Reelika Parve, Josef Richter

Linking a simple INFORUM model as a satellite to the BTM – The case of AEIOU

1 Introduction

This paper gives a short description on how the simple Austrian INFORUM MODEL AEIOU was linked to the BTM as a kind of satellite. Information on demand for Austrian exports and on Austrian import prices were derived from the BTM system for arriving at scenarios for Austria, without considering any feedback from the Austrian economy to the BTM system.

This exercise was carried out on the basis of experience gained with linking a previous Austrian INFORUM MODEL to the INFORUM CONSORTIUM of models (s. Richter 1991). Similar experience was available in Italy: in its early stage of development INTIMO, the INFORUM MODEL for Italy, also started as a satellite. In this phase, Italy took the advantage of being ready to be hosted in the INFORUM INTERNATIONAL link model. Import and export prices as well as sectoral foreign demand, incorporating the forecast generated by the country models, were made available to the Italian team so that INTIMO could start on as a "stand alone" model on the basis of very meaningful exogenous variables for foreign trade relationships.

The paper gives a very short outline of the present stage of the Austrian model and describes the linking process in some detail. The description of this semi-final stage seems necessary to underline why the option "satellite" was chosen instead of "full linkage". The final chapter is devoted to a discussion of the advantages and limitations of a satellite approach. We hope that model builders in other countries – and in small open countries in particular – might benefit from the experience gained with the Austrian model.

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2 AEIOU in its present stage

AEIOU is a typical INFORUM model in its infant stage of development. It is based on a bottom-up philosophy and tries to make utmost use of all empirical evidence available in Austria.

Work on the new Austrian model started in 2005 and was made possible by grant 11144 from the Oesterreichische Nationalbank (Austrian National Bank). This phase of the development was finished early in 2007[1]. Bernhard Böhm (University of Technology, Vienna) was the project leader, Josef Richter (University of Innsbruck) the continuous element in the work.

Without the substantial contributions of Clopper Almon and Maurizio Grassini it would have been impossible to get started. Reelika Parve offered so much advice and wrote so many substantial parts of the computer code, that she has to be considered co-author of the project.

2.1 Accounting framework

The disaggregation is by 56 industries and 56 groups of commodities. The clear distinction between industries and commodities is made throughout the entire model.

In final demand three categories of private consumption, two of government consumption and 15 categories of capital formation are distinguished explicitly[2]. Value added is broken down into six components. The details are given in the Annex.

Empirically the starting point for AEIOU is the Austrian input-output table according to the make-use system for the year 2001. The valuation concept takes care of the distinction between basic prices and purchasing prices. This implies that equations for components of final demand must be formulated in purchasing prices and the estimated results transformed into basic prices. This procedure guarantees that trade and transport margins, commodity

[1] In this stage the Institute for Industrial Research, Vienna, provided the organizational background.

[2] The considerations which led to this specific form of disaggregation are described in some detail in Böhm, Richter (2006).

taxes and commodity subsidies are all properly accounted for. Institutional accounts have been aggregated into three sectors: households, enterprises, and government.

AEIOU takes economic data very seriously. Much attention was paid to the theoretical foundations on which the data generating process (and the compilation of the national accounts in particular) are based.

The essential set of product-to-product tables was derived relying on hybrid technology assumptions, but primarily using a slightly modified version of the Almon purification approach (Almon 2000).

Three big steps were needed to arrive at a meaningful product-to-product table. In the first step the standard commodity-technology assumption was applied to identify “problematic areas” in the underlying make-use data set. The non-characteristic output of two industries was found to be the source of many and big negative elements.

For these two productions, input structures were estimated on the basis of a modified industry-technology assumption integrating additional expert information. The isolation of these two sub-industries resulted in modified make and use matrices. In addition, lower bounds were introduced exogenously. The lower bounds were established to make sure that at least a small amount of commodity i for the production of j is “left” after purification. There are a number of commodities such as electricity or telecommunication services for which common sense indicates that some direct input is needed for the production of all commodities. The estimation of the matrix of lower bounds was again based on a kind of industry-technology assumption, starting from the shares of characteristic output in the modified make-table.

In the second step, the Almon approach was applied to this modified dataset. In order to have import matrices consistent with the matrix of total flows recipe matrices were estimated for the matrix of domestic flows and the matrix of imported goods separately. The matrix of total flow was calculated bottom-up. A number of checks helped to arrive at plausible relationships in the value added matrix and the employment matrices in a disaggregation by commodities and in plausible relationships between these two matrices.

In a third and final step the resulting purified value added was modified once again to make sure that the column totals equal the row totals[3].

