CPB Memorandum

CPB Netherlands Bureau for Economic Policy Analysis

Sector	:	Conjunctuur en Collectieve Sector
Unit/Project	:	Conjunctuur
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Number	:	203
Date	:	16 September 2008

Decomposition of GDP-growth in some European Countries and the United States[1]

The composition of economic growth can be analyzed in two different ways. In the 'traditional method' for the decomposition of GDP growth, total imports are deducted from exports. This approach underestimates the importance of exports for the growth in GDP, and overestimates the importance of domestic expenditure categories. In the alternative methodology proposed in this paper, imports are allocated to all expenditure categories. Although this 'import-adjusted method' is more complex than the 'traditional method', it has the considerable advantage that the contributions of the expenditure categories to GDP growth provide a better understanding of why GDP growth decelerates or accelerates. The methodology and data requirements for calculating the import content of final demand, and the implications for the decomposition of real GDP growth, are discussed. For six European countries and the United States, the paper shows that applying the alternative methodology provides rather a different economic story.

[1] This paper is a shortened version published in 'De Economist', 2008, vol. 157, nr. 3.

1 Introduction

Which expenditure categories are the driving forces behind the economic growth of a country or region? This question is often raised in publications or speeches from national and international economic institutions about recent developments and short term prospects. In most cases, the question is answered using a methodology that calculates the contribution of exports to GDP growth as the contribution of net exports, while the contributions of domestic demand are not corrected for (final) imports. However, this traditional methodology for calculating the contribution of demand categories to GDP growth can easily lead to misinterpretations about the expenditure categories that are really driving the (changes in) economic growth.

This paper discusses the advantages and disadvantages of both this 'traditional method' and an alternative methodology ('import-adjusted method') to quantify the contributions to economic growth. The core issue underlying the two different approaches is whether imports are allocated exclusively to exports or also to domestic expenditure categories.

In the Netherlands, the Central Bank, the Netherlands Bureau for Economic Policy Analysis (CPB) and Statistics Netherlands have applied the alternative method since 1988.[2] At least since 1999, this approach is also applied by Statistics Canada.[3] More recently, institutions in France and Denmark have published forecasts with a decomposition of GDP growth using this import-adjusted method.[4] The application of the 'traditional method' and the 'import-adjusted method' frequently produces very different analyses about the expenditure categories driving economic growth.

Section 2 unveils the differences between both methods. Section 3 explores the import-adjusted method and its data requirements. The outcomes of both methods for the period 2003-2007 for Belgium, France, Germany, Italy, the Netherlands, Spain and the United States are presented in section 4. Finally, the last section summarizes the most important findings, and discusses the advantages and limitations of the approach used in this paper. Technical and statistical details are described in two appendices.

[2] For this reason, in earlier publications this approach was called the 'Dutch method' (see Kranendonk and Verbruggen, 2005).

[3] Cameron and Cross (1999) and Cross (2002) use the concept 'Value-added contributions'.

[4] See DGTPE (2006), which refers to 'IO-based contribution', and Box 1 in Ministry of Finance Denmark (2006), which refers to 'contribution net of import content'.

2 The two methods in general terms

By definition, Gross Domestic Product (GDP) equals final expenditures less total imports. This produces the following well-known formula:

(1) $Y = C + I + G + E - M$,

where

Y = gross domestic product (GDP)
C = private consumption
I = investment
G = government expenditures
E = exports
M = imports

In the calculation of the contribution of the expenditure categories to GDP (or to growth in GDP), imports should be deducted from the expenditure categories. The way in which this is done constitutes the crucial difference between the two methods. International institutions, including OECD, EC, IMF and ECB, allocate the (negative) contribution of imports exclusively to the contribution of exports. In that case, the contributions of domestic demand (household consumption, investment and government expenditures) to real GDP growth are equal to

(2a) $(C/Y)_{-1}.\overset{\circ}{c}$
(2b) $(I/Y)_{-1}.\overset{\circ}{i}$
(2c) $(G/Y)_{-1}.\overset{\circ}{g}$,

where lower case variables are deflated by the current period price increase and a little circle above a variable indicates a percentage change. The contribution from abroad is determined as

(2d) $(E/Y)_{-1}.\overset{\circ}{e} - (M/Y)_{-1}.\overset{\circ}{m}$.

The advantages of this approach are its simplicity and the fact that it is clear at first sight what the (net) contribution of foreign trade has been to economic growth. The main drawback, however, is that this approach provides limited insight into the actual contribution of the expenditure categories to GDP growth. After all, imports are used for domestic expenditures as well. This occurs not only through imports of final goods and services, but also through the import of intermediary goods and services to businesses that sell products domestically. Taking these two channels into account, as is done in the 'import-adjusted method', improves the

comparability of the domestic and foreign contributions to economic growth, while better insight is provided into the background or composition of the economic development.
In the alternative approach, imports are divided into separate components:

(3) M = MC + MI + MG + ME,

where

MC = final and intermediate imports for private consumption
MI = final and intermediate imports for investments
MG = final and intermediate imports for government consumption
ME = final and intermediate imports for exports

The real contributions of the demand categories can, in theory, be calculated as

(4) $(X/Y)_{-1}.\overset{\circ}{x} - (MX/Y)_{-1}.\overset{\circ}{mx}$,

where X is C, I, G or E and likewise for the corresponding (lower case) real variables.

