# Sectoral interdependences and cost structure in the Belgian economy : an application for input-output tables

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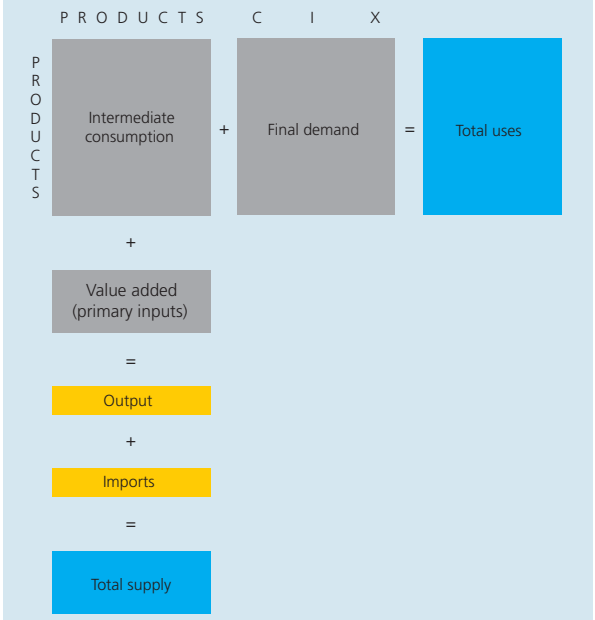
## Introduction (1)

The input-output tables (IOTs) published by the NAI give an integral view of all the flows of goods and services recorded by the Belgian economy over the course of a given year. They supply a detailed and coherent overview on the origin – import or domestic production – of products and their destination : consumption, investment or export. In particular, the IOTs offer an understanding of flows between different branches of activity in the economy, via their intermediate consumption. The IOTs are therefore extremely useful when undertaking a detailed analysis of an economy's structure.

Presented in schematic form, the IOTs comprise three "blocks" or matrices. The central section corresponds to intermediate consumption flows, that is, the use made of the intermediate inputs required for production in the different branches. Below this matrix can be found that of value added generated by the output of products – arranged in columns – according to its different components (wages, gross operating surplus, etc.). Considered in its entirety, each column provides a breakdown of the production process for the product given at the top of the column between intermediate and primary inputs. In much the same way, each line provides a breakdown, between intermediate and final uses, of all the uses of the product given at the top of a line. Final uses, broken down

**CHART 1** INPUT-OUTPUT TABLE
(Total flows, including intermediate and final imports)




(*) The authors wish to thank L. Aucremanne and L. Dresse for their valuable advice.
(1) For further methodological information, see NAI and FPB publications.

by category of expenditure, form the final demand matrix for each product.

In order to determine the interrelationships and changes in demand purely within the national production process, it is usual to limit the IOT analysis to the sub-table of domestic production. This sub-table, which has the same layout as the full table, is limited to internal flows: the two-way flows of intermediate consumption do not include imported products and, likewise, final expenditure is only considered insofar as it is satisfied by domestic production.

In general terms, the IOTs can provide an analysis of output, cost structure and productivity as well as an analysis of the different production inputs and interdependences between branches of activity (NAI, 2005). On the basis of the direct cross-relationships provided by the IOTs, it is possible to develop the so-called cumulative approach to interrelationships between branches of activity, which gives a comprehensive overview of the Belgian economy. This approach is used to illustrate, in turn, the nature of relationships between the different branches of activity, the special features related to the degree of openness and structure of production of the Belgian economy, and the process of price formation.

IOTs at current prices are published every five years by the FPB on behalf of the NAI. The most recent data, which are used in this article, relate to the year 2000. These are available with a detail of 60 branches, in other words the A60 base of the NACE-BEL nomenclature. The various calculations have been undertaken at this level of detail. In order to ensure clarity, however, the results will be presented according to a classification aggregated into six categories (cf. Annex 1).

## 1. Relationships between the branches of activity of the Belgian economy

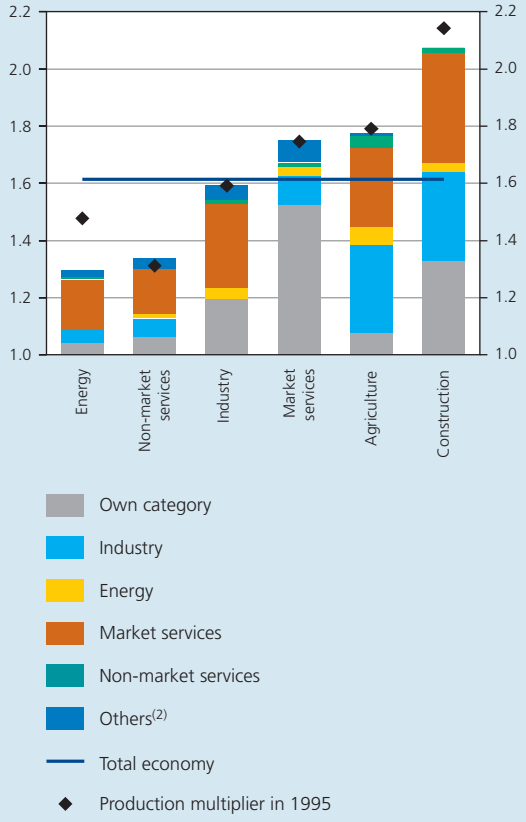
The cumulative approach consists of working back up the production chain of a branch in order to consider all the direct and indirect inputs necessary for the production of a given product. Thus one additional unit of final demand for a given product will give rise to the production of that unit, but also to an intermediate demand for other products required to produce that additional unit. The production of these other products will generate further intermediate demand, and so on. All in all, the production of one additional unit of the product in question requires a cumulative production of more than one unit throughout all the branches of the economy.

### 1.1 Production multipliers

The most direct way of characterising the extent and nature of interrelationships between branches of the Belgian economy is probably to use the production multiplier, which provides – for a given branch – the ratio between the cumulative production generated by this branch and its direct production. The higher this ratio, by definition equal to or more than 1, the more the production of the product in question leads to second-round effects in all branches of the economy, possibly including the branch of origin, via a feedback effect.

**CHART 2** MULTIPLIERS AND DISTRIBUTION OF THE SECOND-ROUND EFFECTS OF PRODUCTION (1)

(In relation to branch output on the horizontal axis; 2000 figures unless otherwise stated)




Sources: NAI, NBB calculations.

(1) The height of the column indicates the value of the multiplier, in other words, total output generated in the economy as a whole by one unit of final demand in the branch noted on the horizontal axis. In the chart, the second-round effects are also broken down according to the benefiting branches.

(2) Agriculture and/or construction, depending on the branch given on the horizontal axis.

For the economy as a whole, the multiplier is 1.61 : on average, to produce one euro, the Belgian economy must thus provide 61 cents of additional output to cover the intermediate consumption needs. The multiplier varies substantially, however, depending on the branch, according to the level of intermediate consumption of domestic products in the production process. The second-round effects of production, amounting to 34 cents per euro, are therefore relatively weak in non-market services, where the production process is based primarily on the use of the factors of production, capital and labour, rather than on the use of intermediate inputs. Similarly, they only amount to 30 cents per euro for energy and 59 cents for industry, branches in which intermediate consumption is significant but relies more heavily on imports.

