

The Effects of Export on the Czech Economy: Input-output Approach

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Introduction

The development of economic performance measured by gross domestic product is on the demand-side influenced by different dynamics of the individual components. A relatively high proportion of government final consumption expenditure, foreign trade and the fixed capital formation characterize the structure of demand in the Czech economy. Within the years 2000 and 2008, GDP grew on average by 4.3%, with the growth exceeding 6% limit in the years 2005 - 2007. Key role has played foreign trade balance, which contributed until 2003 negatively, while since 2004 its contribution was positive, the most in 2005, when foreign trade contributed to GDP growth almost by three-quarters. In the following text we focus on the analysis of the demand effect of exports to the performance of the Czech economy.

Analytical framework

At the level of the national economy holds the balance of supply and demand, which can be expressed by the following formula:

$$GO + Imp + NTP = IC + FC + GFCF + CHgS + Exp \quad (1)$$

where

GO = gross output

Imp = imports (of goods and services)

NTP = net taxes on products

IC = intermediate consumption

FC = final consumption

$GFCF$ = gross fixed capital formation

$CHgS$ = change in stock

Exp = exports (of goods and services)

When analyzing the impact of exports on domestic output, only the demand components produced in domestic economy are relevant. At the level of sectors the basic equation can be expressed in the matrix form (EUROSTAT, 2002):

$$A_D x + f_D = x \quad (2)$$

$$x - A_D x = f_D \quad (3)$$

$$(1 - A_D)x = f_D \quad (4)$$

where

x = n -member vector of output by industries,

f_D = n -member vector of final demand (from inland),

A_D = matrix of direct coefficients (from inland) of dimension $n \times n$.

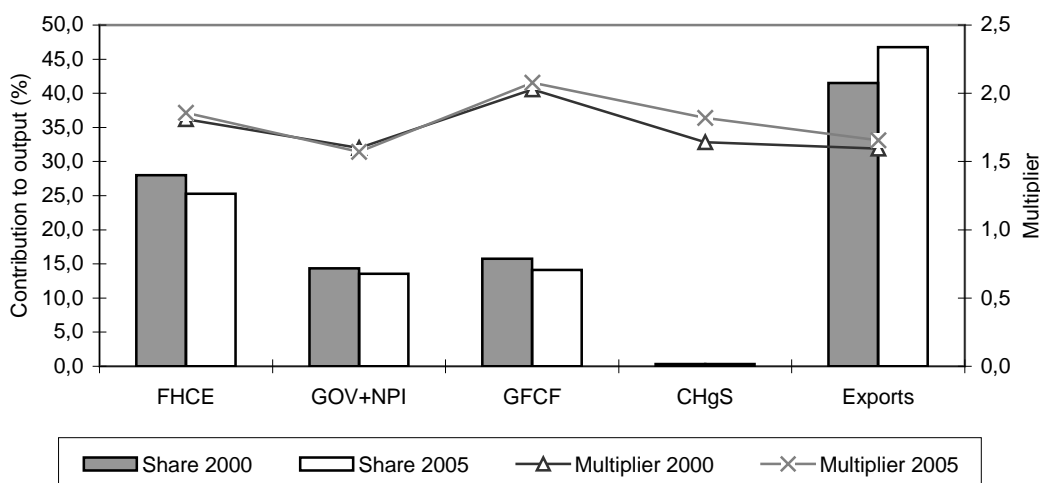
The vector f may represent the overall final use of the country, as well as its individual components. If you gradually put into the equation (4) individual components of final use, we get vectors, which constitute the vector sum of domestic production. By using

this procedure we can fully decompose the total domestic output to the contributions of the final household consumption, government consumption, capital formation (including changes in inventories) and exports. The share thus obtained and the individual components of demand get their multipliers reflecting the ability of components to generate output in the economy.

Multiplication effect of demand component

By putting the data of the symmetrical input-output tables for 2000 and 2005 into the model we get the results that can be seen in Figure 1.