Because Statistics Austria provided no time series at constant prices of a given base year, such series (base year 2001) had to been calculated starting from chain-linked indices. Unfortunately (and quite surprisingly) Austrian national accounts do not provide price data by groups of commodities (CPA). The only time series for domestic prices can be derived indirectly from the times series of total output in current and the ones at constant prices.

If calculated in a correct way, the "price" of the output of an industry can be seen as the weighted sum of the prices of the commodities produced by this specific industry. In matrix notation the relation can be written as:

(1) $$pdm * C = pind$$

pdm stands for the vector of domestic prices by groups of commodities (CPA) and C is the product-mix matrix derived from the make-matrix V by:

(2) $$C = V' * Outdiag^{-1}$$

by dividing the elements of the transposed make-matrix by the output vector. *Outdiag* stands for the diagonalized output vector by industries.

In the Austrian case time series for output prices *pind* by industries (NACE) were available. They were transformed by using the relations of the C matrix of 2001 by:

(3) $$pdm_t = pind_t * C^{-1}$$

In this process C was assumed to remain constant over time, which is of course a simplification. To have domestic prices by commodities was an important step for the estimation of relative prices and their use in the import share equations.

[3] For a detailed description of the estimation of a consistent set of matrices see Koller (2006).

2.2 Behavioral relationships

At the moment private consumption, capital formation, employment and imports are endogenized by means of econometrically estimated sets of equations. For most of the equations time series covering the period 1976 to 2004 were available. In the following paragraphs a very short description is given for the some of the blocks. For a more detailed version see Böhm, Richter (2006).

Private consumption

Private household consumption of Austrian residents was estimated in a disaggregation by 37 COICOP groups of expenditures. In addition consumption expenditures of Austrian residents abroad (no distinction by commodities) were estimated as a complementary item. The estimation was done in purchasers' prices, the only relevant valuation concept for consumer decisions. The main explanatory variables are:

- Total consumer expenditures including expenditures of Austrian residents abroad;
- Prices of the individual COICOP categories relative to the price of total consumer expenditures;
- Prices of the individual COICOP categories relative to the price of subgroups of competitive consumer expenditures.

The resulting vector of consumer expenditures in purchasers' prices by COICOP categories is then transformed into a vector of consumer expenditures in purchasers' prices by commodities (CPA). In a second step the vector in purchasers' prices is transformed into a vector in producers' prices, allocating the commodity specific trade margins to the three trade commodities (CPA 50 "Trade and repair services of motor vehicles etc," CPA 51 "Wholesale and comm. trade services., ex. of motor vehicles" and CPA 52 "Retail trade services, repair services, ex. of motor vehicles") , five commodities of transport services (CPA 60 and 61 "Land and water transport and transport via pipeline services", CPA 62 "Air transport services", CPA 63 "Supporting transport services and travel agency services", CPA 64 "Post and telecommunication services" and CPA 66 "Insurance and pension funding services" because of transport related insurance) commodity taxes and commodity subsidies, compatible with the valuation concept of the basic input-output identities.

Capital formation

For each of the 15 categories of capital formation mentioned before a specific investment equation was estimated. The main explanatory variables are:

- Total output of the investing industry (or groups of industries);
- User costs of capital;
- Output prices.

The resulting global demand for investment is then split up into commodity specific demand (valued at purchasers' prices) using 15 specific bridge matrices. Then six different valuation transformation matrices (for equipment, vehicles, etc.) are applied to arrive at a valuation in producers' prices.

Exports of merchandise goods

The future demand for exports from Austria for the 29 commodity groups (CPA) of merchandise exports[4] was directly taken from the BTM results after aggregating the available 120 BTM categories (see Chapter 3).

The valuation of merchandise exports is the same as in the foreign trade statistics. A specific transformation matrix is applied to arrive at a valuation in producers' prices.

Exports of other commodities (services)

The (very small) statistical discrepancies between foreign trade statistics and the base tables were allocated to exports of services.

Calculation starts from an exogenously given total which is disaggregated by means of a specific bridge matrix in order to arrive at the commodity detail in producers' prices.

[4] In fact there are only 28 groups of merchandise exports, since there are no merchandise esxports of "Recovered secondary raw materials".

Imports of merchandise goods

As already mentioned, a distinction is made between merchandise imports and imports of services. The 29 commodity groups of merchandise imports are modelled with the help of 27[5] import share equations.

In order to integrate AEIOU as quickly as possible into the international consortium of INFORUM models, imports by groups of commodities are modelled in a way which is already used in many INFORUM models. The basic consideration behind this approach is to model the development of the import share (the share of imports in total demand) as a function of relative prices (prices of imported goods\prices of domestic goods) and a specific trend, called the "Nyhus-trend" (Nyhus, Wang 1996).

