final demand. Since we have identified eight different categories of final demand from the SIOT, the matrix **F** will be of dimensions 7×8. The results derived for the case of the Greek economy are presented in Table 2.

The rows of the table describe the different categories of primary inputs, while the columns describe the different categories of final demand. The last column of the table reports the contribution of primary inputs to the formation of the price index of total final demand. We observe that profits (29%), imports (24%) and wages (23%) have the largest contribution to the formation of the price index of total final demand, while the primary inputs with the highest contribution to the price indices per category of final demand are: (a) profits, which form about 36% of the price index of private consumption; (b) wages, which form about 39% of the price index of government consumption; and (c) imports, which form about 38% of the price index of gross fixed capital formation, 36% of the price index of exports intra EU and 37% of the price index of exports extra EU. These findings could be useful in the formulation of anti-inflationary policies and, therefore, in export-oriented policies through boosting the competitiveness of the economy.

Next, we estimate the vectors $\mathbf{f}_k^j$ and $\mathbf{g}_j$ of the Greek economy (see equations (8) and (9), respectively), i.e., the contribution of primary inputs to the formation of the different price indices per sector of origin of each primary input. By also taking into account the results from the estimation of the matrix **F**, we can decompose the price index of each category of final demand per primary input and sector of origin. For the sake of brevity, we focus on the results of the categories of final demand with the most significant contribution to total final demand. In order to get a picture of the contribution of all sectors to the formation of the price indices of final demand, Figure 7 gives a visual representation of the values of the elements of the matrix that is formed by the different vectors $\mathbf{g}_j$ of the Greek economy for the following categories of final demand: 1) private consumption, 2) government consumption, 3) exports intra EU, 4) exports extra EU, and 5) total final demand.[11] Thus, the first row of the figure corresponds to the vector $\mathbf{g}_1$ and shows the contribution of the 64 sectors of the Greek economy to the formation of the price index of private consumption; the second row corresponds to the vector $\mathbf{g}_2$ and shows the contribution of the sectors to the formation of the price index of government consumption, etc. Figure 8 gives the distribution chart of the values in this matrix, while Table 3 presents the respective statistics.

We observe that the range of the values of the vectors $\mathbf{g}_j$ that correspond to government consumption and exports extra EU is relatively larger than those for private consumption and exports intra EU. The highest value for government consumption (36.36%) corresponds to sector 55 ("Public administration and defence services; compulsory social security services"), while the highest value for exports extra EU (21.99%) corresponds to sector 32 ("Water transport services"). Regarding the rest of the categories of final demand, sectors 45 and 44 ("Real estate services") have the largest contribution to the formation of the price index

10. For the sake of brevity, we do not present the matrices $\mathbf{D}_k$ for the rest of the primary inputs. All the available empirical results are available on request from the authors.

11. Private consumption, government consumption and exports compose more than 85% of total final demand.

TABLE 2 The contribution of primary inputs in the formation of price indices

	Categories of final demand								
Categories of primary inputs	**Private consumption**	**Final consumption of NPISH**	**Government consumption**	**Gross fixed capital formation**	**Changes in valuables**	**Changes in inventories**	**Exports intra EU**	**Exports extra EU**	**Total final uses**
Net taxes	3.09%	6.55%	2.30%	3.07%	2.21%	5.08%	3.64%	4.13%	3.11%
Wages	19.82%	44.53%	39.36%	19.67%	14.32%	39.88%	17.68%	14.99%	23.17%
Employers' contributions	5.43%	11.74%	12.07%	5.80%	3.85%	10.40%	4.97%	4.07%	6.64%
Other net taxes on production	-0.88%	0.29%	0.71%	0.09%	0.11%	-10.45%	-0.94%	-0.50%	-0.37%
Depreciations	14.51%	12.43%	16.17%	8.49%	9.72%	19.26%	12.16%	14.23%	13.76%
Profits	36.34%	13.81%	16.25%	25.39%	39.60%	65.78%	27.00%	26.01%	29.26%
Imports	21.69%	10.65%	13.13%	37.49%	30.19%	-29.96%	35.50%	37.06%	24.43%

FIGURE 7
Representation of the matrix of the total contribution of sectors to the formation of price indices

FIGURE 8
Distribution chart of the values of the matrix of the total contribution of sectors to the formation of price indices