3 The import-adjusted method in greater detail

The shares and growth rates of import components needed for the alternative method are not readily available. Moreover, the import intensities are not constant over time. This section first discusses a method to estimate the contributions of total imports to the various demand categories. The volatility of import intensities, and ways in which to cope with that phenomenon, are discussed later in the section.

3.1 CPS matrix for base year

In the alternative method, total imports have to be attributed to all expenditure categories. This can be done by using ratios derived from what is known as a Cumulated Production Structure (CPS) matrix.[5] For all expenditure categories this matrix shows the composition of output by gross value-added components (such as wages, profits and depreciation allowances) and the (final and intermediary) imports. The CPS matrix is calculated by eliminating domestic intermediary demand in the Input-Output table (see Appendix A).[6]

[5] The CPS matrix derivation is based on Klein (1983). See Appendix A.
[6] For this purpose, valuation at market prices is assumed, so that the sum of gross value added per expenditure category is equal to GDP at market prices. This means that the contributions to GDP include the indirect taxes relating to the various expenditure categories as well.

In value terms the CPS matrix formula reads:[7]

(5) $$CPS = P \,.\, (\, I - A \,)^{-1} \,.\, F + W \,,$$

where

CPS = Cumulated Production Structure Matrix

P = matrix of primary input coefficients

I = unit matrix

A = matrix of domestically produced intermediary demand

F = matrix of domestically produced final demand

W = matrix of primary inputs that are at the same time final demand (e.g. final imports or indirect taxes and subsidies on final sales)

Table 3.1 gives the CPS matrix of the German economy for the year 2000. The columns show the four expenditure categories: private consumption, government consumption, investments and exports. The rows show their composition in terms of domestic production and (final and intermediate) imports. Unfortunately, the lack of relevant Input-Output tables prevents a finer distinction in demand categories.[8]

Table 3.1 Cumulated Production Structure matrix for Germany, 2000

	Private consumption	Government consumption	Investments	Exports	Total
	billions of euros				
(1) GDP	962	361	320	419	2063
(2) Imports	221	31	130	251	632
- Final	106	4	70	94	274
- Intermediate	116	27	59	157	358
(3) Total demand	1184	392	449	670	2694
	%				
(4) Average import intensity, i.e. (2) as a % of (3)	19	8	29	37	23

Source: CPB calculations

The table shows that in Germany the import intensity of exports and investments is higher than that of consumption. This holds true in almost all European countries.

[7] See also CPB (1992), section 2 and Appendix I.

[8] Eurostat - website www.ec.europa.eu/eurostat, theme 'Economy and finance', 'ESA 95 Input-Output tables'.

3.2 Volatility of import intensities

If the import intensities were constant over time, then the CPS matrix for a single year could easily be used to calculate the contributions of the demand components to GDP growth for a longer period. Unfortunately, they are not. The import intensities vary over time for several reasons:

- Globalisation and international specialisation lead to growth rates of imports and exports which are, on average, higher than the growth of GDP and domestic demand;
- Changing relative prices can cause (temporary) higher or lower import intensities;
- Total demand and imports have different price developments;
- Temporarily high or low rates of capacity utilization can lead to more or less imports;
- Import intensity of aggregates can fluctuate because of different developments of components. In the Netherlands, for example, imports for private consumption depend mainly on the consumption of durable goods, which is rather volatile.

In spite of their volatility, the import intensities of a specific base year could be applied in the calculation. Then the results would provide a rough approximation of the contributions of the demand components to GDP growth. More precise results call for the use of real *marginal* import intensities, indicating which part of changes of yearly demand has led to additional imports and which part was domestically produced. Calculation of yearly real *marginal* import intensities requires yearly Input-Output tables in constant prices. These are, to the best of our knowledge, available only for the Netherlands, for the period 1988-2006. As shown in the box, the *marginal* import intensities for the Netherlands are rather volatile, an outcome that can be expected also for other (European) countries. If Input-Output tables in constant prices were available for these countries, we could calculate the exact contributions to GDP growth of the several demand components. They are not available, but with the available information we can estimate real marginal import intensities.

Appendix B describes the method for estimating real marginal import intensities in detail. The basis idea is as follows. For each country analysed in this research an Input-Output table is available for some base year, for most countries this is the year 2000.[9] This Input-Output table is used to calculate a CPS matrix. National Accounts data for the real growth rates of GDP, for the demand components and for imports are used to construct CPS matrices for the years 2003 and 2007, in prices of 2000. This approach uses information about the import intensities in some base year to estimate the inner part of the CPS matrix — in other words, to allocate total demand in imports and value-added — under the restriction of observed total imports and GDP.

[9] For the United States the most recent available Input-Output table is for the year 1997.