In a later stage a more detailed approach could be considered in analogy to the procedure already chosen in previous Austrian INFORUM models (Richter 1991). In this approach, use is made of the information contained in the detailed import matrices for intermediate demand and final use.

The import shares imps (i) of commodity group i (CPA) are defined as:

(4) $$imps_i = \frac{imp_i}{Supply_i + imp_i}$$

The standard specification of the import share equations is:

(5) $$imps_i = f\left(\frac{pim_i}{pdm_i}, NT_i\right)$$

NT (i) stands for the logistic Nyhus-trend.

In a few cases, soft constraints were added into the estimation process of the parameters. For some commodity groups it was necessary to fix the level of domestic output and to treat import demand as a residual. This approach was chosen for the following commodity groups: CPA 10 "Coal and ores", CPA 11 + CPA 13 "Crude oil" and CPA 30 "Office machinery and

[5] Only 27 import equations because there are no merchandise imports of "Recovered secondary raw materials" and import of electricity is treated exogenously.

computers". In all three cases the import share imps (i) as defined in equation (4) is 80% or even more. Domestic production in Austria is very low and there are obvious capacity constraints. All additional domestic demand has to be met by imports.

In accordance with the domestic concept of the input-output table, consumer expenditures of Austrians abroad are not treated as imports. They are part of the consumption model, but do not show up in the input-output accounting framework in their commodity detail.

Imports of other commodities (services)

The (very small) statistical discrepancies between foreign trade statistics and the base tables were again aggregated with imports of services.

The exogenously given total is disaggregated by means of a specific bridge matrix in order to arrive at the commodity detail in producers' prices.

Since domestic supply is a function of the technology matrix A and final demand minus imports, imports and supply have to be calculated simultaneously. The standard INFORUM software offers a version of the Seidel process that computes in an iterative way imports simultaneously with supply (Almon 1996).

2.3 Major deficits

In its present stage many components of final demand are already explained by econometrically estimated equations. Only total expenditures of tourists in Austria, total consumption of private non profit organization, total government consumption, inventory changes, and exports of services and imports of services are treated exogenously. These exogenous assumptions can easily be replaced by either simple global behavioral equations or sets of equations on the level of commodity detail.

Some work has been devoted to the estimation of a simple accountant to link private consumer expenditures of Austrian households to the income generated in the various industries, taking the process of redistribution of income into account. A lot of work remains to be done in this respect.

What has not yet been implemented is the price side of the model although some steps in order to arrive at a well elaborated price model have however already been taken. The estimation of wage equations by industries is the most important one in this context.

At the moment domestic prices are treated exogenously. Future prices are based on simple trend extrapolations. The lack of a price model and the absence of other relevant variables like investment by industries or capital stock by industries are the main reasons, why it was by far too early to consider full linking with the help of the BTM model.

3 Adapting the BTM Scenario

3.1 Bridge BTM classification – European Standard Product Classification CPA

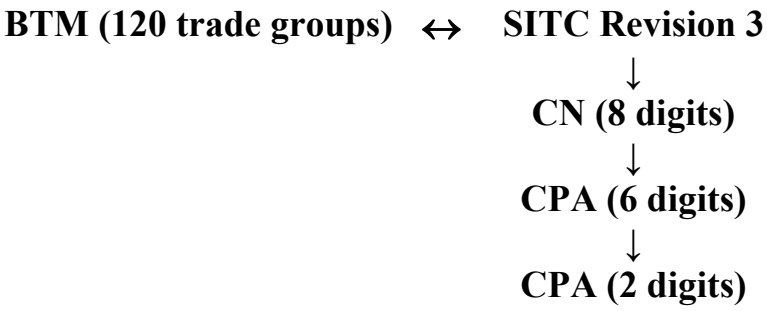
The Bilateral Trade Model of INFORUM has its own "special" classification where products classified according to the United Nation's SITC (Standard International Trade Classification) Revision 3 are aggregated into 120 groups of products using Q.Ma's (Ma, 1996) scheme. This kind of disaggregation is suitable to make trade analysis at commodity level, but as this information had to be linked to an EU country model based on the European standard classification, CPA (Classification of Products by Activity) with "only" 60 groups of merchandises and services,[6] we had to aggregate 120 trade groups in some reasonable way providing a concordance between BTM trade groups and CPA.