In contrast, activity in market services, agriculture and especially construction entails above average second-round effects. For construction, the multiplier is 2.07, second-round effects of production being more important than direct production.

Between 1995 and 2000, the multipliers overall varied little, which might indicate a degree of stability in the production processes. In industry and market services in particular, there was no change at all. The most significant change related to the energy branch. The 18 cent fall in the multiplier for this branch is partly attributable to an increase in oil prices over the period in question. This price increase significantly raised the value of imported intermediate consumption for the refined petroleum products branch and, consequently, reduced the share of domestic intermediate consumption, including for example business activities and wholesale trade. This illustrates the limitations of an analysis over time of IOTs at current prices.

The cumulative intermediate consumption of a branch can be broken down according to its originating branches. First, it appears that relationships are significant within the actual branches themselves, even though the fairly aggregated nature of the categories of branches chosen backs up this result. Thus in the case of market services, 53 of the 75 cents per euro of cumulative intermediate consumption come from market services, for example, when a road transport company outsources its bookkeeping or when an insurance company calls upon the services of a cleaning company. Similarly, output from construction and industry includes a significant level of intermediate goods produced within their own branches.

In general terms, market services take up a significant position in the production process of all branches, ranging from 16 to 39 cents per euro of production. In particular, the effects on market services of activity in industry, agriculture and construction exceed 30 cents per euro. Other interrelationships are also worth noting, namely, the second-round effects on industry of agricultural production and construction output, which amount to 31 cents per euro. The agricultural production process includes products from the food industry, whilst construction uses glass and metal for example. As for dependence on energy, this is fairly comparable from one branch to another, around 3 to 4 cents of cumulative intermediate consumption per euro of production. This ranges from 1.8 cents for non-market services to 6.3 cents in agriculture.

## 1.2 Indirect employment

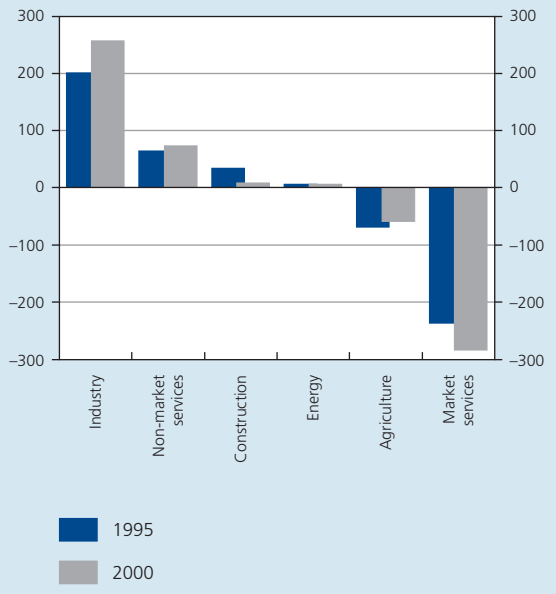
In addition to the effect on output, relations between branches can also be assessed in terms of indirect employment. The IOTs include, for reference, the number of jobs observed in each of the branches under consideration and thus enable, by using the average productivity of the different branches, a calculation to be made of the cumulative employment necessary for the output of a given branch.

Schematically, the calculations made in this context consist of distinguishing, within the employment observed in each branch of activity, the jobs directly allocated to production destined for final demand, on the one hand, and the jobs necessary for production destined for the intermediate consumption of the other branches, on the other. Thus in the same way as, when calculating the multipliers, the production of intermediate products is reclassified in the branch that initially gave rise to it in order to respond to the final demand addressed to it, employment corresponding to this intermediate production is reclassified in the branch that uses it. For each branch, cumulative employment, obtained via the sum of direct and indirect jobs created in other branches, represents all the labour used in the economy for production destined for the final demand of this branch.

At the level of the economy as a whole, cumulative employment and observed employment are equal, indirect employment being simply reallocated among the branches. At the level of individual branches, the cumulative employment of a branch is higher than observed employment if the number of jobs in other branches indirectly allocated to its production exceeds the number of its jobs deployed to satisfy the intermediate demand of the other branches. This is primarily the case for industry, where the cumulative employment required for production totals 903,000 persons although this branch actually employs only 646,000 workers. In other words, in employment terms, industry provides more labour to

**CHART 3** DIFFERENCE BETWEEN CUMULATIVE EMPLOYMENT AND OBSERVED EMPLOYMENT

(Thousands of salaried and self-employed workers)




Sources : NAI, NBB calculations.

other branches than other branches provide to industry, its activity being a net creator of jobs in other branches, amounting to 257,000 units. Market services are the main beneficiaries, with a net total of 215,000 jobs, followed by agriculture, with 53,000 jobs, due to the size of the food industry.

Overall, cumulative employment turns out to be higher than observed employment in industry and non-market services, and lower than observed employment in agriculture and market services. The two employment levels are more or less the same in construction and energy. These observations confirm the conclusions of Avonds and al. (2003), according to whom a difference between cumulative and observed employment is indicative of the nature of the product : generally close to final demand when the sign is positive, more often destined for intermediate consumption when it is negative.

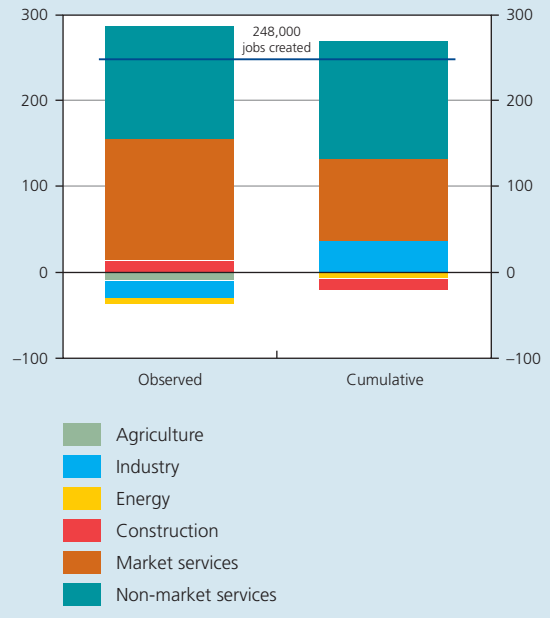
Closer to final demand than industry, non-market services thus create a net positive number of jobs in other branches, mainly in business activities but also in wholesale trade, hotels and restaurants and post and telecommunications services. Conversely, like market services, agriculture works largely for other branches, to the extent that nearly two-thirds of agricultural production is destined for the intermediate consumption of the food industry.