Figure 1: Decomposition of the multiplication effect to individual final demand components in 2000 and 2005 (% , current prices)

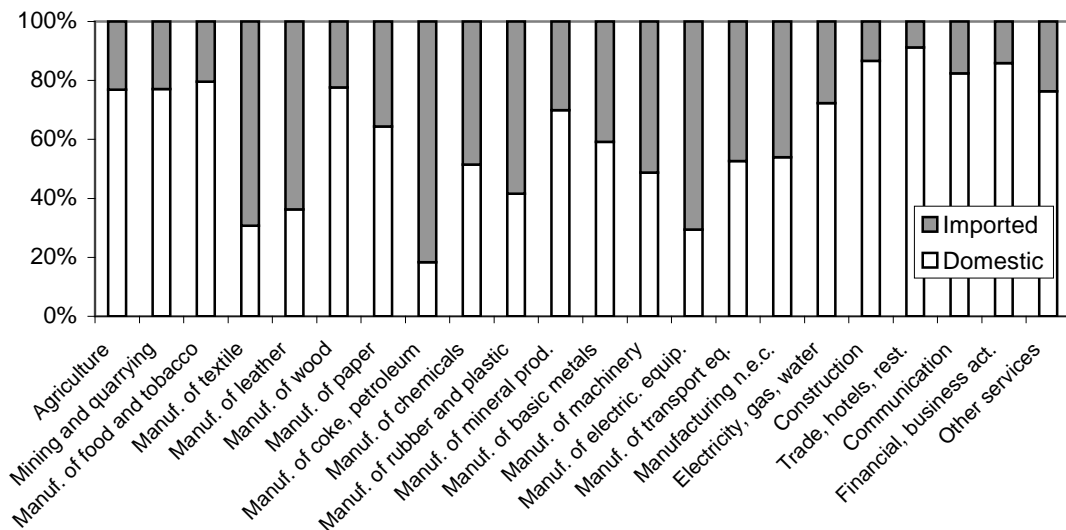


Source: CZSO – input-output tables, author’s calculation.

Figure 1 shows that for the whole economy, the share of exports generated by the production ranged between 42% in 2000 and 47% in 2005. The share of exports to the final use in both years was slightly (about 2 pp) higher, on average, has a multiplier value of exports less than other components of demand. The highest value of the multiplier reaches gross fixed capital formation, particularly the high value of the multiplier effect in the construction sector.

The gross value of goods exported contains the value of imported materials (or energy or services). The higher the degree of international fragmentation of production, the lower the domestic production of induced external demand. Using this overestimates the aggregate value added generated by the foreign sector. Conversely, an indicator of net exports contribution of external sector in a sense an underestimate, since it includes the goods and services that satisfy domestic final demand. The solution is to calculate the indicator of export, which is cleansed only by the value of imports, which is linked to it. The methodology of calculating this indicator is described in the text.

Figure 2: Share of IC from inland and imports by sectors (year 2005)



Source: CZSO – input-output tables, author’s calculation.

Using the import intensity indicators (II) of exports, derived on the basis of input-output tables can be avoided intentional breakdown of the intermediate goods and other categories of goods. Input-output table enables the production of each sector into two parts – other sector’s intermediate and final use (Breda, 2007):

$$II_{direct} = u A_M EX, \tag{7}$$

where

II_{direct} = direct import intensity,

u = unit vector of dimension n ,

A_M = matrix of direct coefficients from imports of dimension $n \times n$,

EX = n -member vector of export.

Use of input-output tables enables to calculate the value of inputs, which are indirectly used in the production of exported products. In fact, it may be the entry of imports used in industry, whose output is used in the second and then in the third sector, is to capture the value of all inputs for export production. In this case, includes an indicator of the import intensity of exports both direct and indirect inputs from imports, the indirect inputs are included in the value of inputs purchased domestically. Indicator import performance will look like this:

$$II_{TOT} = u A_M (1 - A_D)^{-1} EX, \quad (8)$$

where II_{TOT} = total (direct + indirect) import intensity,

A_D = matrix of technical coefficients from domestic sources of dimension $n \times n$.