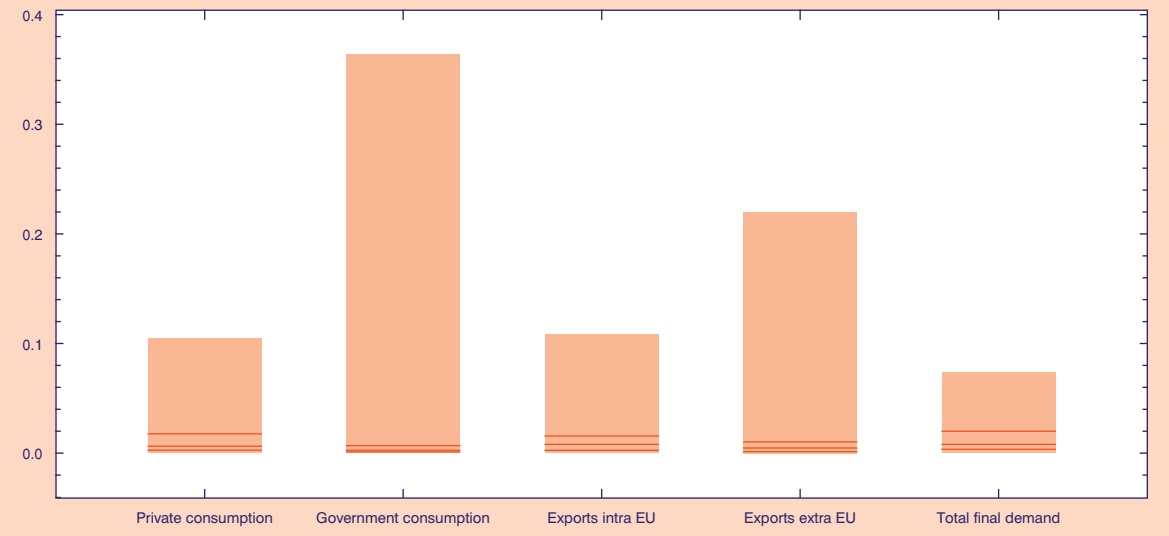
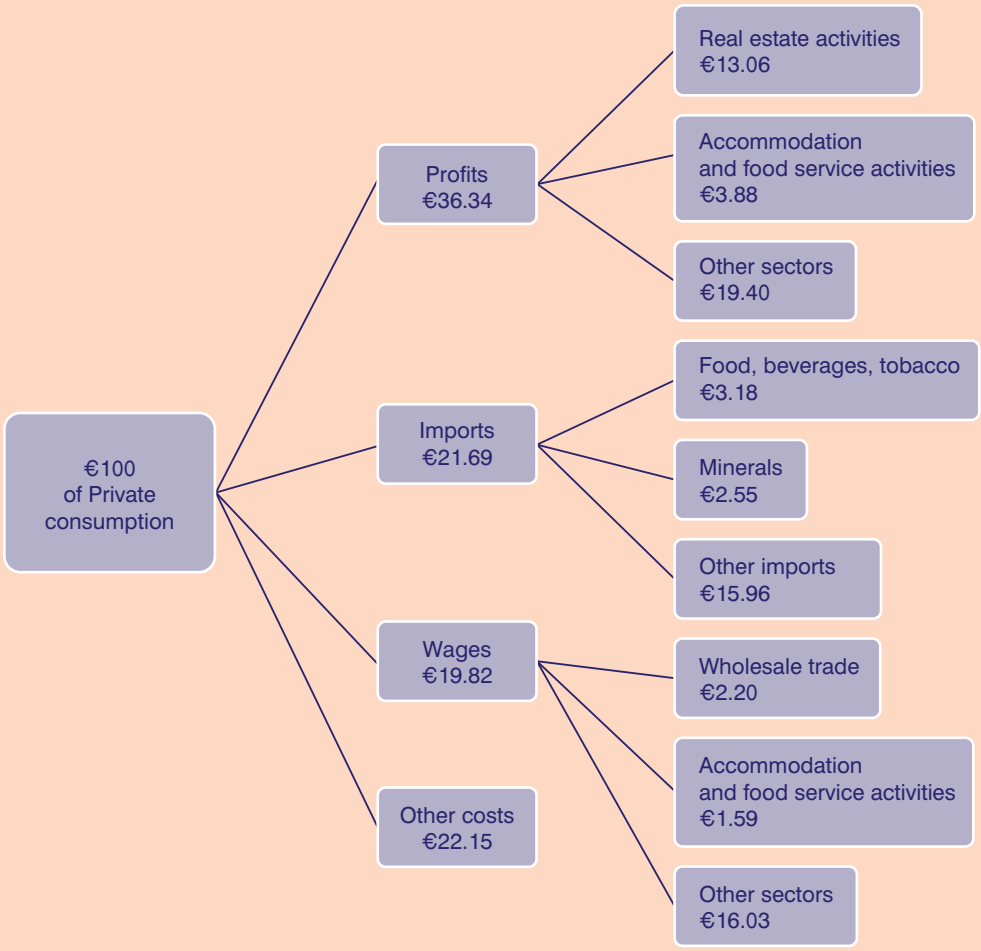