Given that no correspondence table exists between Ma's classification and European Union's CPA, we had to produce it by ourselves going through several steps. As already mentioned the BTM uses Statistics Canada trade data classified by SITC. So the first step was quite natural one: the Ma's table on the "Concordance between Trade Sector and SITC Revision 3" was used to find out a corresponding CN (Combined Nomenclature) code for each single

[6] A half of these commodity groups concerns goods.

commodity code by SITC Rev.3. As the second stage, the conversion table between CN and CPA permitted us to obtain the definitive table at desired aggregation level.[7]

Figure 1 – Aggregation Scheme



The only major problem involved was that no direct correspondence in the BTM classification was found for CPA 37 "Secondary raw materials" (commodity group 28 in AEIOU). This group includes the following goods:

- CPA 371010 Metal secondary raw materials;
- CPA 371020 Ship-breaking services;
- CPA 372010 Non-metal secondary raw materials.

With the exception of the second one (CPA 371020 ↔ BTM103 "Shipbuilding and repairing") no correspondence was found.

The export forecast and prices for the AEIOU come from the BTM run of last September called "BAH base"[8].

Goods

Exports and imports of goods are aggregated according to the correspondence table BTM120-CPA60 in order to get 29 product groups instead of the original 120. In the Austrian model, there are 29 commodity groups instead of the usual 32:

[7] These last two correspondence tables are available on the Eurostat's Metadata Server, RAMON: http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL.

[8] BAH stands for "Booze Hallen Hamilton.

- CPA 11 “Crude petroleum and natural gas”, CPA 12 “Uranium and thorium ores”, CPA 13 “Metal ores” are aggregated into one group;
- CPA 05 “Fish products” are added to CPA 01 “Products of agriculture”, as the fish products do not represent a relevant order of magnitude in the Austrian economy.

Prices

In order to get import prices, the first step was to calculate nominal and real values for the 29 CPA groups we were interested in. It means that, as the forecasts are expressed in constant USD, we had to calculate nominal values of the traded goods at detailed level by multiplying each BTM commodity group by its price as follows:[9]

```
f nomi1 = b.aum1*b.maup1+b.aum2*b.maup2+b.aum3*b.maup3+b.aum4*b.maup4+
          b.aum5*b.maup5+b.aum6*b.maup6+b.aum7*b.maup7+b.aum8*b.maup8+b.aum1
          0*b.maup10
f real1 = b.aum1+b.aum2+b.aum3+b.aum4+b.aum5+b.aum6+b.aum7+b.aum8+ b.aum10
f price = nomi1/real1
…
```

where *aum* stands for Austrian Imports by commodity group and *maup* is import price index by commodity group.

4 Linking AEIOU as a satellite to BTM. Necessary adaptations and indexing

As already mentioned in the introduction, the “satellite status” is characterized by the fact that information on demand for Austrian exports and on Austrian import prices are derived from the BTM system, without considering any feedback from the Austrian economy to the BTM system. The following paragraphs describe the technical aspects of this linking process.

[9] For the sake of brevity, only the aggregation for the first AEIOU sector is reported.

4.1 Merchandise exports

The BTM forecast, expressed in constant USD, in order to be introduced into the Austrian model, was indexed. As the last year for foreign trade data is 2004 the index was constructed dividing all the forecasted trade flows by the last available year's value.

The time series for Austrian exports in constant US $ from the adapted BTM run were indexed to 2004 = 1. 2004 is the last year for which historical data for Austrian exports by CPA categories is available in the Hist bank. The indices were then linked to the historical series and led directly to exogenous estimates for Austrian exports by CPA categories.

Indexing

```
# calculate the index base year 2004:
gdates 1980 2025
# Merchandise exports:
vr 0 1 1.5 2.0 3.5 7
do {
ti Exports: Index 2004=1
f expind%1 = a.atx%1/a.atx%1{2004}
gr expind%1 }(1-29(28))
```

Extending

```
fdates 2004 2015
vam C:\aeiou\model\hist b
dvam b
do {vf expg%1 = expind%1*expg%1{2004}}(1-29(28))
```

4.2 Merchandise Imports

Merchandise imports were estimated on the basis of the import share equations mentioned above. The time series for the import prices pim (i) for the forecasting period were again derived from the BTM simulation. Because import prices in the BTM are expressed in US $ whereas the import prices in the Austrian model are expressed in EURO, an adaptation for the exchange rate US $ / EURO became necessary. After this adjustment, the series for import

prices were again indexed to 2004 = 1. and linked to the historical time series for Austrian import prices.

With the exception of the exchange rate adaptation, the procedure was analogous to the one for merchandise exports.

5 Is the assumption of a one – way dependency justified? Empirical evidence from the BTM

5.1 The case of Austria

The omission of feedback effects can be justified if a pronounced one-way dependency can be assumed, i.e. if Austrian exports are dependent on import demand of the countries in the BTM system, whereas the exports of no country in the BTM system are dependent on Austrian import demand in a significant way. The same one-way dependency should be given with respect to prices.