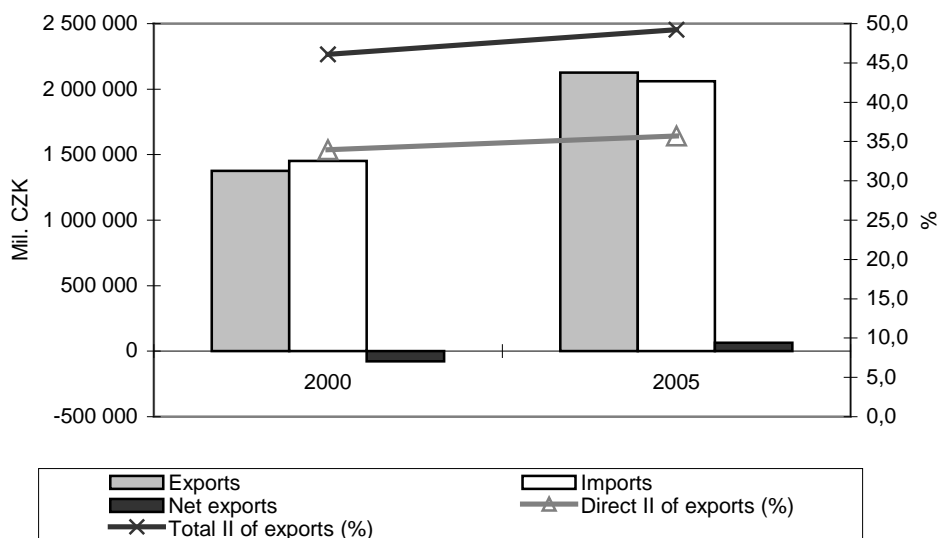
In Figure 2 we can see that in the manufacturing sector is significantly higher share of imports in the intermediate than in other sectors. This proportion is highest in the refinery industry (DF), which consists of more than 80% intermediate, which is the dominant share of imported oil (see Table 3). For comparison, consumption of materials, energy and services in the country make up about two thirds of the total intermediate consumption, imports and third.

Shares of imports to intermediate are predominant in the electrotechnical industry (71%), in the textile and clothing industry (69%), leather industry (64%) and

manufacture of rubber and plastics (58%). In these sectors can also expect a relatively lower effect of exports on domestic production, because there is a leakage of demand abroad. The relatively low proportion of intermediate imports are, however, in service sectors, agriculture, construction and energy (less than one quarter share).

Once the data for the years 2000 and 2005 in equation (7) obtained data on the direct import intensity of exports (DN), using equation (8) then predict total impact involving indirect inter-relations. Figure 5 shows that the direct import intensity make up about one third, counting the indirect effects of about half the value of exports. The proportion between 2000 and 2005 increased slightly, which means that the import intensity of exports in the economy increased on average. In 2005, the trade balance is positive, while in 2000, significantly negative. It follows that in 2005 there was a reduction in the share of total imports to exports, while an indicator of increased import intensity, which means reducing the share of imports for the other components of final use (especially private household consumption and capital formation).

Figure 3: Import intensity of exports in the Czech Republic in 2000 and 2005



Source: CZSO – input-output tables, author’s calculation.

Effects of exports on value added and employment

Up to now we derived only the impact of changes in the final use of the (gross) output. In practice, we are much more interested in the impact on the value added in the economy, ie the equivalent of GDP (in abstraction from taxes and subsidies), which is a key indicator of economic performance. Production, including intermediate consumption is an indicator, which is very dependent on the degree of internationalization, outsourcing, or organizational changes in the economy. On the contrary the added value should be relatively stable over time and is also directly linked to the income component (wages, taxes, operating surplus).

In the framework of input-output model, we will assume a fixed proportion of value added to value of production, as well as the commodity structure of intermediate consumption. Shares of value added in each sector between 2000 and 2005 are presented in Table 1A. The table can be used to read a different proportion of value added and employment per unit of money made (gross) output. On average for the whole economy has been between 2000 and 2005 a significant decline in employment per unit of production (from 0.93 to 0.66) and a very slight decline in the value added to production (from 0.37 to 0.36). This means that the change in final demand in 2005 had relatively less impact on the value added and employment in the economy. On the other hand, increasing the relative share of exports to the final use (from 40 to 44%), which will increase the effect of exports, on the contrary.