TABLE 3 Statistics of the matrix of the total contribution of sectors to the formation of price indices

	Max	75%	Median	25%	Min
Private consumption	0.104592	0.0176559	0.00629493	0.00265484	0.000316106
Government consumption	0.363622	0.00677396	0.00265284	0.00109537	1.2735×10^{-7}
Exports intra EU	0.107921	0.0156135	0.00798317	0.00258007	7.59369×10^{-10}
Exports extra EU	0.219928	0.0102403	0.00466614	0.00137293	7.31334×10^{-10}
Total final demand	0.0735378	0.0200374	0.00800609	0.00346547	0.000408383

FIGURE 9
Decomposition of Private consumption per primary input and sector of origin

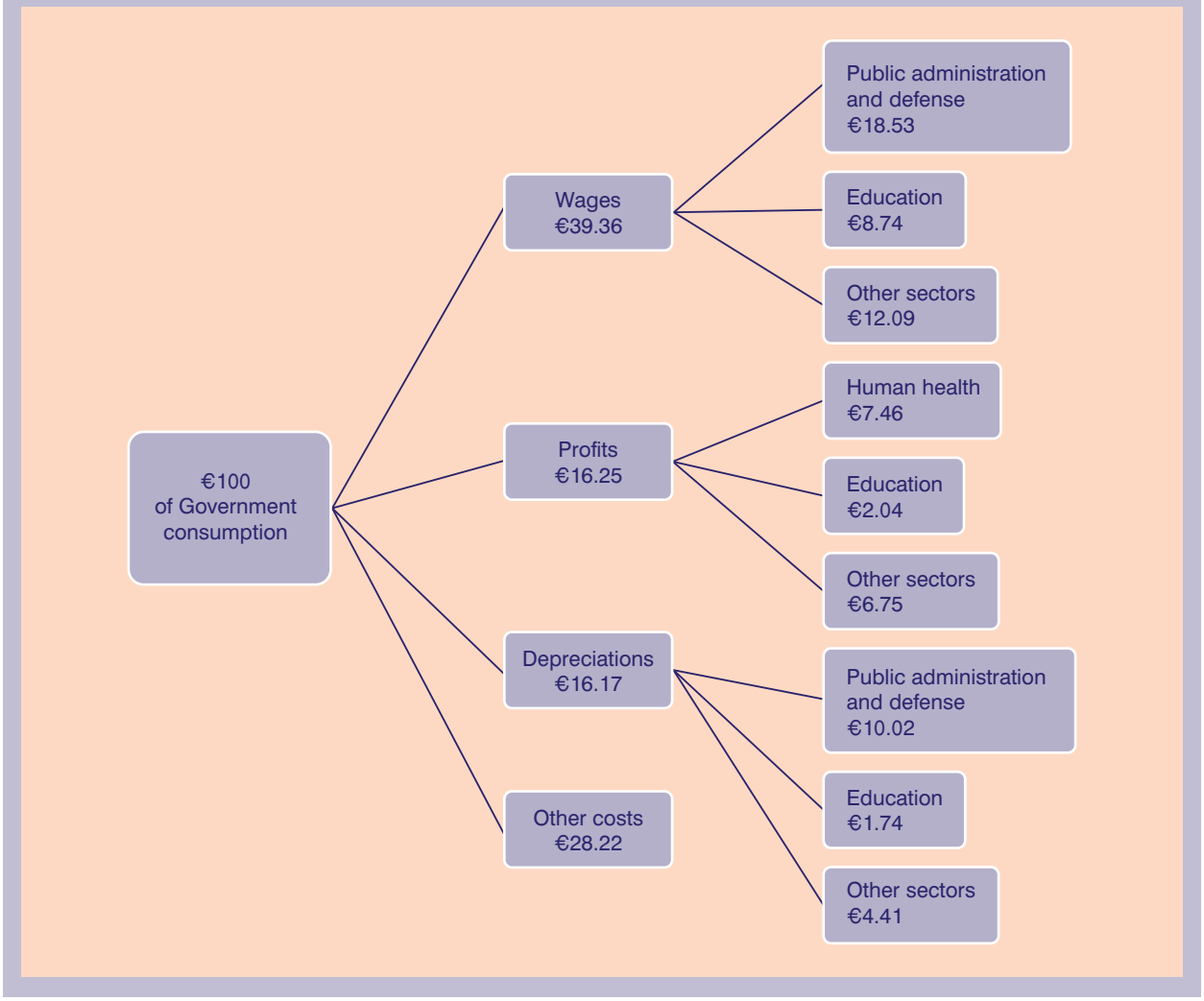


of private consumption, with 10.46% and 10.41%, respectively, while sector 32 has the highest contribution to the formation of the price index of exports intra EU (10.79%). Finally, sectors 55, 45 and 44 have the highest contribution to the formation of the price index of total final demand, with 7.35%, 6.48% and 6.45%, respectively. Furthermore, Figures 9-13 present the decomposition of each €100 of private consumption, government consumption, exports intra EU, exports extra EU, and total final demand per primary input and sector of origin.

From Figure 9 it is deduced that 13.06% of private consumption is formed by profits of the sector "Real estate activities", 3.18% is formed by imports of Food, beverages and tobacco, 2.20% is formed by wages of the sector "Wholesale trade", etc. Further analysis of the sectors of origin of the remaining primary inputs reveals that 7.07% of private consumption is formed by depreciations of the sector "Real estate activities". Thus, this sector forms over 20% of the price index of private consumption. Further analysis of the sectors of origin of the rest of the imports reveals that 14% of private consumption is formed by imports of industrial commodities, while the total imports of primary production and industry form about 18% of the price index.

From Figure 10 it is deduced that 18.53% of government consumption is formed by wages of the sector "Public administration and defence", 8.74% is formed by wages of the sector "Education", 7.46% is formed by profits of the sector "Human health activities", 10.02% is formed by depreciations of the sector "Public administration and defence", etc. Further analysis of the sectors of origin of the remaining primary inputs

FIGURE 10
Decomposition of Government consumption per primary input and sector of origin