Empirical evidence can be derived from the data in the BTM system to illustrate to which extent this set of assumptions is acceptable. The first way for doing this is just looking at the Austrian shares in the imports in countries included in the BTM system. In order to investigate the Austrian market shares, the latest BTM forecast was aggregated into 29 CPA merchandise categories.

The only two countries where Austrian goods play a significant role are Germany and Italy. But even in this case we have to bear in mind that the Austrian share in their home market is likely to be very small, of course with some exemptions. Two product groups where Austria appears to be a relevant trading partner are CPA 02 “Products of forestry” and CPA 20 “Wood and Wood products”.

Figure 2 – The share of Austria on the Italian and German markets of Forestry products (CPA 02).

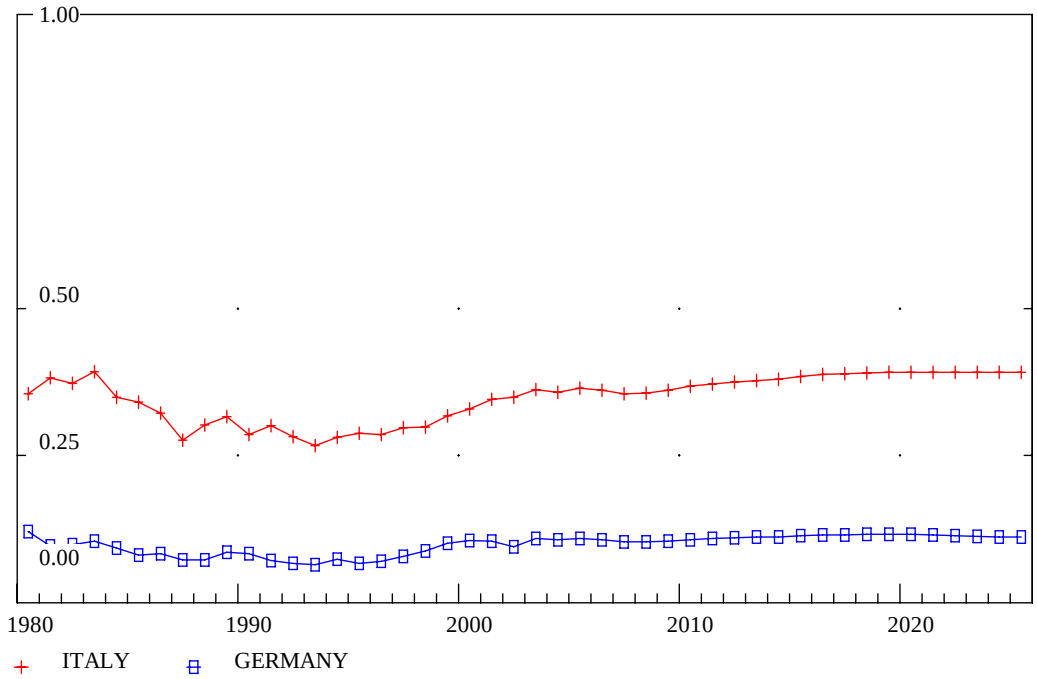
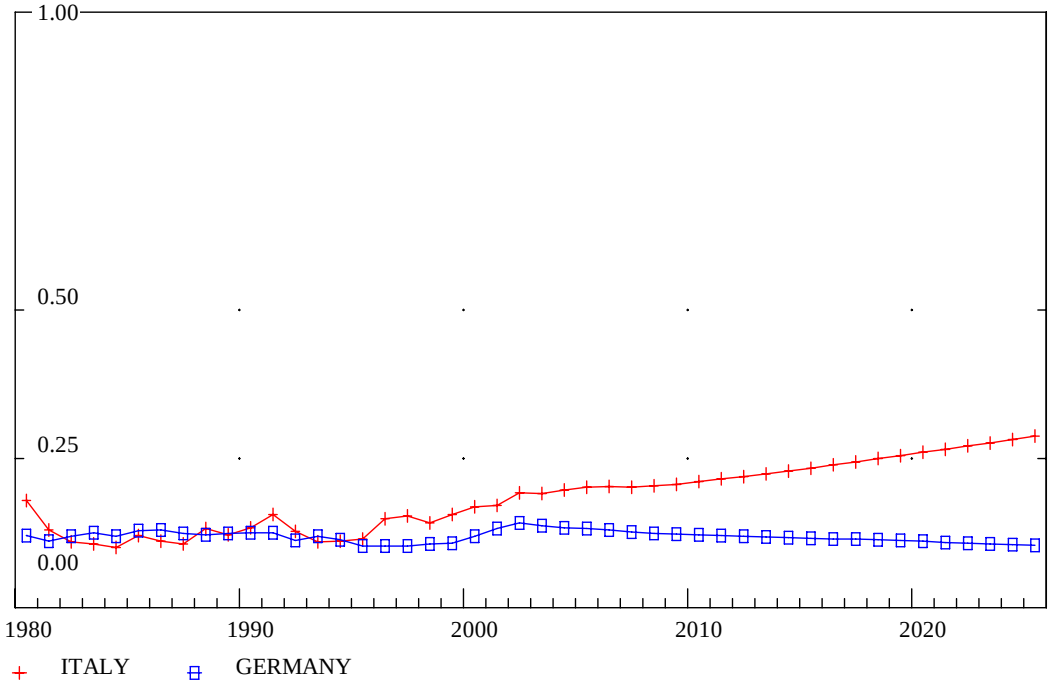