Volatility of import intensity in the Netherlands

Input-Output (IO) tables contain important information on the structure of the production and the import intensities of countries. Statistics Netherlands has published Input-Output tables back to 1969 in value terms, and back to 1988 in prices of the previous year. Application of an Input-Output table in current prices for specific years allows the *average import intensity* for each demand category to be calculated. A time-series analysis for this statistic over a longer period provides insight into the relevance of globalisation and import penetration of a country. However, for the analysis of the effect of the business cycle on the import intensity, another statistic is more relevant, i.e. the *real marginal import intensity*. This variable quantifies which part of the *real growth* of final demand is imported.

Expressed in a formula, the definitions of both measures for import intensity are
average nominal import intensity : $Mx(t) / X(t)$

real marginal import intensity: $[Mx^{cp}(t) - Mx(t-1)] / [X^{cp}(t) - X(t-1)]$

where,

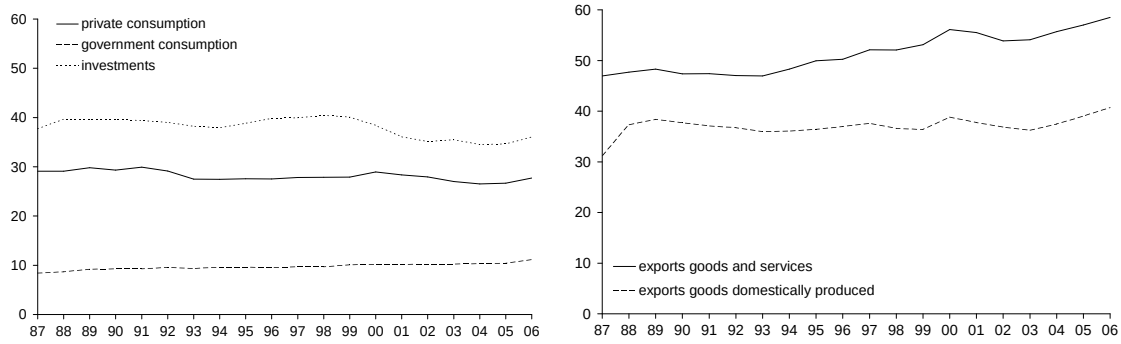
cp : constant prices of previous year

Mx : import content of demand factor X

X : demand categories private consumption, government consumption, investments and exports

The first two graphs show that the average nominal import intensities for domestic demand and exports of goods produced in the Netherlands are rather stable over time. The increase for total exports can be explained by the strong increase of the share of re-exports in total exports.

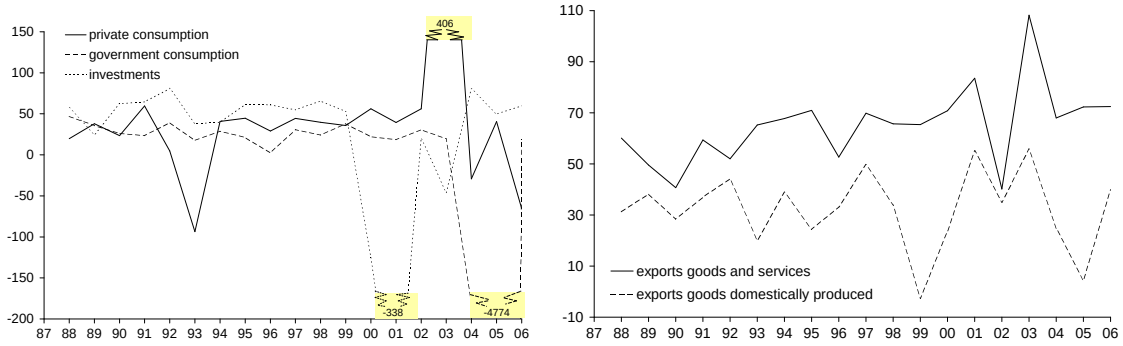
Average nominal import intensity in the Netherlands, 1988-2006



The second set of graphs illustrates the volatility of the marginal import intensity in real terms from year to year. In years with exceptionally low growth of a particular demand factor, the denominator of the marginal import ratio can be close to zero and hence the ratio unusually high (in absolute terms).

Volatility of import intensity in the Netherlands (continued)

Real marginal import intensity in the Netherlands, 1988-2006



For domestic demand, the real marginal import intensities for the period 1988-2006 on average are higher than the average nominal intensities. This illustrates the ongoing import penetration in real terms. Because prices of domestic demand increase on average more than the relevant import prices do, the nominal import intensities rise either negligibly or not at all.

Average import intensities in the Netherlands, 1988-2006

	Nominal	Real marginal
	%	
Private consumption	28	36
Government consumption	10	25
Investments	38	61
Export of goods and services	51	67
of which goods domestically produced	37	34

The two (constructed) CPS-matrices for 2003 and 2007 give information about the (real) increase of the import intensities for countries analysed.

Applying this method with constructed marginal import intensities we can calculate an approximation of the contributions of the demand categories to GDP growth. This approximation, however, gives a better picture of the contributions of the various demand components to GPD growth than the use of average intensities for a single year, and also better than in the traditional method, where all imports are simply deducted from exports.