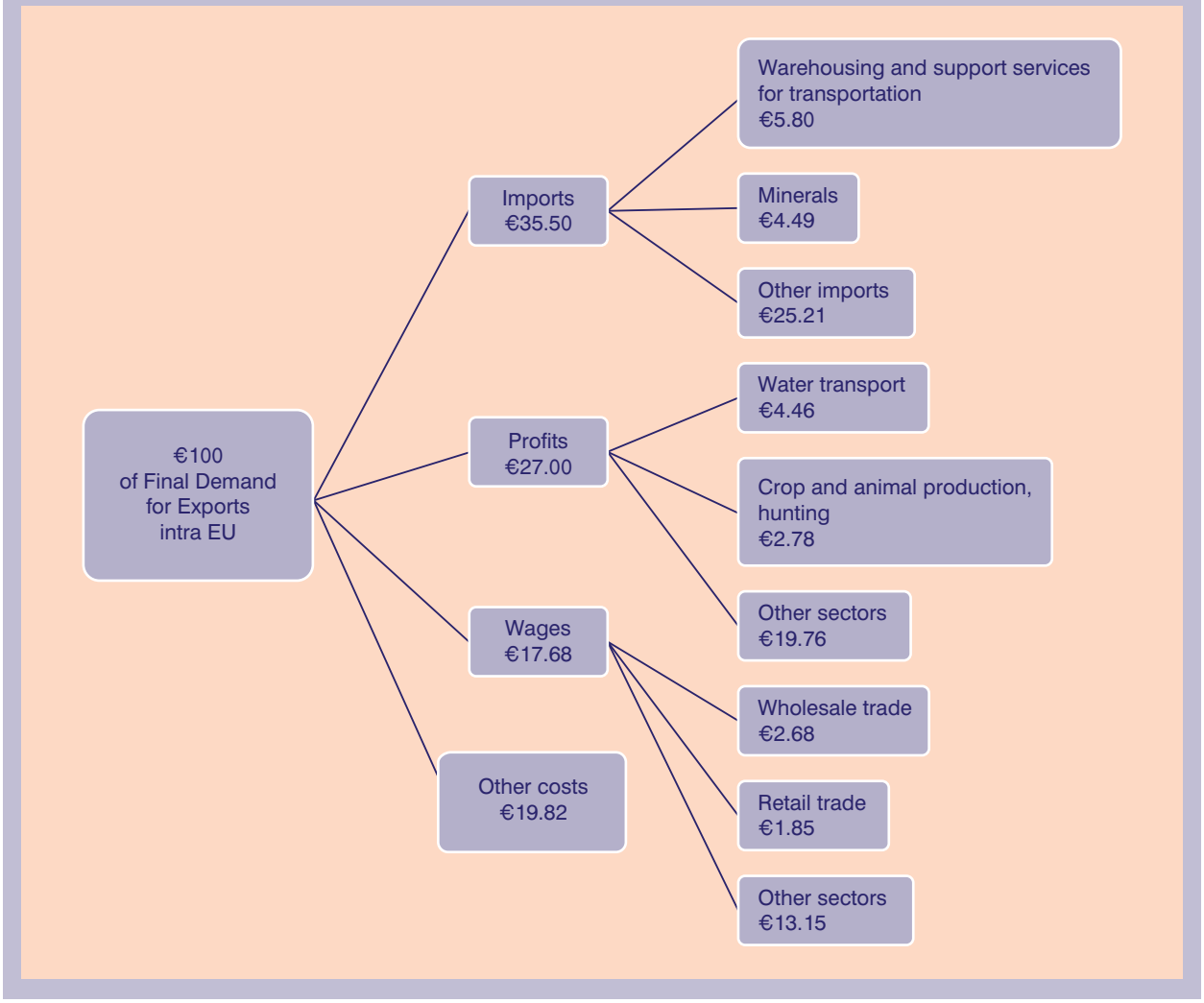


reveals that about 10% of government consumption is formed by employers' contributions of the sectors "Public administration and defence" and "Education", while 7.27% is formed by imports of "Basic pharmaceutical products and pharmaceutical preparations". Thus, the sectors "Public administration and defence" and "Education" form over 50% of the price index of government consumption.

From Figure 11 it is deduced that 5.80% of final demand for exports intra EU is formed by imports of "Warehousing and support services for transportation", 4.49% is formed by imports of minerals, 4.46% is formed by profits of the sector "Water transport", 2.78% is formed by profits of the sector "Crop and animal production, hunting", 2.68% is formed by wages of the sector "Wholesale trade", etc. Further analysis of the sectors of origin of the remaining primary inputs reveals that 6% of the price index of final demand for exports intra EU is formed by depreciations of the sectors "Water transport" and "Real estate activities". Further analysis of the sectors of origin of the rest of the imports reveals that about 21% of the price index is formed by imports of industrial commodities, while the total imports of primary production and industry form almost 27% of the index.

From Figure 12 it is deduced that 9.81% of final demand for exports extra EU is formed by imports of Minerals, 7.59% is formed by imports of "Warehousing and support services for transportation", 9.09% is formed by profits of the sector "Water transport", 1.83% is formed by profits of the sector "Crop and animal production, hunting", 2.69% is formed by wages

FIGURE 11
Decomposition of Exports intra EU per primary input and sector of origin