Figure 3 – The share of Austria on the Italian and German markets of Wood and Wood products (CPA 20).



For some other products only Germany seems to be an important destination for Austrian goods: CPA 21 “Pulp, paper and paper products”, CPA 22 “Printed matter and recorded media”, CPA 40 “Electrical energy”. As can be seen from Table 1 from an Austrian perspective the shares of these commodity groups in total exports are quite low.

Table 1 The most important commodity groups of Austrian exports 2001 seen from the perspective of imports in countries included in the BTM system

CPA		Share in total Austrian exports in %
02	Products of forestry	0,11
20	Wood and products of wood	3,34
21	Pulp, paper and paper products	4,88
22	Printed matter and recorded media	2,08
40	Electrical energy	1,25

Another important aspect is that the production of forestry products and the production of wood and products of wood are primarily based on inputs produced in Austria, i.e. the total import content of these commodities is very low. Consequently, any increase or decrease in exports of these commodities only will lead to a very small change in the import demand of Austria, which therefore can be neglected.

On the other hand, the most important commodity groups for Austrian exports (see Table 2) play only a little role seen from the perspective of the importing countries represented in the BTM system.

Table 2 The most important commodity groups of Austrian exports 2001

CPA		Share in total Austrian exports in %
29	Machinery and equipment n..c.	13,76
34	Motor vehicles, trailers and semi-trailers	13,40
24	Chemicals, chemical products	8,78
27	Basic metals	7,38
32	Radio, TV and communication equipment	6,70

The production of these commodities in Austria relies on imported inputs considerably; the total import content of machinery and vehicles is very high. Any change in the export performance of these commodities will thus – in reality – lead to a change in the Austrian import demand from countries represented in the BTM system. The Austrian share in import demand of vehicles of the countries in the BTM system (see Figure 5) is quite low, so no big distortions must be expected. More serious effects can result in the case of machinery. As might be seen from Figure 4 Austria is one of the most important German trading partners (after Italy) with a market share approximately equal to 10%. In all the other BTM countries, the Austrian share appears to be low. The omission of feedback effects of the Austrian-German trade in machinery may cause serious limitations for the use of the Austrian model especially for some specific kinds of policy simulations.

Figure 4 – The share of Austria on the Italian and German markets of Machinery and Equipment (CPA 29).