Using input-output tables can also quantify the impact of changes in the final use of the employment, if the tables extend the industrial structure of employment. To analyze the

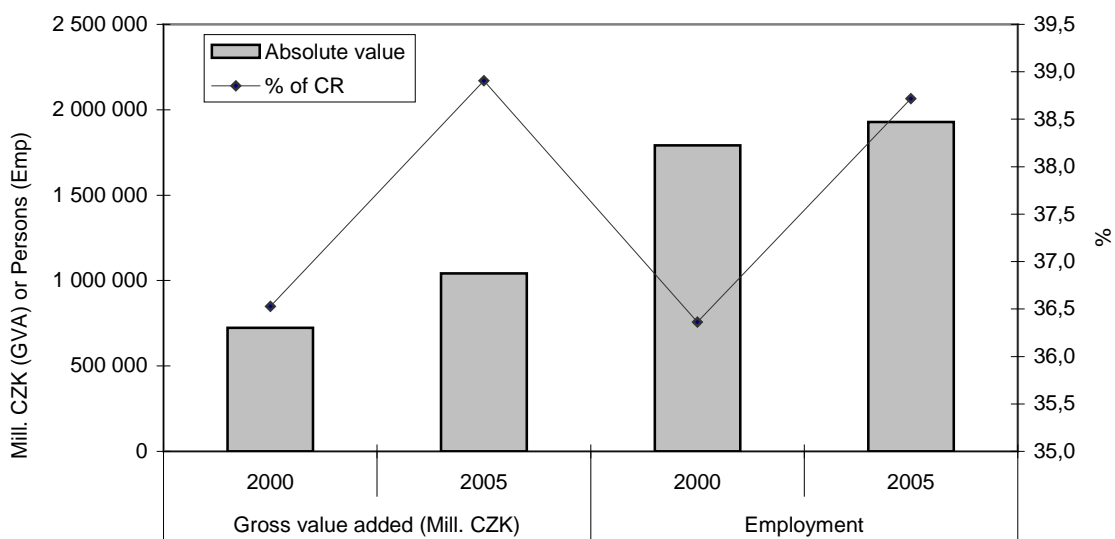
impact of changes in export employment can benefit from the following equation, which we get by adjusting equation (5):

$$Z = B (1 - A_D)^{-1} EX \quad (9)$$

where Z = the matrix of the resulting export employment (direct and indirect demand),
 B = matrix of coefficients of labour intensity of output.

If we put into equation (9) vectors of exports and labour ratios, we get an estimate of the impact of exports on employment in various sectors and whole economy. Comparison of the impact of exports on value added and employment between 2000 and 2005 is shown in Figure 4. It is clear that for the whole economy, the share of exports to value-added and employment increased by more than 2 pb. While the share of exports generated by the (gross) output ranged between 42% in 2000 and 47% in 2005 (see Figure 1), the impact on the creation of added value was lower, and 36% in 2000, respectively 39% in 2005. The effect on the employment differs only slightly within this period.

Figure 4: Comparison of the effect of exports to value added and employment between 2000 and 2005



Source: CZSO – input-output tables, author’s calculation.

It is clear that employment and value added are very much linked together. While the link of value added to the output is more and more loose due to intensification of globalization processes. In absolute terms, this means that exports in 2000 contributed to the creation of gross value added (in abstraction from the effect on taxes and subsidies also to the creation of GDP) amounting to 723 billion, in 2005 and 1024 billion. Similarly, to quantify the impact on employment when in 2000 the export has created 1.79 million jobs (FTE) in 2005 was 1.93 million jobs.