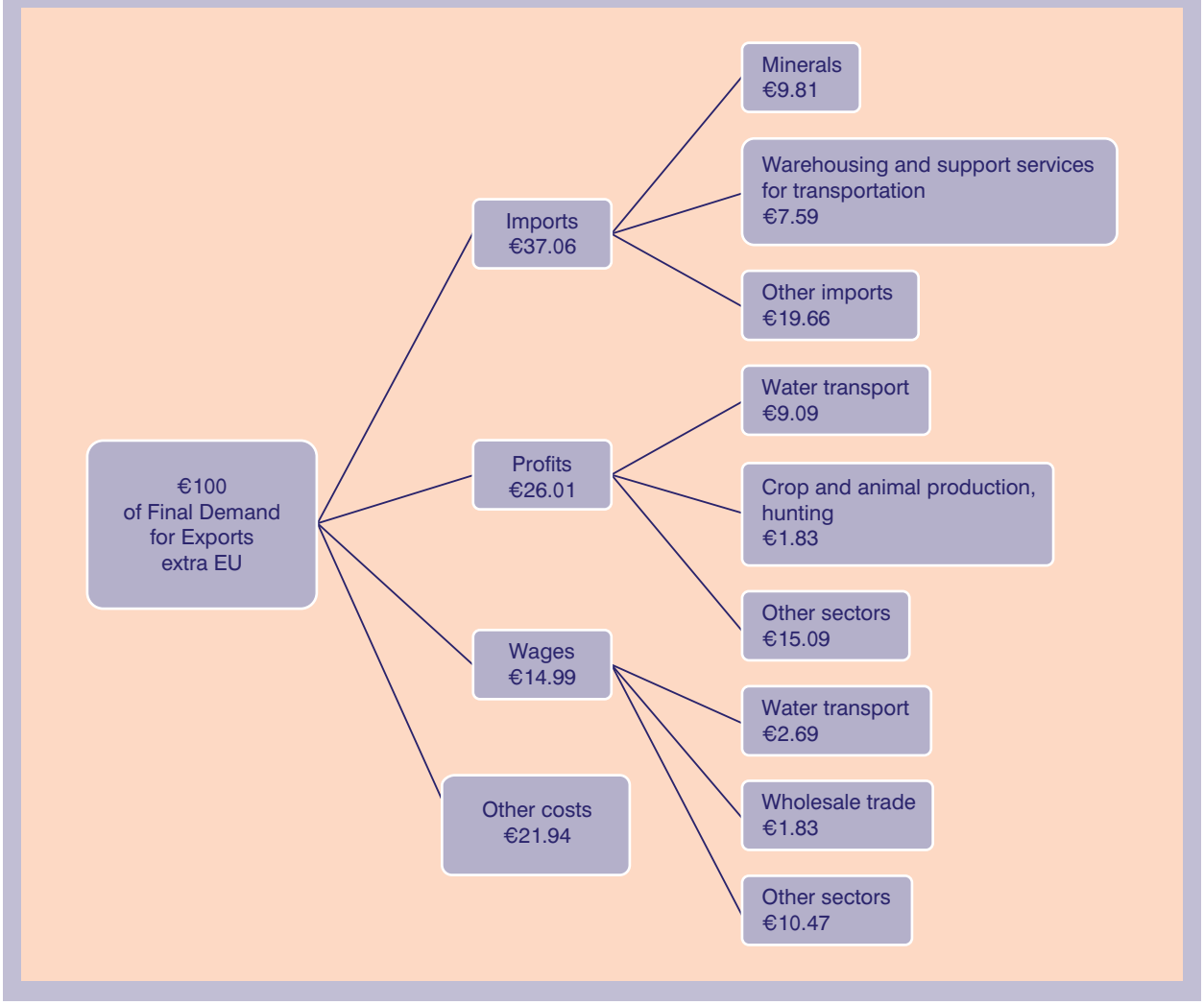


of the sector "Water transport", etc. Further analysis of the sectors of origin of the remaining primary inputs reveals that about 10% of the price index of final demand for exports extra EU is formed by depreciations and net taxes of the sector "Water transport". Thus, the sector "Water transport" forms over 20% of this price index.[12] Further analysis of the sectors of origin of the rest of the imports reveals that about 17% of the price index is formed by imports of industrial commodities, while the total imports of primary production and industry form over 27% of the index.

Finally, from Figure 13 it is deduced that 8.09% of total final demand is formed by profits of the sector "Real estate activities", 3.41% is formed by imports of Minerals, 3.75% is formed by wages of the sector "Public administration and defense", etc. Further analysis of the sectors of origin of the remaining primary inputs reveals that 4.38% of total final demand is formed by depreciations of the sector "Real estate activities", while about 3.50% of the price index is formed by depreciations and employers' contributions of the sector "Public administration and defense". Thus, these two sectors form about 20% of the price index of total final demand. Further analysis of the sectors of origin of the rest of the imports reveals that 14% of total final demand is formed by imports of industrial commodi-

12. Similar findings have been reported by Tsekeris and Skintzi (2017) who found that the exports of transport and warehousing services have the highest domestic value added for the Greek economy.

FIGURE 12
Decomposition of Exports extra EU per primary input and sector of origin