3.3 Calculating the contributions to GDP growth

The calculation of the contributions to GDP growth is done in two steps. In the first step the average real marginal import intensities are applied. As discussed in the previous section, these

intensities are not exact for each separate year. Applying these intensities will thus lead to a sum of imports that may differ from total imports. This residual should be allocated in the second step, for example, *pro rata* across the imports for the expenditure categories applying marginal import shares.

An alternative for this two-step procedure is a method that constructs CPS matrices for all years in constant prices, using a RAS spreader procedure. This is, from a technical point of view, a rather simple procedure, but it has the disadvantage that the residual is spread on the basis of the structure in some base year. The two-step procedure is preferable because it gives explicit information about the quality of the applied import intensities. Large residuals give the message that the applied import ratios do not sum to total imports and new research on the applied import intensities is necessary. Such situations occur when the real marginal import intensities differ significantly from their historical average (for reasons mentioned in subsection 3.2). The two step procedure can be summarized in the following formulas:

(6) $$contr_x{}^p = [(X/Y)_{-1} . \overset{\circ}{x} - (MFX/Y)_{-1} . \overset{\circ}{mfx}] . (100 - \alpha_x)/100$$

(7) $$contr_x{}^f = 100 . [contr_x^p + \beta_x (y - \sum contr_x^p)] \quad ,$$

where

X = C, I, G or E and likewise for the corresponding (lower case) variables

$contr_x{}^p$ = preliminary contribution of expenditure category x to real change of GDP, in % per year (i.e. before allocating the residual)

$contr_i{}^f$ = final contribution of expenditure category x to real growth rate of GDP, in % per year (i.e. after the residual)

α_x = marginal real import intensity of expenditure category x, excluding final imports : 100 * ΔMX / ΔX

β_x = share of expenditure category x in total imports; 100 * ΔMX / Δ M

MFX = final imports for expenditure category X

mfx = real growth rate of final imports for expenditure catagory x

MX = final and intermediate imports for expenditure category X

y = real growth rate of GDP

Y = Gross Domestic Product (GDP), in billions of euros (in value terms)

These formulas refer to a situation in which information is available about the development of final imports. This variable is set equal to zero when such information is absent, and the

parameters α and β should be based on the marginal CPS matrix: row (2) for the β's and row (4) for the α's.[10] Appendix B presents detailed information on the parameters α (table B.3) and β (table B.4). It also contains figures that illustrate the size of the residuals from the first step.

4 Results

This section compares the results of the import-adjusted method with those of the traditional method. The calculations are based on OECD data from the Economic Outlook of June 2007. This database contains time series for GDP, consumption, investments, exports and imports in prices of a base year. Figures 4.1-4.7 show the allocation of GDP growth for the years 2003-2007 for Belgium, France, Germany, Italy, the Netherlands, Spain, and the United States.

The differences are significant. The two methods tell rather different stories about the expenditure categories driving economic growth. For France and Spain, the traditional method suggests that the contribution to GDP growth from abroad is almost always negative, whereas the import-adjusted method indicates that most of the time the contribution of exports to economic growth was close to zero or positive. Even stronger is the difference for Belgium and Germany. The import-adjusted method shows that on average around 50% of the GDP growth originates from abroad— quite different from the zero or negative contribution suggested by the traditional method. The differences between both methods are relatively small for Germany and Italy, although the contribution of exports to GDP growth in 2006 and 2007 is much higher in the import-adjusted method than in the traditional method. The import-adjusted method shows that more than half of the German and Italian economic growth in these years can be attributed to exports, while in the traditional method this contribution is about one-third. For the Netherlands, the traditional method suggests that the contribution of exports to GDP growth is decreasing in the period 2004-2007 and almost zero, while according to the import-adjusted method this contribution is rather stable and very significant.

Even for a more closed economy like the United States both methods tell different stories. The traditional method suggests that the contribution of exports is rising from negative figures in the first years to a just above zero in 2007. The import-adjusted method shows that the contribution is positive in all years and rather stable in the period 2004-2007. Around 20% of total GDP-growth can be attributed to the (real) increase of exports, which is a substantial higher part then the nominal share of exports in GDP (10%).

[10] When information on final imports is available, the α's should be based on the quote of only intermediate imports as a percentage of total demand.