The key relationship, however, is that which links industry with market services. Of the 903,000 cumulative jobs necessary for industrial production, only 540,000 are actually located within industry, whilst 268,000 are found in the market service branches. From a supplier's point of view, this means nearly one-sixth of total employment in market services is thus allocated to producing services for industry. This demonstrates the preference on the part of industrial companies to focus on their core activity, whilst outsourcing secondary activities. This trend has increased over time [(1)], becoming even more marked between 1995 and 2000. In fact, 54,000 of the 143,000 jobs created in market services over this five-year period were due to the effects of industrial activity. Overall, industry is the only category of activity to have combined a decline in observed employment of 20,000 units over this period with the creation of indirect jobs in other branches, totalling 36,000 units, industrial activity thus contributing to an increase in net employment. By way of comparison, over the same period, 248,000 jobs were created in the Belgian economy, primarily in the service branches.

(1) See Avonds (2005).

**CHART 4** CHANGES IN EMPLOYMENT BETWEEN 1995 AND 2000

(Thousands of salaried and self-employed workers)




Sources : NAI, NBB calculations.

At a more detailed level, it appears that industry's use of market services is heavily concentrated in certain branches. For industry, the most important second-round effects in terms of labour are logically generated by the branches that are already the major sources of direct employment, that is, food, chemicals and motor vehicles. Apart from the effect of size, the first two do make relatively extensive use of market services. Of these, more than 40 p.c. of second-round effects in terms of employment created by industry relate to business activities, whilst wholesale trade and land transport also benefit from significant indirect effects. In all, these three branches account for more than three-quarters of the jobs created by industry in market services.

The predominance of these three service branches is easily explained by the segmentation of activity that characterises developed economies. Business activities cover tasks of a secondary nature, outsourced by industrial companies, whether they be legal advice, accounting, staff recruitment – including temporary staff –, cleaning, secretarial support and translation, to name but a few. For their part, wholesale trade and land transport branches serve as an intermediary in terms of getting industrial products to the market. This effect is partly magnified by the IOT methodology, since the trade and transport margins generated by industrial companies on their own sales or transport activities are included in the corresponding service branches.

Finally, it could be argued that, in some respects, the nature of the services involved in production enables a distinction to be made among the industrial branches themselves. In fact, it seems that the branches generally considered to be the most technological, found in the manufacture of electrical and electronic equipment, tend to make greater use of business and IT services but resort less to the more traditional services of wholesale trade and land transport.

## 2. Features of the Belgian economy

Using the cumulative approach, the IOTs also make it possible to reconsider certain essential features of the structure of production in the Belgian economy, for example, in relation to the size of multipliers and the actual share of value added or of imports in production. Compared to the measurements directly observed via the national accounts, this approach takes into account the composition of intermediate consumption.

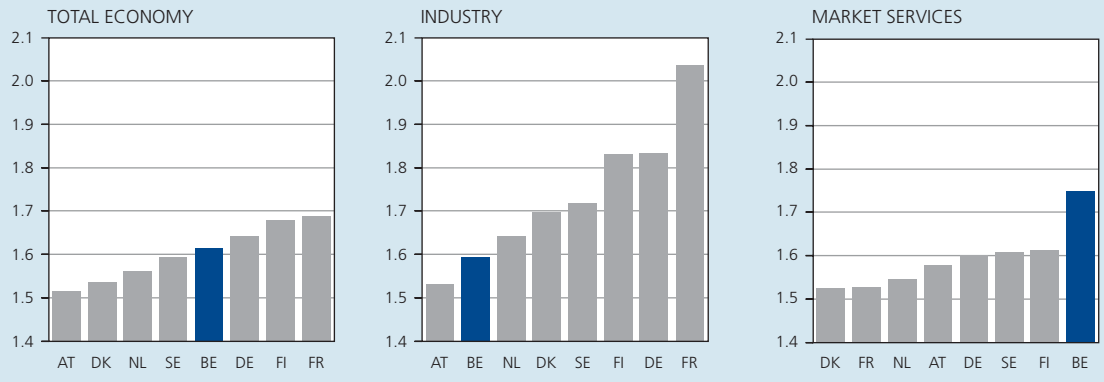
### 2.1 Size of the economy and leakages

An international comparison of production multipliers highlights some special features of the Belgian economy [1]. Although, for the economy as a whole, Belgium has a median multiplier, it has the highest figure for market services, and one of the lowest for industry. It is, moreover, the only country – along with Austria – where the production multiplier is higher for market services than for industry.

(1) Observations for European countries (Austria, Denmark, Finland, France, Germany, Netherlands, Sweden), made on the basis of figures for the year 2000 in order to use the most recent figures, are confirmed by data for 1995, available also for Spain and the United Kingdom.

**CHART 5** PRODUCTION MULTIPLIERS [1]

(In relation to the output of the economy or branch, 2000 figures)




Sources : EC, NAI, NBB calculations.

(1) Total output generated in the economy as a whole by one unit of final demand in the economy, industry or market services.

The weakness of the industrial production multiplier closely reflects leakages through imports, linked to the size and degree of openness of the economy. Indeed, the two large economies in the sample are also those that have the highest multiplier, this being moreover higher in France than in Germany, whilst small open economies, such as Belgium and the Netherlands, have a lower multiplier. In these economies more than elsewhere, it can in fact be argued that the satisfaction of one supplementary unit of final demand produced within the country is based on inputs produced abroad rather than locally. Put another way, even if it is produced in Belgium, additional final demand provides larger benefits for foreign economies.

The size or degree of openness of the economy is not, however, the only factor determining the size of the multiplier. This also depends on the share of value added in output. Thus, although less open than Belgium and the Netherlands, Austria presents a lower multiplier than these two countries for industry. Conversely, domestic second-round effects from industrial production are as high in Finland as in Germany. Apart from an outlying geographical location, which certainly explains a more marked inward-looking orientation, Finnish industry has a relatively asymmetric structure, based on two strong legs embedded in the national economy, each representing almost one quarter of industrial production : the technological branch of communications equipment, within which activity is organised in clusters, feeding interrelations between companies, and the wood/paper industry whose second-round effects on production benefit local forestry.

In terms of the importance of the market services multiplier in Belgium, this is borne out in numerous service branches, and cannot therefore be explained by a structural effect. More specifically, it seems that the market service branches in Belgium make relatively greater use of business activities than other economies. Outsourcing of secondary tasks has therefore clearly not been limited to industrial companies. Indeed, whether in terms of output or value added, the business activities branch is more important in Belgium than in other countries in the sample : it accounts for 9.5 p.c. of the economy's value added, a comparable share to that of France and Germany but greater than that of other countries by between 0.8 and 5.5 percentage points.