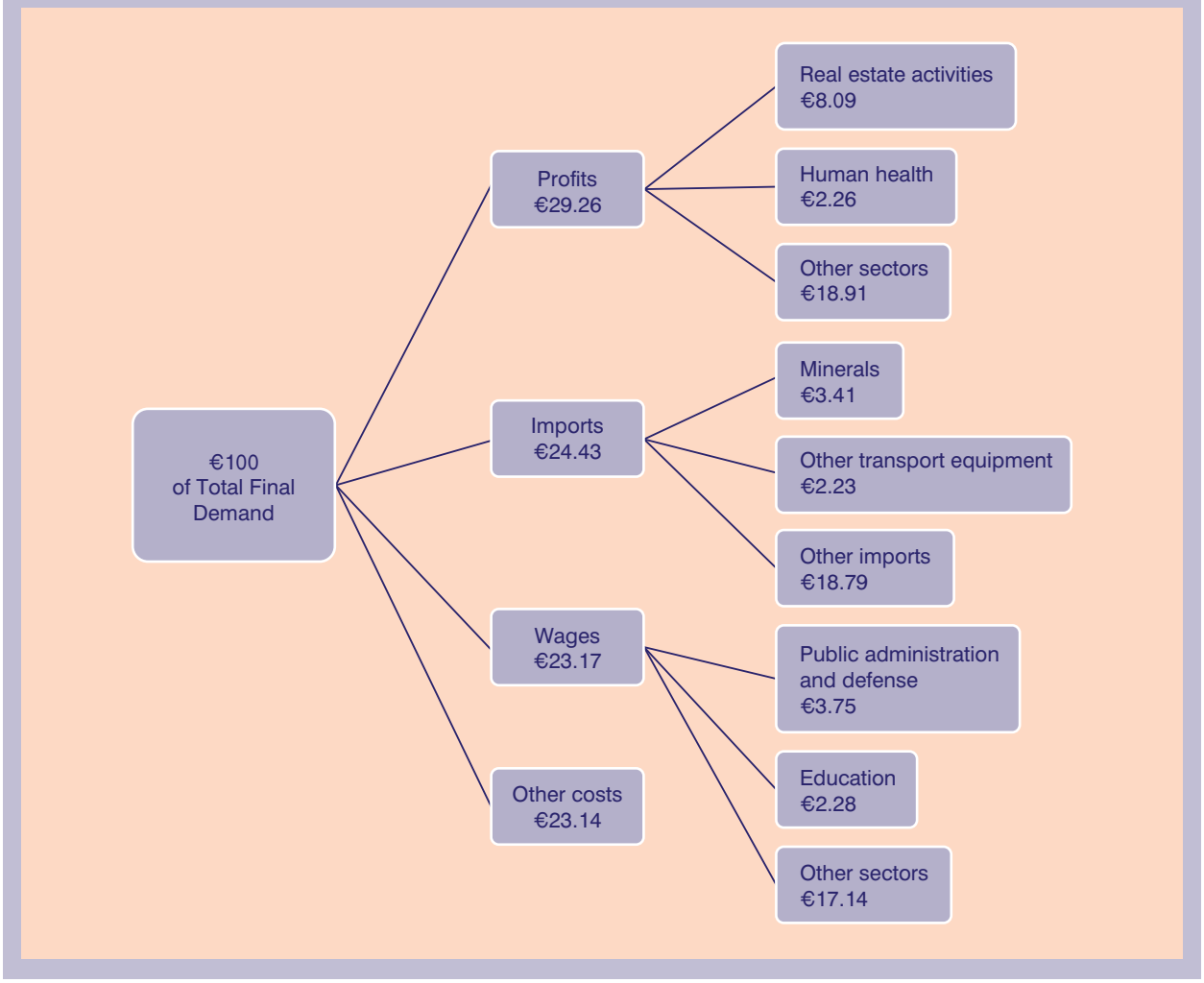


ties, while the total imports of primary production and industry form almost 20% of total final demand.

The previous findings offer a wide range of alternative economic policy choices. They seem to be in accordance with the results of the internal devaluation policy followed by the Greek governments in the previous years since, according to our findings, cuts in wages ("internal devaluation") tend to be more effective in the reduction of the price index of government consumption and less effective to the reduction of the price indices of private consumption and exports. That is because wages have a high contribution to the price formation of commodities that are related to government activities, while imports have a low contribution to the relative price index. On the other hand, wages have a relatively low contribution to the formation of the exports' price index, while imports have a high contribution to the relative price index. Similar findings are reported by Athanassiou and Tsouma (2013), who estimate the import content of consumption and exports in Greece and detect a high technological dependency of the country on imported industrial inputs.[13] Thus, the improvement of the performance of the external sector of the economy requires the application of im-

13. For further findings related to the dependency of the Greek economy on imported commodities, see, e.g., Ntemiroglou (2016), Leriou et al. (2016), Mariolis (2018), Mariolis and Soklis (2018), and Mariolis et al. (2019a), while for findings related to the international competitiveness of the Greek industrial sector, see, e.g., Konstantakopoulou (2015), and Konstantakopoulou and Skintzi (2015a, 2015b).

FIGURE 13
Decomposition of Total Final Demand per primary input and sector of origin



port substitution policies and, in particular, import substitution of industrial commodities.[14]

4. Concluding remarks

On the basis of the open input-output system of Leontief and data from the Symmetric Input-Output Table of the Greek economy for the year 2010, this article estimated the total (direct and indirect) contribution of primary inputs to price formation for the economy as a whole as well as per category of final demand. It has been found that:

(i) Imports, profits and wages have the largest contribution in price formation, while imports have a relatively larger contribution in the price formation of industrial commodities. More specifically, the average contribution of imports in the price formation of industrial commodities is about 50%.