Figure 4.1 Contributions to GDP growth in Belgium, 2003-2007

Traditional method **Import-adjusted method**

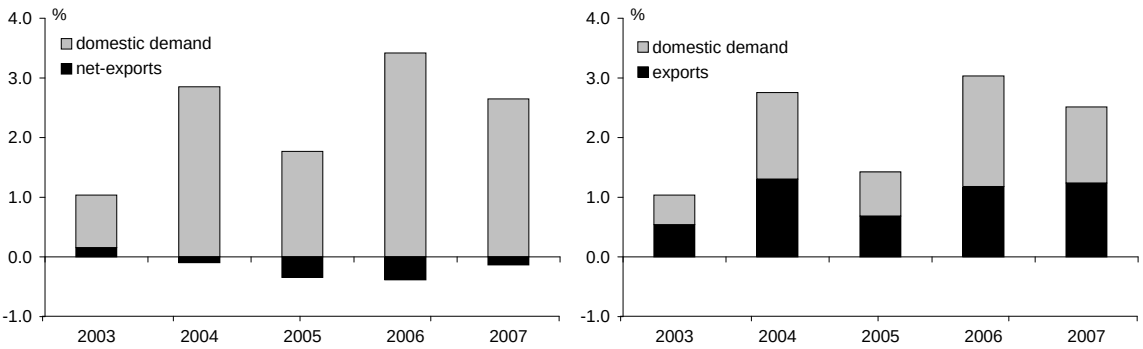


Figure 4.2 Contributions to GDP growth in France, 2003-2007

Traditional method **Import-adjusted method**

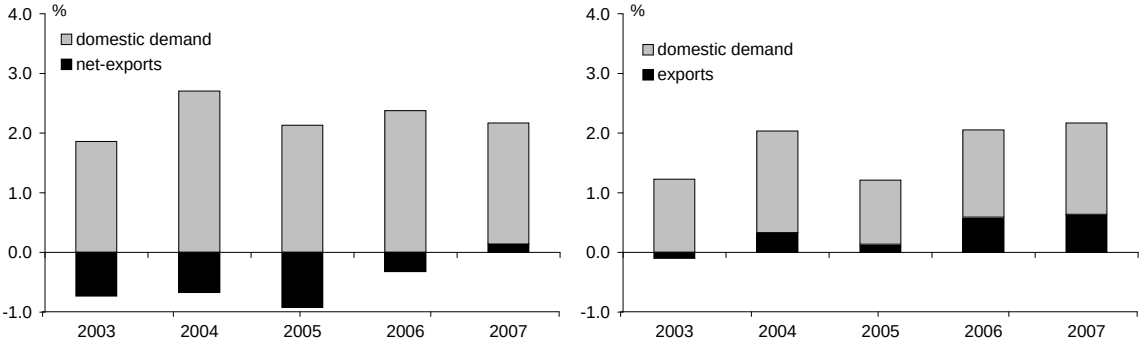


Figure 4.3 Contributions to GDP growth in Germany, 2003-2007

Traditional method **Import-adjusted method**

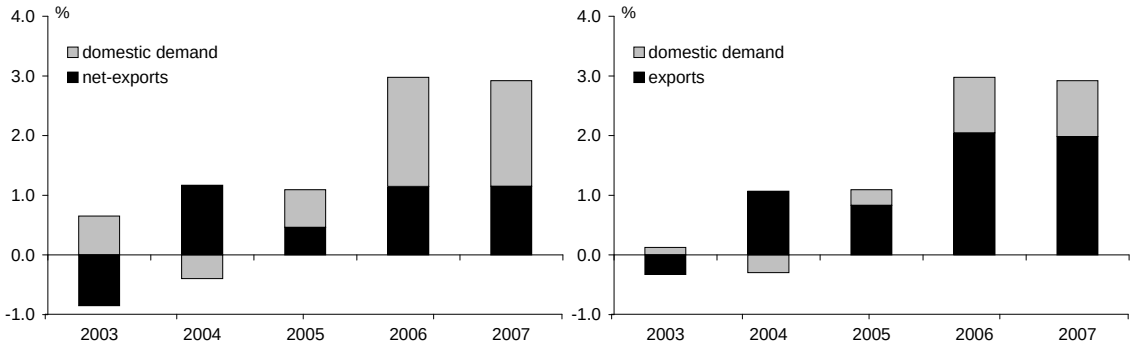


Figure 4.4 Contributions to GDP growth in Italy, 2003-2007

Traditional method **Import-adjusted method**

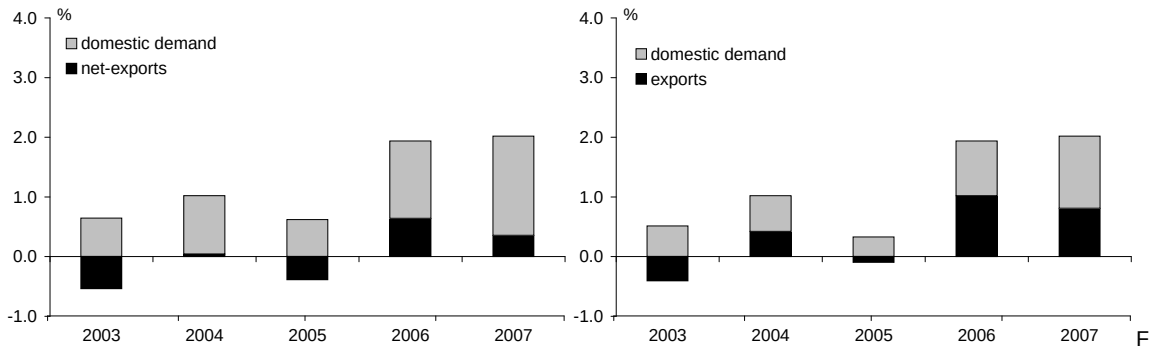


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Figure 4.5 Contributions to GDP growth in the Netherlands, 2003-2007