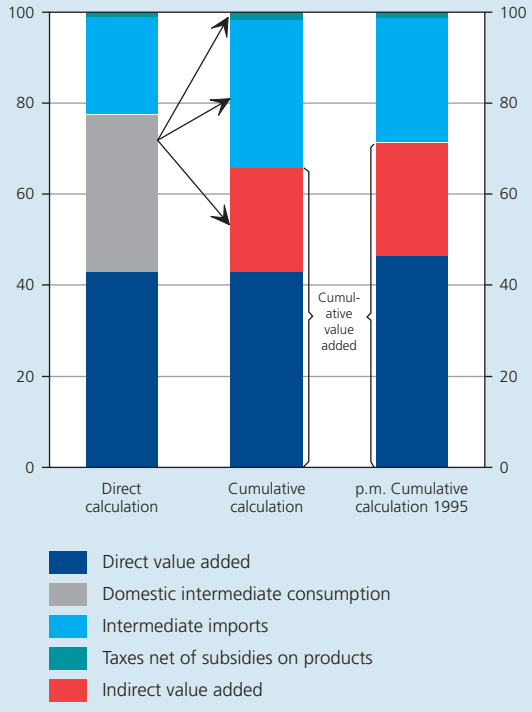
## 2.2 Structure of production : value added and imports

Initially, production is primarily divided into intermediate consumption – of domestic origin or imported – and value added, to which must be added the fairly low share of taxes net of subsidies on products. By going back up the chain of suppliers, the value added of each intermediate input produced in Belgium can be extracted, leaving only intermediate consumption, for which the value added can also be extracted, and so on. Overall, the output of a branch will essentially no longer comprise anything other than value added, generated directly by the branch or indirectly through domestic intermediate consumption in the economy as a whole, and intermediate imports.

In 2000, output consisted of 42.9 p.c. value added generated directly, 21.4 p.c. intermediate consumption directly imported, and 34.6 p.c. intermediate consumption produced within the national economy. The changeover to the cumulative approach demonstrates that intermediate consumption of domestic origin is itself made up of value added and intermediate imports. Overall, the Belgian

**CHART 6** BREAKDOWN OF THE ECONOMY'S OUTPUT BASED ON THE DIRECT AND CUMULATIVE APPROACHES

(Percentages of total, 2000 figures unless otherwise stated)



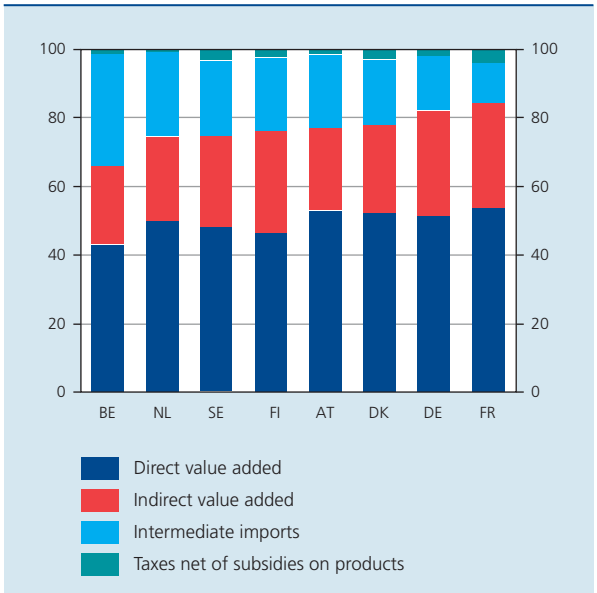

Sources : NAI, NBB calculations.

economy's output therefore includes a 65.8 p.c. value added content, of which a share of 22.9 p.c. comes indirectly from production destined for intermediate consumption, whilst the share of intermediate imports increases to 32.5 p.c. The balance, made up of taxes net of subsidies on products, also increases slightly, from 1.1 to 1.7 p.c.

Between 1995 and 2000, the relative importance of the two major components of production changed significantly, cumulative value added falling more than 5 percentage points to the benefit of intermediate imports. The fall in value added content occurred both at the direct and indirect levels. It thus applies both to activities whose output is primarily aimed at satisfying final demand and activities of intermediate production, which is confirmed by the branch results. This change is partly explained by a price effect, insofar as – over this period – import prices generally rose more rapidly than production prices, because they were affected by the price of oil. A volume effect also seems to have contributed to this, however. This could indicate an underlying trend in the Belgian economy towards an increasing use of imports in the production process.

**CHART 7** BREAKDOWN OF THE ECONOMY'S OUTPUT BASED ON THE CUMULATIVE APPROACH : INTERNATIONAL COMPARISON

(Percentages of total, countries classified by ascending share of cumulative value added in output, 2000 figures)



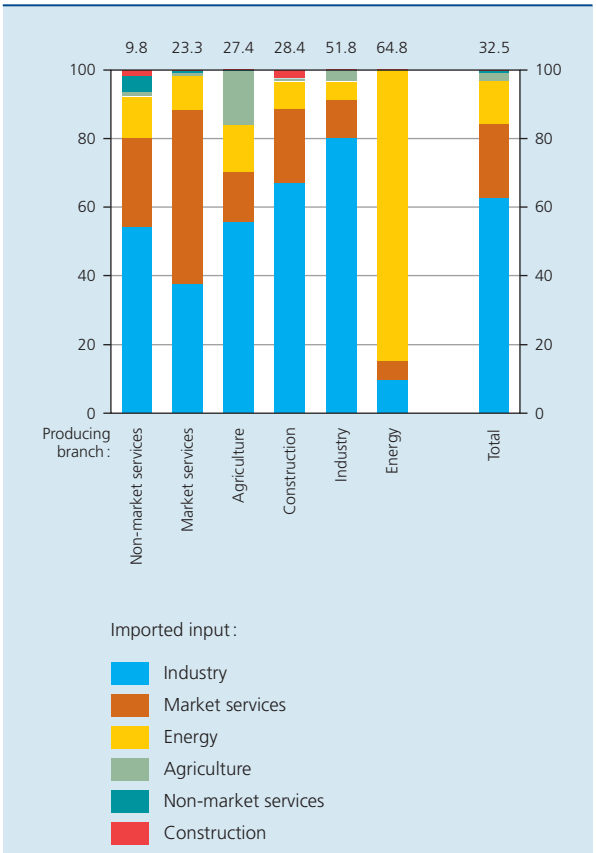

Sources : EC, NAI, NBB calculations.

Overall, compared with the other economies under review, the share of intermediate imports is greatest in Belgium. As a consequence, the value added content is lowest there. This difference emerges particularly with regard to direct value added, for which it ranges from 3.6 to 10.7 percentage points, depending on the country. It seems that this difference in terms of direct value added content is more significant in market services and construction than in industry. In the latter branch, it can be explained in particular by the higher proportion of semi-finished products.

A difference can also be seen in indirect value added, a consequence of the leakages already noted. This difference between Belgium and the other countries ranges from 1.2 to 7.7 percentage points. In this regard, it should be noted that the IOTs, drawn up along geographical lines, only provide an imperfect account of all the interactions that may result from the internationalisation and

**CHART 8** NATURE OF CUMULATIVE INTERMEDIATE IMPORTS (1)

(Percentages of total, 2000 figures)




Sources : NAI, NBB calculations.

(1) The branches are classified in ascending order, according to the share of all cumulative intermediate imports in output. This share is noted at the top of the chart's columns.

segmentation of production processes. For example, if an intermediate stage of production is undertaken abroad rather than within the domestic economy, it will break the supplier chain within the economy and thus reduce the importance of the second-round effects of value added, even if this stage undertaken abroad itself benefits from intermediate production carried out at home. This would tend to reduce the importance of production multipliers and indirect value added in small economies.