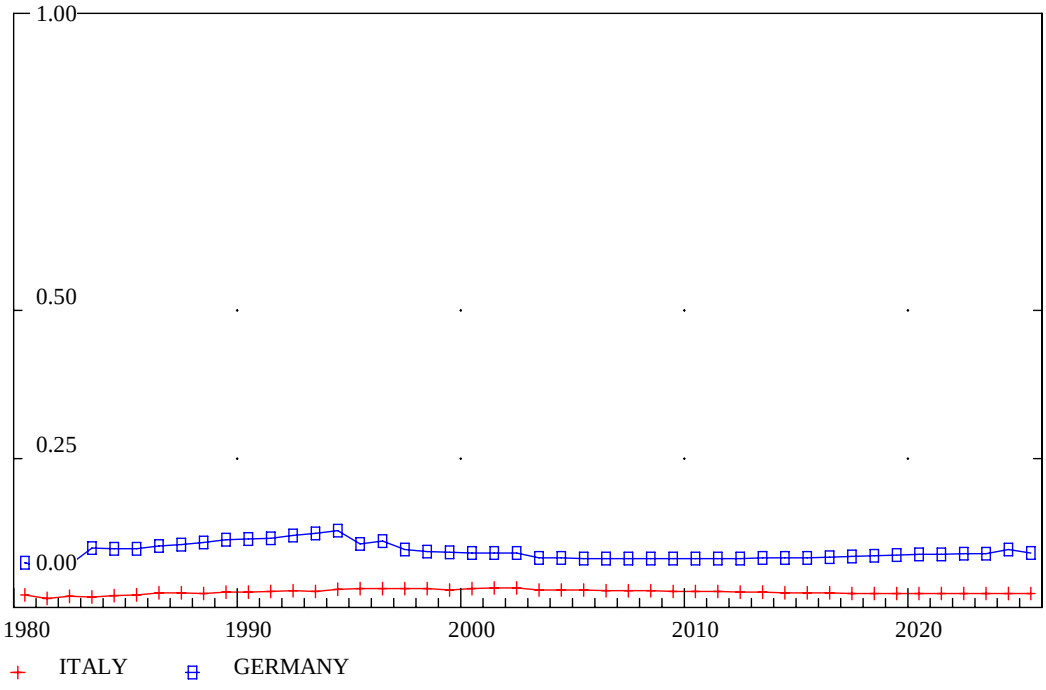
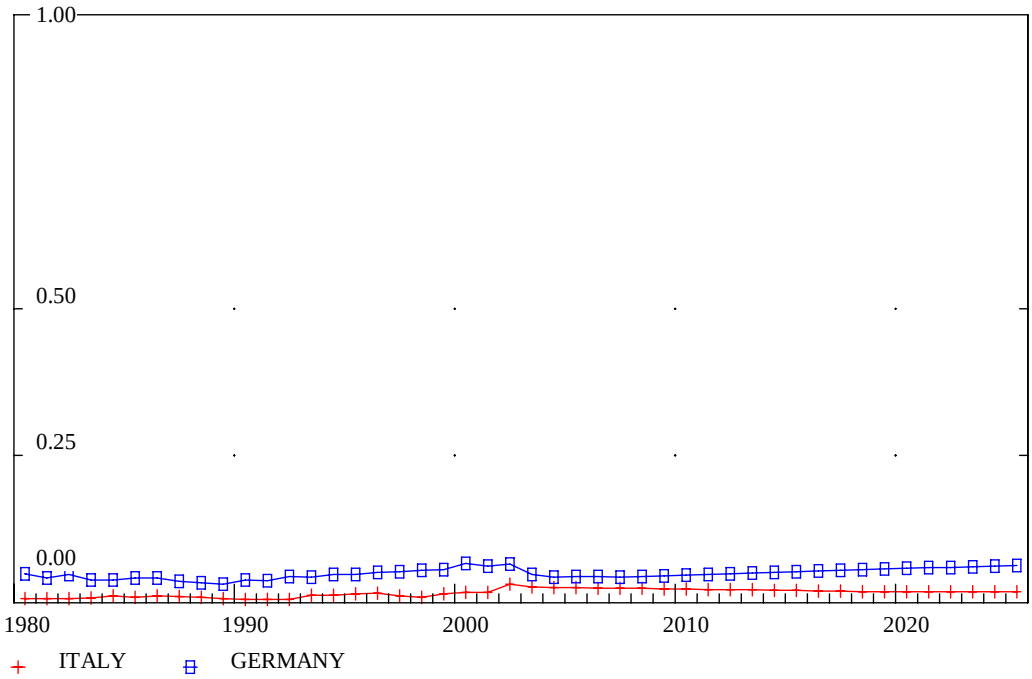


Figure 5 – The share of Austria on the Italian and German markets of Vehicles (CPA 34).



To conclude, it seems that the only countries able to "distort" to some amount our results because of the lack of any feedback from other countries are, mainly, Germany and, to some extent also Italy. The size of these distortions produced by lacked consideration of changes in foreign demand depends clearly on the pattern of Austrian specialization, i.e. whether or not those merchandises absorb a significant amount of the Austrian total foreign trade.

5.2 The case of other small countries

The satellite approach can fruitfully be adopted for other small countries, like Estonia, Latvia, Poland as well as other new European Union member States, which are able to influence the global trade even less than Austria. Please note that the following empirical examples come from the bilateral trade database for the European Union while the forecasts for Austria are taken from BTM. For a detailed description see Grassini, Parve (2006).

For example, we can look at Estonia[10] and observe its market shares in the countries of BTM system. As Estonian exports are primarily oriented to the European Unions' markets, we can ignore US and other extra-European countries. Currently, Estonian market shares do not reach 1 per cent in any EU country of BTM system, with the exception of CPA 20 "Wood and wood products" which account for approximately 3 per cent in Denmark (see Tables 4a-4e).[11] Latvia faces almost the same situation.