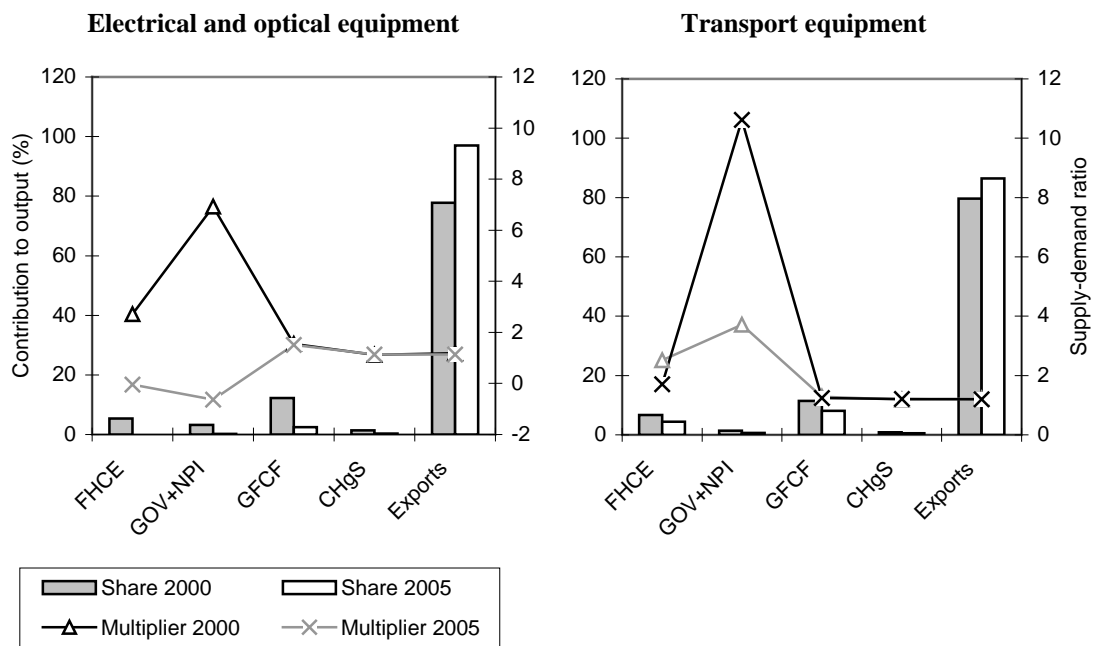
Comparison of the exports effect in selected industries

Manufacture of electrical and optical equipment is one of the most dynamic sectors of the Czech economy. The bulk of production is created in enterprises under foreign control, while the vertical FDI with a significant export focus of production. Most of the components of this sector is imported, which means a very low value added generated in the Czech Republic, as is the low contribution to trade balance.

In the electrotechnical industry declined between 2000 and 2005 the share of value added to production (from 20 to 17%), and the labour ratio as a percentage of the number of employees per million crowns produced (from 0.60 to 0.39). The export sector is quite dominant share of the generated output, which is in the period 2000-2005 increased from 78 to 97% (see Figure 5). Expressed in number of employees was 131 thousand in 2000 and 2005 is already 179 thousand, an increase of more than one third. Reciprocal declining share of capital formation and household consumption, which in 2005 had only a negligible effect on domestic output.

The supply-demand ratio (see figure 5) was relatively low in 2000 (1.18) and by 2005 there was a further reduction to 1.14. This means that the indirect effect of every dollar spent for electrical appliances by non-resident customers generated only 14 cents additional production of respective industry. It is clearly due to the high import intensity of production (and hence exports), which in 2005 exceeded 70%.

Figure 5: Decomposition of the multiplication effect in selected manufacturing industries and the supply-demand ratio in 2000 and 2005 (% , current prices)



Note: Value of sector multiplier can be interpreted as amount of output of individual sector produced in comparison with the amount spent by final users. Source: CZSO – input-output tables, author’s calculation.

In the **Manufacture of transport equipment** in the Czech Republic automobile industry is the dominant sector in terms of total production, while it is a key export sectors of Czech economy. The industry accounts for nearly one fifth of total exports, although its share on the value added is only about 4 %.