The cumulative approach of IOTs also enables an illustration to be made of the actual importance of imports in satisfying final demand. This manifests itself directly, if imports are used 'as is' for consumption, capital formation or exports. It also appears indirectly, insofar as imported intermediate inputs are used in domestic production aimed at final demand.

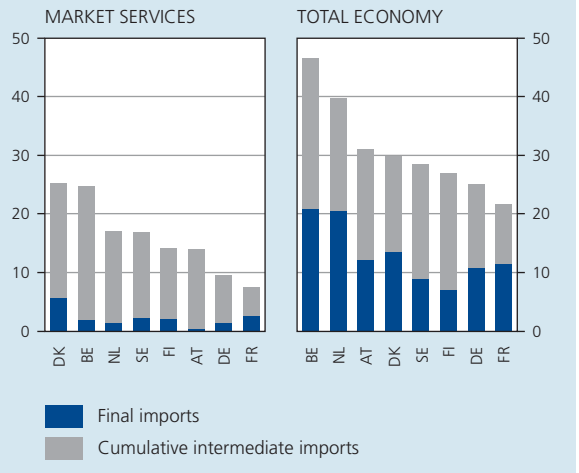
With regard to these intermediate imports, they are – in most branches – largely made up of industrial goods. For the economy as a whole, these represent 62.5 p.c. of cumulative intermediate imports. For energy and market services, however, cumulative intermediate imports primarily take the form of their own product, in the former case by virtue of the importation of crude oil for the purposes of refining.

The dependence of market services on intermediate imports is another special feature of the Belgian economy, in addition to the already noted importance of their domestic intermediate consumption in relation to the situation prevailing in other economies. It can thus be calculated that imports cover almost one quarter of the final demand for market services. Since, by nature, the latter are rarely the object of final imports – less than 3 p.c. in all the countries studied except Denmark –, their dependence on imports is above all determined by the inclusion of intermediate imports in the production process. From this point of view, the figures for Belgium are higher than in the other countries by between 3.2 and 17.9 percentage points. Not counting financial intermediation, which is dealt with in a specific way within the context of the national accounts and the IOTs[1], the output of the transport and IT branches appears more internationalised than in the other countries[2]. More specifically, a relatively high level of foreign services is included in the water transport and auxiliary transport service branches, due to the use of foreign auxiliary transport services; in air transport, which uses a great deal of foreign production in the form of refined petroleum products and transport equipment[3]; and in computer services, a branch that in turn purchases foreign IT and business services.

At the level of the economy as a whole, imports are involved in satisfying final demand to the extent of 46.5 p.c., 20.7 p.c. being accounted for by direct satisfaction and 25.8 p.c. by intermediate consumption. This is the highest ratio, followed by the Netherlands with 39.7 p.c.

**CHART 9** DEPENDENCE OF FINAL DEMAND ON IMPORTS

(Percentages of final demand, 2000 figures)




Sources: EC, NAI, NBB calculations.

## 3. Implications for the cost structure of the economy

The IOTs analysis framework can also be used to examine the cost structure of an economy and can, therefore, provide useful information for the study of price formation and inflation dynamics. Moreover, this type of analysis can also provide information on the relative importance of the different factors which can affect the economy's price competitiveness. In this section, the various stages leading from the production process to the different categories of final expenditures, in order to highlight the cost structure at each level, are examined. Private consumption is analysed in more detail since it corresponds, to a large extent, to the expenditure covered by the Harmonised Index of Consumer Prices (HICP), which is a key variable for the conduct of monetary policy within Monetary Union.

(1) In the IOTs, to enable cumulative calculations, Financial Intermediation Services Indirectly Measured (FISIM) are allocated to the intermediate consumption of their producing branch – financial intermediation – although they are not allocated to a particular branch in the national accounts. There is a resulting high but fictitious intermediate consumption on the part of the branch from itself, which inflates the indirect effects of its output in relation to a relatively weak production aimed at final demand. Due to the high value of the FISIM in relation to the output of the branch in Belgium, this methodological constraint has a marked effect on the production multiplier and on the imported share of intermediate consumption of this branch.

(2) Denmark's position is explained exclusively by the extent of imports of auxiliary transport services on the part of the water transport branch.

(3) The 2000 figures used include the activity of Sabena, since bankrupt.

To achieve this, the breakdown of the economy's total output, based on the direct and cumulative approaches already shown in Chart 6, is used. Here the breakdown is extended to include the different elements of value added, that is compensation of employees, gross operating surplus and gross mixed income [1] and taxes net of subsidies on production [2]. In addition, the breakdown of the cost structure is presented for the six main branches of activity.

## 3.1 Cost structure of the six main branches of activity

Whilst a direct approach provides an overview of the cost structure as observed at individual company level, the cumulative approach reflects the importance of each type of cost from the macroeconomic standpoint. At individual company level, the purchase of intermediate inputs is considered to be a cost external to the business in question. From the macroeconomic point of view, it is only partly an external cost for the economy as a whole, to the extent that the production process for intermediate inputs relies not only on imports but also on domestic inputs. This is why the cumulative approach of the cost structure is more relevant for macroeconomic analysis.

Logically, moving from a direct approach to a cumulative approach not only increases the share of intermediate imports and that of domestic value added, as shown in Chart 6, but also the importance of each component of this value added. Therefore, for the economy as a whole, the share of compensation of employees rises from 25 p.c. with the direct approach to 38 p.c. with the cumulative approach, whilst the share of gross operating surplus and gross mixed income increases from 17 p.c. to 27 p.c. The amount of taxes net of subsidies on production and products also increases in the cumulative approach but remains very small all the same.

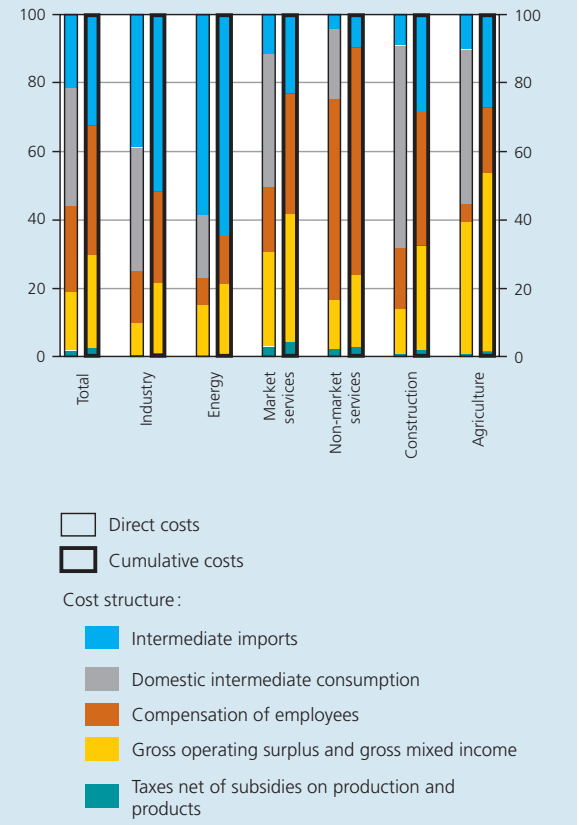
Overall, based on the cumulative approach, for the economy as a whole, the costs linked to intermediate imports represent approximately one third of all costs, wages a little more than one third, whilst the balance reflects mainly the importance of the gross operating surplus and gross mixed income as well as the small share of taxes net of subsidies on production and products.