(ii) The primary inputs with the highest contribution to the price indices per category of final demand are:

14. For the investigation of the relationships between the competitiveness of the external sector of the Greek economy and the internal and external deficits of the economy, see Aliber (2010; 2011), while for the effects of wage reduction to the effective demand of an economic system, see Bhaduri and Marglin (1990), and Stockhammer and Onaran (2012). For the multiplier effects of changes in effective demand to the output and the employment of the Greek economy, see Athanassiou et al. (2014); Mariolis and Soklis (2018); Ntemiroglou (2016); Tsekeris (2017), and Mariolis et al. (2018). Finally, for a comparative analysis between internal and external devaluation in the Greek economy, see Mariolis et al. (2019b).

(a) profits, which form about 36% of the price index of private consumption; (b) wages, which form about 39% of the price index of government consumption; and (c) imports, which form about 38% of the price index of gross fixed capital formation, 36% of the price index of exports intra EU and 37% of the price index of exports extra EU.

(iii) The price index of private consumption and, especially, the price indices of exports are mainly formed by the cost of imported industrial commodities, while the price index of government consumption is mainly formed by the wages of sectors related to government activities.

These findings seem to be in accordance with the results of the internal devaluation policy, which had a relatively higher impact on the improvement of the state budget deficit and a relatively lower impact on the improvement of the performance of the external sector and the decrease of the consumer price index. At the same time, these findings indicate the necessity for the implementation of well-targeted policies of import substitution of industrial products in order to enhance the international competitiveness of the economy.

Future research efforts should also take into account the corresponding findings from the analysis of the system of physical quantities of the Greek economy and extend the analysis to more recent input-output tables.

Appendix

TABLE A1 Sector classification of the Greek economy

No	Nomenclature
1	Crop and animal production, hunting and related service activities
2	Forestry and logging
3	Fishing and aquaculture
4	Mining and quarrying
5	Manufacture of food products, beverages and tobacco products
6	Manufacture of textiles, wearing apparel and leather products
7	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
8	Manufacture of paper and paper products
9	Printing and reproduction of recorded media
10	Manufacture of coke and refined petroleum products
11	Manufacture of chemicals and chemical products
12	Manufacture of basic pharmaceutical products and pharmaceuticals
13	Manufacture of rubber and plastic products
14	Manufacture of other non-metallic mineral products
15	Manufacture of basic metals
16	Manufacture of fabricated metal products, except machinery and equipment
17	Manufacture of computer, electronic and optical products
18	Manufacture of electrical equipment
19	Manufacture of machinery and equipment n.e.c.
20	Manufacture of motor vehicles, trailers and semi-trailers
21	Manufacture of other transport equipment
22	Manufacture of furniture; other manufacturing

TABLE A1 continued

No	Nomenclature
23	Repair and installation of machinery and equipment
24	Electricity, gas, steam and air conditioning supply
25	Water collection, treatment and supply
26	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
27	Construction
28	Wholesale and retail trade and repair of motor vehicles and motorcycles
29	Wholesale trade, except of motor vehicles and motorcycles
30	Retail trade, except of motor vehicles and motorcycles
31	Land transport and transport via pipelines
32	Water transport
33	Air transport
34	Warehousing and support activities for transportation
35	Postal and courier activities
36	Accommodation and food service activities
37	Publishing activities
38	Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities
39	Telecommunications
40	Computer programming, consultancy and related activities; information service activities
41	Financial service activities, except insurance and pension funding
42	Insurance, reinsurance and pension funding, except compulsory social security
43	Activities auxiliary to financial services and insurance activities
44	Real estate activities (excluding imputed rent)
45	Imputed rents of owner-occupied dwellings
46	Legal and accounting activities; activities of head offices; management consultancy activities
47	Architectural and engineering activities; technical testing and analysis
48	Scientific research and development
49	Advertising and market research
50	Other professional, scientific and technical activities; veterinary activities
51	Rental and leasing activities
52	Employment activities
53	Travel agency, tour operator reservation service and related activities
54	Security and investigation activities; services to buildings and landscape activities; office administrative, office support and other business support activities
55	Public administration and defence; compulsory social security
56	Education
57	Human health activities
58	Social work activities

TABLE A1 continued

No	Nomenclature
59	Creative arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities
60	Sports activities and amusement and recreation activities
61	Activities of membership organisations
62	Repair of computers and personal and household goods
63	Other personal service activities
64	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

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