Traditional method **Import-adjusted method**

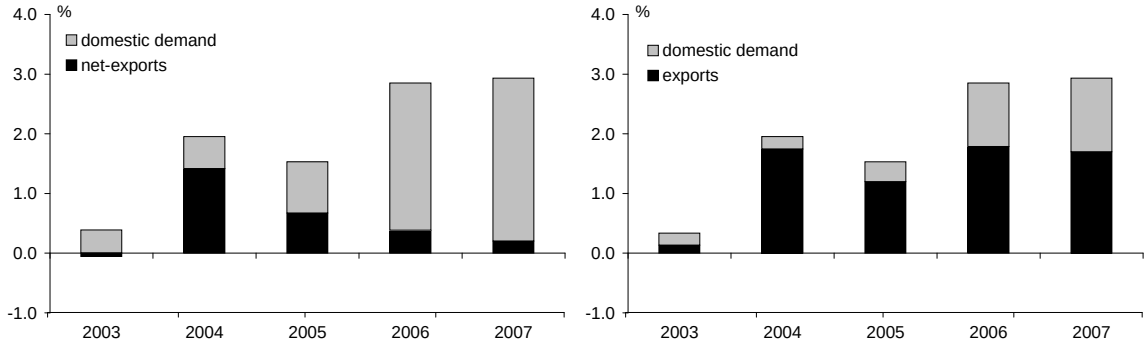


Figure 4.6 Contributions to GDP growth in Spain, 2003-2007

Traditional method **Import-adjusted method**

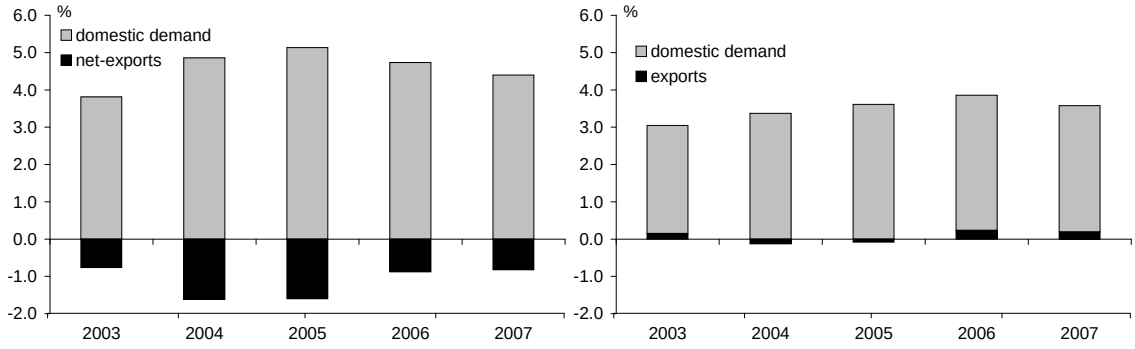
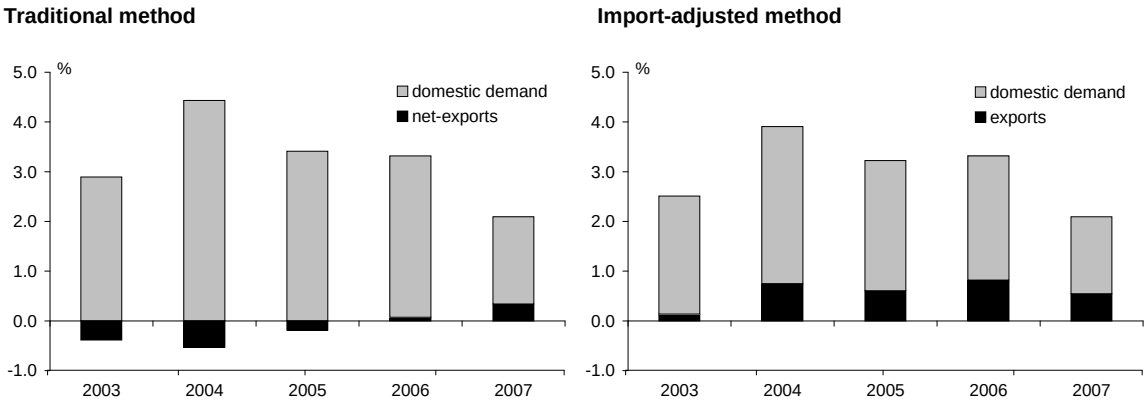


Figure 4.7 Contributions to GDP growth in United States, 2003-2007



5 Conclusions and evaluation of the methodology

An analysis of contributions to economic growth can use two different methods, which in most cases give divergent outcomes. The traditional method, in which imports are exclusively allocated to exports, underestimates the importance of exports and overestimates the importance of domestic demand. The explanation is that final and intermediary goods and services are imported not only for exports, but also for domestic expenditures. This paper presents a methodology that provides a better decomposition of the sources of economic growth.

The methodology presented here is applicable for all countries that have at least one Input-Output table for some base year available. Because most import ratios increase gradually and fluctuate from year to year, it is preferable to have Input-Output tables for a number of years. Comparison of Input-Output tables from different years can provide greater insight into the volatility of the import intensities. The rapid increase of re-exports in some countries, in particular, may provide an important explanation for the rising import ratios.[11]

Only with detailed Input-Output tables in constant prices is it possible to obtain an exact decomposition. In all other situations, the method gives an approximation. Thus, the decomposition can change when new Input-Output tables become available. Changing figures are, however, an aspect of economic reality. Data on economic growth alter when new National Accounts are published, and even after a long period of time revisions can take place. In any case, the approximations obtained form an import-adjusted method provide a better economic analysis then does the traditional method.