(1) In the case of self-employed workers, it is not always possible to distinguish between the "profit" made as an entrepreneur and the compensation for the work carried out by the owner or members of his family; this is why the term mixed income is used.

(2) For the purposes of simplicity and clarity, taxes net of subsidies on production – which account for one element of value added – were classified with taxes net of subsidies on products.

**CHART 10** COST STRUCTURE OF THE ECONOMY [1]

(Percentages)




Sources : NAI, NBB calculations.
(1) At basic prices, excluding final imports.

Large disparities can be observed from one branch to another, in terms of the extent of the changes to which a move from a direct approach to an indirect approach gives rise as well as in terms of the cost structure based on the latter approach.

The increase in the importance of wages and gross operating surplus and gross mixed income between the two approaches is most pronounced in the branches where the production multiplier is high, particularly in construction and agriculture. In these two sectors, moreover, the gross operating surplus and gross mixed income are more significant than in the economy as a whole. This share comes to 52 p.c. in agriculture and 28 p.c. in construction, which primarily reflects the relative importance of self-employed workers in these sectors. As for wages, their share is highest (66 p.c.) in non-market services. In market services and construction, wages account for 35 p.c. and 39 p.c. respectively of overall production costs.

In industry, which is undoubtedly the branch most exposed to international competition[1], the share of wages is relatively small with a direct approach (15 p.c.). On the basis of this assessment, wage moderation as a factor capable of safeguarding competitiveness is sometimes regarded as unimportant at individual company level. However, in addition to the wages paid by the company itself, the selling price of the industrial production is affected by Belgian wages paid during the production phase of intermediate domestic inputs. According to the cumulative approach, which also takes account of this externality, the share of wages almost doubles to 27 p.c. The reason for this is not only the inclusion of wages paid for the production of the intermediate inputs of the industry itself but also the wages paid in other branches, particularly market services. The fact that, overall, the share of wages in industry remains lower than that observed in most other branches is explained by industry's heavy reliance on intermediate imports (see also Chart 8)[2].

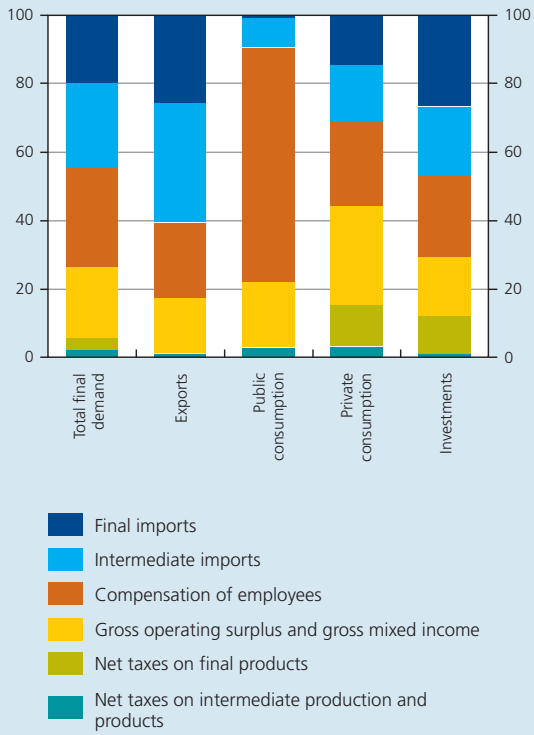
A simplistic view of the facts, which does not take account of the interactions between companies and sectors, not only underestimates the importance of wages but may also imply a risk that certain decentralised decisions – for example those resulting from wage negotiations confined to individual company level or sector level – fall short of what is required from the macroeconomic point of view. This would particularly be the case if the decentralised decisions were taken within an environment marked by a lack of competitiveness. According to a number of studies[3], this type of argument justifies a centralised approach to wage negotiations under certain circumstances, precisely because at this level some externalities, as described above, can be internalised. However, this argument does not obviate the need for a degree of flexibility, which allows the development of wages to be adapted to the specific conditions of certain companies or sectors.

## 3.2 Cost structure of the different categories of final expenditure

The cumulative cost structure can also be analysed on the basis of the different components of final demand. At the most detailed level, there is no difference in cumulative cost structure according to type of final demand, that is, according to the use made of a product at the final stage. In fact, for a particular product, the share of intermediate imports and components of value added required for the production process is identical, whether the product is consumed by a household or exported, for example. However, the relative share of the different products may vary considerably according to categories of expenditure.

**CHART 11** CUMULATIVE COST STRUCTURE OF FINAL DEMAND AND ITS COMPONENTS[1]

(Percentages)




Sources : NAI, NBB calculations.
(1) At purchasers' prices, including final imports.

Consequently, when the cost structures at product level are aggregated, differences do appear. This is the case, for example, if a product requiring many intermediate imports is exported more than it is consumed : all things being equal, however, the share of intermediate imports in exports will be higher than that observed for private consumption.

In order to obtain a complete overview of the cost structure of final demand, final imports must also be taken into account, that is imports which are not used in the production process but which satisfy final demand directly, by being directly consumed, invested or exported[4].

Moreover, the taxes on final products – net of subsidies –, should be included, whilst only taxes on intermediate production and products have been taken into account at this stage. These taxes, which correspond essentially to VAT and

(1) Cf. Aucremanne and Druant (2004).
(2) For the same reason, the share of wages only comes to 14 p.c. in the overall production costs of the energy branch.
(3) For example Calmfors and Driffill (1988) and Calmfors (1993).
(4) These final imports are not taken into account in Chart 10, insofar as it relates primarily to the domestic production process. However, in Chart 9, final imports and intermediate imports are added together to measure the (total) dependence of final demand with regard to imports.

excise duties, are substantial, above all, for household consumption and investments, where they amount to 12 p.c. and 11 p.c. of costs, respectively. Exports, on the other hand, are exempt from VAT in the exporting country, given that they are taxed in the importing country. Once these taxes have been taken into account, the cost structure of final demand, evaluated at purchasers' prices, is obtained.

Final imports represent 20 p.c. of total final demand, which is added to the 25 p.c. of intermediate imports. Final imports are primarily important for investments (27 p.c.) and exports (26 p.c.) and, to a lesser extent, household consumption (15 p.c.). In the case of exports, which is the component of final demand which relies most on imports, with 61 p.c. of costs, these final imports correspond to re-exports, that is, final products imported by residents for direct export without processing [1]. Public consumption, for its part, hardly ever relies on final imports and contains only a small proportion of intermediate imports.