In the production of means of transport between 2000 and 2005 the share of value added to production increased from 17 to 19%, while the labour ratio decreased significantly

(from 0.31 to 0.24). Export demand is the predominant component, although less than in the case of manufacture of electrical and optical devices. Its share of production, however, created in the period 2000 - 2005 also increased, from 80 to 86%. The export of means of transport employed directly and indirectly 72 thousand people in 2000 and more than 100 thousand in 2005. Among other components of demand include capital formation and household consumption, whose share declined. The import intensity of this sector is significantly lower than that of manufacturing of electrical appliances. The value of output multiplier as an indicator of multiplication effect of this sector on the economy as a whole increased between 2000 and 2005, but rather via indirect than direct effects. It can be explained by the increasing role of domestic suppliers.

Conclusion

Using input-output tables, we estimate the share of exports to production of the Czech economy, which ranged between 42% in 2000 and 47% in 2005. The share of exports to the final use is slightly in both years (about 2 pp) higher, on average, has a multiplier value of exports less than other components of demand. The highest value of the multiplier reaches gross fixed capital formation, particularly the high value of the multiplier effect in the construction sector.

Direct import intensity of exports make up about one third, counting the indirect effects of about half the value of exports. The proportion between 2000 and 2005 increased slightly, which means that the import intensity of exports in the economy increased on average. During this period, the trade balance improved significantly, which means a reduction in the average import intensity of exports. It follows that to reduce the share of imports for the other components of final use (especially private household

consumption and capital formation). They were increasingly satisfied with domestic production.

Using this approach, we compared the characteristics of two key manufacturing sectors in the Czech Republic, i.e. production of electrical and optical equipment and manufacture of transport equipment. The results showed distinct characteristics of both sectors in terms of the impact of exports on output and employment as well as the degree of import intensity. The relatively higher contribution of exports to employment was in 2005 in absolute terms in electrical industry (179 thousand) than in the manufacturing of transport equipment (100 thousand). In both sectors, between 2000 and 2005 a slight decrease took place in the value of production in comparison with the value of the export, and domestic demand. At the same time, the value of the multiplier output increased as an indicator of the impact of demand for the production sector on the economy as a whole. It can be concluded that the increased influence of indirect effects played a role, such as greater involvement of local subcontractors. This can be seen in particular in the manufacturing of means of transport.

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Annex

Table 1A: GVA and labour ratio to gross output in 2000 and 2005 (%)

		GVA		Employment (FTE)	
		2000	2005	2000	2005
TOTAL		0,37	0,36	0,93	0,66
A+B	Agriculture, forestry, fishing	0,45	0,45	1,43	1,14
C	Mining and quarrying	0,47	0,52	1,07	0,63
DA	Manufacturing of food and tobacco	0,24	0,22	0,53	0,43
DB	Manufacturing of textile	0,26	0,27	1,37	1,03
DC	Manufacturing of leather	0,26	0,24	1,45	1,12
DD	Manufacturing of wood	0,29	0,29	1,15	0,93
DE	Manufacturing of paper	0,30	0,27	0,52	0,49
DF	Manufacturing of coke, petroleum	0,06	0,05	0,04	0,04
DG	Manufacturing of chemicals	0,30	0,24	0,35	0,27
DH	Manufacturing of rubber and plastic	0,25	0,23	0,62	0,39
DI	Manufacturing of mineral products	0,37	0,35	0,77	0,56
DJ	Manufacturing of basic metals	0,25	0,25	0,79	0,50
DK	Manufacturing of machinery	0,29	0,27	0,96	0,63
DL	Manufacturing of electric. and optic. equip.	0,20	0,17	0,60	0,39
DM	Manufacturing of transport equipment	0,17	0,19	0,31	0,24
DN	Manufacturing n.e.c.	0,26	0,28	1,04	0,72
E	Electricity, gas, water	0,29	0,26	0,25	0,15
F	Construction	0,27	0,28	0,90	0,69
G+H	Trade, hotels, restaurants	0,54	0,52	1,63	1,20
I	Communication	0,43	0,42	0,80	0,56
J+K	Financial, business, renting services	0,53	0,45	0,78	0,55
L-Q	Other services	0,57	0,59	1,87	1,32

Note: FTE = Full Time Equivalent. Source: CZSO – input-output tables, author's calculation.