[11] See Mellens, Noordman and Verbruggen (2007).

Appendix A Derivation of the CPS matrix

The Cumulated Production Structure (CPS) matrix aims to provide a direct link between primary inputs and final demand. The matrix indicates how much of each primary input category is needed, both directly and indirectly (through the use of intermediaries), to produce each category of final output.[12] To derive this matrix, consider the following Input-Output table:

	(n)	(f)	(1)
(n)	A	F	z
(p)	P	W	x
(1)	z'	y'	

where

A	=	n × n matrix of domestically produced intermediary demand
F	=	n × f matrix of domestically produced final demand
z	=	n × 1 vector of domestically produced total demand
P	=	p × n matrix of primary inputs used by domestic firms
W	=	p × f matrix of primary inputs that are the same time final demand
x	=	p × 1 vector of total primary inputs
y	=	f × 1 vector of total final demand
n	=	number of industries
f	=	number of categories of final demand
p	=	number of primary input of categories

It should be noted that the existence of the matrix W is not standard in the international input-output literature. In Dutch Input-Output tables, the matrix contains primary costs that are simultaneously final demand components, such as the imports of final products, indirect taxes and subsidies on final products. In Input-Output tables for most other countries these components are incorporated in the matrices P and F. For those Input-Output tables, the proper CPS matrix can be derived by setting W=0 in the remainder of this appendix.

Define the matrices A^* and P^* by dividing the column entries of A and P by the corresponding entry in z'. A^* is the matrix of intermediary input coefficients, and P^* is the matrix of primary input coefficients. The entries A_i^{*j} and P_i^{*j} indicate the amounts of intermediary input of industry i and of primary input of category i needed to produce one unit of gross output of industry j. Define the n × f matrix X as $(I - A^*)^{-1} F$. Each column in X is the vector of total demand (by industry) generated by the corresponding column vector of final demand in F.

[12] The derivation of the CPS matrix is based on Klein (1983).

Form the p × f matrix CPS' as follows:

$$CPS' = P^{*} \cdot X$$
$$= P^{*} (I - A^{*})^{-1} \cdot F$$

Each entry CPS'_{ij} represents the total or cumulated amount of primary input of category i needed to produce the j^{th} column vector of final demand in F. Recall that W_{ij} is the amount of primary input of category i that is at the same time a component of final demand of category j. $CPS'_{ij} + W_{ij}$ is the total amount of primary input of category i needed to produce the total final demand of category j. We define the CPS matrix as follows:

$$CPS = CPS' + W$$
$$= P^{*} (I - A^{*})^{-1} \cdot F + W$$

The column totals of this CPS matrix are the total values of the primary inputs needed, both directly and through intermediaries, to produce the corresponding categories final demand. Since total cost must equal total production, these column totals must equal the entries of vector y'. The row totals are the total amounts of primary inputs used, and thus form the column vector x.

Appendix B Import intensities

This appendix discusses the import intensities for some European countries and the United States.

Subsection 3.2 noted that import intensities fluctuate from year to year, with a tendency to rise. This appendix first illustrates the phenomenon of increasing import intensity, applying Input-Output tables for Germany for the years 1995 and 2000. During this period, the total average import intensity increased from 17% to 23%. Table B.1 presents the 'marginal' CPS matrix for Germany, which is calculated as the CPS matrix in 2000, minus the CPS matrix in 1995 (all in value terms).

Table B.1 Marginal Cumulative Production Structure matrix for Germany, 2000 minus 1995

	Private consumption	Government consumption	Investments	Exports	Total
	billions of euros				
(1) GDP	115	25	– 6	123	257
(2) Imports	68	10	47	126	251
- Final	26	1	33	51	111
- Intermediate	42	9	14	75	140
(3) Total demand	182	35	41	249	508
	%				
(4) Marginal import intensity, i.e. (2) as a % of (3)	37	29	115	51	49

This table illustrates that around 50% of the increase of domestic demand and of exports was imported. This marginal import ratio is much higher than the average import intensity in the years 1995 and 2000. The import intensity of exports increased very rapidly, thanks to a growth of 50% of the final imports for exports (also called 're-exports'). The marginal import intensity of investments in the period 1995-2000 is even higher than 100%. This may have been caused by a diversified development of different types of investment: a strong increase in import-intensive investments, such as computers and machinery, and a decrease in investments originating from domestic production, such as buildings.

In table B.2 marginal import intensities for the period 1995-2000 are presented for six European countries, based on published Input-Output tables for these years. For France is no Input-Output table available for the year 1995. However, for France is an Input-Output table is available for the year 2004. For the United States is no second recent Input-Output table available. For most countries the marginal import intensities are 10-30%-points higher then the import intensities in the separate years 1995 and 2000. The only exception is France, were the import intensities

seem to be rather stable in the period 2000-2004. However during this period the import prices dropped by 3%, while in the same period the GDP price increased by 10%. This illustrates that nominal import intensities could be less useful for analysis of real development. Unfortunately, only for the Netherlands Input-Output tables in constant prices are available.