The share of compensation of employees, ranging from 22 p.c. to 25 p.c. for exports, household consumption and investments is lower than the average for the whole of final demand which, at 29 p.c., is influenced to a very large extent by public consumption, where wages represent 68 p.c. of costs. Furthermore, it can be seen that the structure of public consumption is logically very similar to that of non-market services described above. For its part, the structure of exports is fairly close to the structure of the industry branch, at least if final imports are disregarded.

The gross operating surplus and gross mixed income are highest in household consumption where they account for 29 p.c. of the total, partly owing to the presence of imputed rent in this cost category (cf. below) and partly because a fair number of goods and services consumed by households are supplied by self-employed workers, whose income is included in the gross mixed income. For the other three categories of final expenditure, the share of the gross operating surplus and gross mixed income ranges from 16 p.c. (exports) to 19 p.c. (public consumption).

(1) Therefore, it does not relate to goods in pure "transit" which are excluded from the national accounts and IOTs. Goods are considered to be in transit when they are imported by non-residents and re-exported without the intervention of a resident.

(2) The cost structure of the margins is as follows: 38 p.c. wages, 26 p.c. imports and 35 p.c. other costs.

## 3.3 Cost structure of the different categories of final household consumption

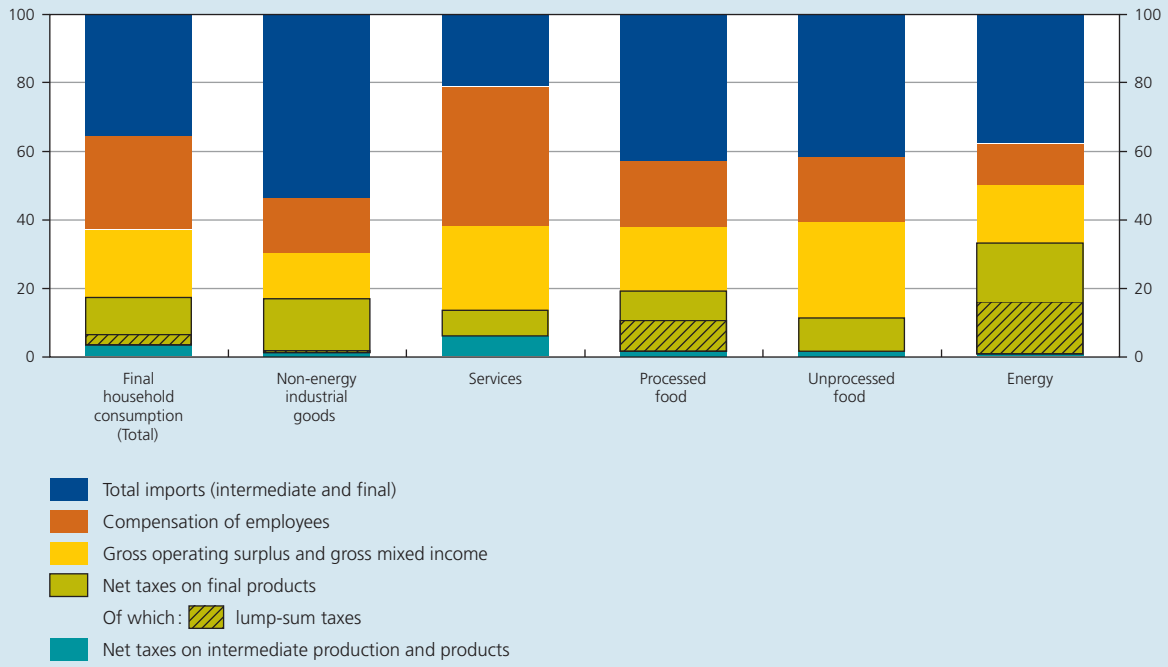
The cost structure of final household consumption is particularly interesting in the context of inflation analysis, which is traditionally centred on the HICP. The link between the cost structure of household consumption in accordance with the national accounts and the HICP is not immediate, however, insofar as the expenditure coverage is not entirely identical. The main difference is that the imputed rent expenditure is included in the IOTs – as in the national accounts – whilst it is excluded from the HICP. In order to ensure a better correspondence with the HICP below, imputed rents have been excluded from the analysis at this stage. The consequence of this adjustment is an increase in the share of imports in household consumption since the exclusion of imputed rents, which do not involve imports, has the effect of increasing the relative importance of the other products in consumption, whose import content is higher.

Moreover, final household consumption was divided in accordance with the five main components on the basis of which inflation is often analysed, that is : non-energy industrial goods, services, processed food, unprocessed food and energy. Given the classification differences and degree of detail available, different assumptions were necessary to obtain this breakdown. It is therefore not perfect, particularly with regard to the categories of processed and unprocessed food. Other assumptions were also required in order to obtain an evaluation of the cost structure at purchasers' prices for each component. In fact, within the framework of the IOTs, the trade and transport margins for all the products are allocated to the corresponding service branches. The cost structure of the other products is evaluated excluding margins. However, in the HICP, the margins are included implicitly in the prices of the different products. Consequently, in order to ensure a comparison, it is necessary to reallocate the margins to the different products. This has no effect at the level of overall household consumption since only the breakdown of the five major categories is concerned. In practice, this means that part of the output of services – which corresponds to the margins – is reallocated to the other categories.

The presence of margins as part of the costs for industrial goods consumed by households alters the initial cumulative cost structure of these goods (ex factory) ; the shares of wages and gross operating surplus are increased since they represent a larger share of the costs in the margins [2] than in the industrial goods excluding margins. Therefore, the apparent or "direct" cost structure is modified first by the production process itself, via cumulative costs,

**CHART 12** CUMULATIVE COST STRUCTURE OF FINAL HOUSEHOLD CONSUMPTION (1)

(Percentages)




Sources : NAI, NBB calculations.

(1) At purchasers' prices, including final imports. Data excluding imputed rents.

then by the distribution process where the cumulative costs of commercial and transport services also arise.

What emerges is that imports represent nearly 36 p.c. of the costs of total final household consumption. Compensation of employees represents 27 p.c., the gross surplus 20 p.c. and net taxes 17 p.c. With regard to the major components, non-energy industrial goods and energy remain the two categories for which the share of wages in the costs – 16 p.c. and 12 p.c. respectively – is the lowest. Non-energy industrial goods are also the most dependent category with regard to imports, which represent 54 p.c. of total costs, whilst for energy, imports represent only 38 p.c., that is less than for processed and unprocessed food for which the share of imports is 43 p.c. and 42 p.c. respectively. It should be remembered that energy mainly comprises the electricity sector which relies particularly on primary domestic inputs such as labour and capital. The weighting of electricity in household consumption – which is greater than for total final demand – also plays a part. Moreover, taxes on energy are particularly high. These amount to 33 p.c. of the costs, a little less than half of which is accounted for by lump-sum taxes such as excise duties or the energy contribution.

Unlike energy, it is in service costs that the share of taxes is lowest, at 13 p.c. of the total. This is mainly due to the fact that certain services are taxed very little or not at all and some are even subsidised, as is the case of rail transport, for example. This is also the sector which relies least on imports, with 21 p.c., and where the share of wages is highest, i.e. 41 p.c. Finally, the proportion of taxes is higher than the average for processed food mainly due to the inclusion in this category of tobacco and alcoholic beverages, which are more heavily taxed, above all in the form of lump-sum taxes.

## Conclusion

This article has analysed the IOTs for the year 2000 which have recently been published by the NAI and, more particularly, examined what they reveal in terms of sectoral interdependences, on the one hand, and cost structure of the Belgian economy on the other. Owing to their level of detail, the IOTs are published every five years with a considerable time-lag in relation to the annual national accounts. This means that the observations made in this article could already be outdated to a certain extent.

Therefore, it is appropriate to be cautious in the interpretation of the results.

Moreover, the IOTs are drawn up at current prices, so that they can be influenced by certain significant price developments. Besides, these tables are entirely static in nature. They only reflect the economic situation at a given moment, in this case the year 2000, and as such do not provide information on the dynamic of the different interactions at work in the economy. With regard to the calculation of the cumulative effects, for example, the implicit assumption is that they are obtained immediately whereas, in fact, there may be a considerable time-lag before all the second-round effects arising from a shock are felt.

Moreover, to calculate these cumulative effects it is assumed that the structure of the economy remains unchanged. Thus, a mechanical exercise based on the IOTs and which attempts to study the incidence of an increase in wages, for example, will inevitably conclude that the level of prices undergoes a corresponding rise pro rata to the cumulative share of wages in the cost structure. Irrespective of the fact that such an effect can only be achieved in the long term, such an exercise disregards the fact that, owing to the rise in the cost of domestic production, reliance on imports will be greater and there will be a partial substitution of capital for labour. The greater the possibilities of substitution, the further removed the cumulative effects calculated on the basis of the IOTs will be from the actual incidence of a shock.

Nevertheless, the IOTs provide unique and interesting information for those wishing to highlight specific structural characteristics of the economy or analyse the cost structure.

A calculation of the cumulative effects of intermediate consumption of the branches of activity takes account of all the interdependences existing between them and offers a comprehensive overview of the actual importance of each one in the economy. Thus, it appears that, on average for the different branches of activity, one euro of production intended to satisfy final demand gives rise to 61 additional cents of intermediate production in the economy. These multiplier effects are greatest in construction. All branches rely to a large extent on the provision of market services, mainly in the form of secondary administrative or support tasks, commercial or transport activities. This is particularly true for industry, the output of which involved the indirect employment of some 268,000 workers in market services in 2000, which is nearly one sixth of total employment in this branch. Between 1995 and 2000, the employment observed in the industrial sectors decreased by 20,000 units, yet at the same time industrial activity generated 54,000 jobs in the market services sector. The intensification of the interrelations between these two branches over time also makes it possible to put into perspective and qualify the deindustrialisation of the economy.

The outsourcing of secondary activities to support services is not unique to industry. It seems to be particularly well developed in Belgium, including in market services themselves. The companies operating in this sector rely on other companies for the provision of specialist services more so than in the other European countries ; they also make extensive use of foreign service providers. In general, the significant dependence of the national production process on intermediate imports – a feature of small open economies – contributes to reducing the second-round effects arising from the activity in the creation of value added. Aside from this lower indirect effect, the output of the Belgian economy includes a relatively small direct content in value added compared with other European countries.

With regard to the cost structure of the economy, mention has first been made of its high dependence on imported goods and services. A share of around 45 p.c. of total final expenditure consists of imports. Imports figure particularly prominently in the structure of exports, but more than one third of household consumption considered in the HICP is also made up of imports. In the past, it was precisely this heavy dependence on products from abroad which determined the conduct of a monetary policy centred on the stability of the exchange rate against the German mark. The launch of Monetary Union extended and spread this irrevocably to the other Member States, by eliminating exchange rate fluctuations between them.

Owing to this heavy dependence on products from abroad, the components of domestic value added, i.e. the compensation of employees, gross operating surplus and gross mixed income, are fairly modest in scale. This is particularly true if, taking a partial view, the purchase of all the intermediate inputs is considered to be a specific cost. Nevertheless, if allowance is made of the fact that these intermediate inputs involve some degree of domestic value added, the cumulative shares of employees' compensation and other components of value added increase significantly. Therefore, wages represent a little over one third of the total production cost for the economy as a whole. This share is largest in non-market services and smallest in energy production. In industry, the cumulative cost of labour accounts for 27 p.c. of the total cost of production. From the perspective of the different components of final expenditure, inclusion of final imports,

on the one hand, and VAT and lump-sum taxes, on the other, further reduces the share of wages. This represents approximately one quarter of the total costs relating to household consumption included in the HICP. This share is highest for services included in the HICP and lowest for non-energy industrial goods and energy. Moreover, indirect taxes constitute, on average, around 17 p.c. of the consumer price.

# Bibliography

Aucremanne L. and M. Druant (2004), "Price-setting behaviour in Belgium : what can be learned from an ad hoc survey ?", *Economic Review of the National Bank of Belgium*, 4th quarter of 2004.

Avonds L., V. Deguel and A. Gilot (2003), *Quelques applications à l'aide du tableau entrées-sorties 1995*, Bureau fédéral du Plan, Working paper 18-03.

Avonds L. (2003), *Een poging tot vergelijking van de Input-Output tabellen van 1990 en 1995*, Federaal Planbureau, Working paper 19-03.

Avonds L. (2005), *Een vergelijkende analyse van de Input-Outputtabellen van 1995 en 2000*, Federaal Planbureau, Working paper 4-05.

Calmfors L. and J. Driffill (1988), "Bargaining structure, corporatism and macroeconomic performance", *Economic Policy*, no.6, April 1988.

Calmfors L. (1993), "Centralisation of wage bargaining and macroeconomic performance – A survey", *OECD Economic Studies*, no.21, Winter 1993.

NAI – Institut des comptes nationaux (2003), *Tableaux entrées-sorties de la Belgique pour 1995*.

NAI – Institut des comptes nationaux (2004), *Tableaux entrées-sorties de la Belgique pour 2000*.

NAI – Institut des comptes nationaux (2005), *Comptes nationaux, Partie 3 Tableaux des ressources et des emplois 2000 et 2001*.

# Annex 1

CATEGORIES OF BRANCHES OF ACTIVITY BASED ON THE NACE-BEL A60 NOMENCLATURE

| Category | NACE Codes | Branches of activity |
|---|---|---|
| Agriculture | 01-05 | Agriculture, forestry and fishing |
| Energy | 10-12 | Mining and quarrying of energy producing materials |
| | 23 | Coke, refined petroleum products and nuclear fuel |
| | 40-41 | Electricity, gas and water supply |
| Industry | 13-14 | Mining and quarrying, except of energy producing materials |
| | 15-37 (except 23) | Total manufacturing (excluding refined petroleum products) |
| Construction | 45 | Construction |
| Market services | 50-74 | Wholesale and retail trade, hotels and restaurants |
| | | Transport and communication |
| | | Financial intermediation |
| | | Real estate, renting and business activities |
| Non-market services | 75-99 | Public administration |
| | | Education |
| | | Health and social work |
| | | Other community, social, personal and domestic services |