Table B.2 Marginal nominal import intensity, 2000 minus 1995

	Private consumption	Government consumption	Investments	Exports	Total demand
	%				
Belgium	42	22	62	71	60
France (2004 minus 2000)	17	11	– 13	– 13	10
Germany	37	29	115	51	49
Italy	26	10	41	38	29
Netherlands	31	13	36	68	49
Spain	26	17	43	58	35

The purpose of our analysis is to attribute the real GDP growth to the four demand categories for the period 2003-2007. To get representative real import intensities we prefer to ignore price developments. We constructed Input-Output tables for the years 2003 and 2007 in prices of the year 2000. This is done by applying the Input-Output table for a recent year (2000 for most countries) and real growth rates for import and the four demand categories (private consumption, government consumption, investments and exports). Applying the RAS-procedure CPS matrices can be constructed for other years in prices of the base year. Table B.3 shows the results for the European countries and the United Sates. For almost all countries the marginal real import intensities for the 2003-2007 are higher then the (nominal) marginal import intensities for the period 1995-2000 in table B.2. For Germany the quotes for private consumption and government consumption in table B.3 are probably too high. Germany experienced a strong growth of both exports (+44%) and imports (+36%) during the period 2003-2007, due to booming re-exports. Application of the RAS-procedure allocated this additional imports partly to private consumption and government consumption, although these demand categories showed almost no real growth in this period. Therefore, we adjusted by hand the import intensities for private and government demand and increased the import quote for exports (adjusted figures in brackets in table B.3).

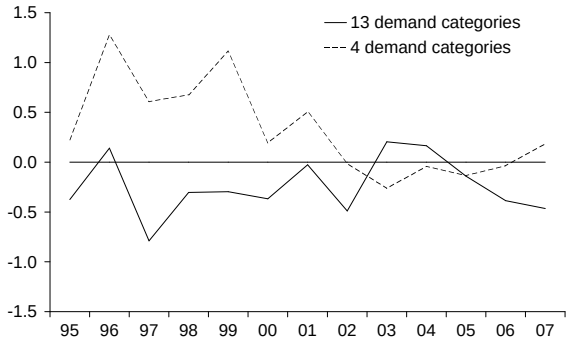
Table B.3 Marginal real import intensity, 2007 minus 2003 (in prices of 2000)

	Private consumption	Government consumption	Investments	Exports	Total demand
	%				
Belgium	55	24	55	72	63
France	39	22	48	65	48
Germany	182 (40)	65 (30)	63	53 (63)	61
Italy	33	15	45	31	33
Netherlands	63	44	57	69	66
Spain	31	16	35	96	43
United States	23	17	40	16	24

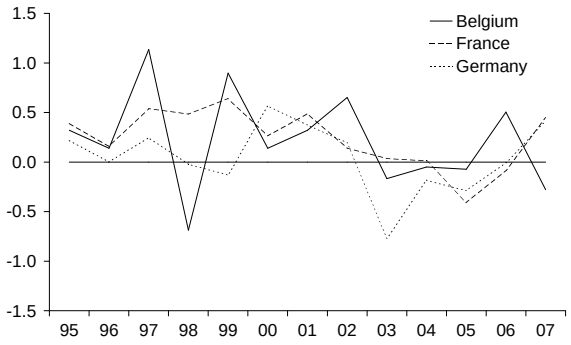
The import intensities form table B.3 are used as the α_x's in formula (6)). Applying these quotes initial approximations of the contributions to GDP growth can be calculated. These do not add up to the GDP growth, because the import ratios fluctuate from year to year. Figure B.1 illustrates the magnitude of the resulting residuals for some countries. The left-hand graph presents two methods for the Netherlands. In the more detailed approach (with thirteen different demand categories, and using also information on final imports), the mean absolute residual is only 0.2%-point of GDP.[13] Applying the more aggregated approach (discussed in this paper) with only four demand categories, the mean absolute residual is 0.4%-point of GDP. The right-hand graph presents the residuals for some European countries.

Figure B.1 Residual of first step

Residuals for the Netherlands



Residuals for Belgium, France and Germany



The CPS matrices also allow us to derive import shares, which sum to 100% over the demand categories (see table B.4). We only increased the weight of the exports for Germany to 70%, more in line with the strong increase of the re-exports. The weights for private consumption and investment were reduced in compensation. In our methodology these shares are used to allocate

[13] See Kranendonk and Verbruggen (2005).

a residual from the first step. This allocation is the second step of the calculation of the GDP contributions. These are the β_x's in formula (7).

Table B.4 Marginal import shares, 2007 minus 2003

	Private consumption	Government consumption	Investments	Exports	Total demand
	%				
Belgium	12	2	20	66	100
France	31	5	17	47	100
Germany	15 (3)	2 (1)	13	70 (83)	100
Italy	33	4	25	38	100
Netherlands	10	2	10	78	100
Spain	27	6	21	47	100
United States	31	5	17	48	100

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