Table 3 – Estonian 5 most important export articles (by CPA, in % on total merchandise exports)

32	Radio, TV and communication equipment	26,0
20	Wood and products of wood	10,5
15	Food products and beverages	8,1
17	Textiles	6,9
18	Wearing apparel; furs	6,9
	Total	**58,4**

[10] Last May, the model for Estonia was updated with the base year 2000. It's current stage is definitely more infant than the present version of AEIOU. It was built up starting from the TINY and using the software with optimizing option. The data situation in Estonia is certainly better as in Latvia, even if some time series are still missing (private consumption at constant prices, output at constant prices) and some other series are extremely short. However, there is good chance to improve the current version thanks to a partnership with a Central Banks team working on some special issues, like labor demand and so on.

[11] Main trading partners of Estonia are Finland and Sweden.

Table 4 - Estonian market shares for its most important export articles in the BTM European countries (%).

a) CPA 32 – Radio- TV and Telecommunication Equipment

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	0,001	0,000	0,000	0,001	0,003	0,000	0,001	0,016	0,041	0,005	0,003
be	0,000	0,000	0,000	0,012	0,000	0,000	0,005	0,002	0,029	0,007	0,018
de	0,001	0,010	0,017	0,009	0,085	0,213	0,040	0,150	0,222	0,199	0,105
dk	0,028	0,045	0,035	0,027	0,033	0,050	0,051	0,052	0,021	0,041	0,042
es	0,000	0,000	0,000	0,000	0,041	0,029	0,002	0,000	0,006	0,003	0,008
fr	0,000	0,000	0,004	0,002	0,000	0,004	0,005	0,003	0,039	0,002	0,000
gb	0,000	0,000	0,001	0,004	0,003	0,008	0,028	0,006	0,018	0,023	0,006
it	0,000	0,000	0,000	0,002	0,000	0,007	0,000	0,000	0,017	0,005	0,001

b) CPA 20 – Wood and Wood products

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	0,047	0,023	0,035	0,025	0,009	0,026	0,052	0,128	0,176	0,120	0,082
be	0,004	0,089	0,082	0,117	0,245	0,214	0,233	0,193	0,188	0,240	0,269
de	0,340	0,378	0,397	0,375	0,563	0,579	0,684	0,843	1,005	0,876	0,844
dk	0,449	1,082	2,202	1,583	1,744	2,249	2,914	2,799	3,281	3,088	2,743
es	0,000	0,000	0,012	0,060	0,025	0,079	0,084	0,099	0,123	0,147	0,187
fr	0,051	0,115	0,186	0,220	0,229	0,203	0,173	0,236	0,252	0,222	0,153
gb	0,416	0,361	0,346	0,347	0,327	0,245	0,272	0,335	0,295	0,403	0,552
it	0,110	0,148	0,334	0,357	0,386	0,234	0,285	0,326	0,419	0,316	0,343

c) CPA 15 – Food and beverages

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	0,002	0,001	0,001	0,000	0,002	0,004	0,007	0,015	0,010	0,020	0,017
be	0,001	0,002	0,008	0,007	0,006	0,011	0,003	0,010	0,010	0,050	0,007
de	0,013	0,013	0,035	0,028	0,024	0,042	0,054	0,093	0,136	0,096	0,109
dk	0,030	0,052	0,043	0,040	0,110	0,153	0,162	0,177	0,173	0,181	0,165
es	0,000	0,000	0,000	0,000	0,000	0,007	0,013	0,026	0,015	0,034	0,019
fr	0,002	0,003	0,007	0,005	0,005	0,008	0,013	0,010	0,014	0,037	0,021
gb	0,002	0,001	0,013	0,016	0,003	0,000	0,003	0,001	0,004	0,001	0,015
it	0,000	0,000	0,000	0,001	0,000	0,001	0,002	0,001	0,002	0,024	0,048

d) CPA 17 – Textiles

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	0,000	0,000	0,005	0,026	0,052	0,118	0,086	0,060	0,096	0,091	0,064
be	0,089	0,242	0,299	0,215	0,136	0,190	0,172	0,143	0,121	0,126	0,100
de	0,109	0,157	0,182	0,215	0,233	0,273	0,309	0,336	0,389	0,263	0,218
dk	0,212	0,310	0,402	0,364	0,383	0,482	0,682	0,685	0,734	0,617	0,547
es	0,003	0,016	0,081	0,039	0,024	0,042	0,019	0,151	0,055	0,017	0,013
fr	0,010	0,027	0,077	0,076	0,059	0,058	0,051	0,039	0,047	0,097	0,118
gb	0,066	0,133	0,164	0,237	0,299	0,449	0,594	0,632	0,528	0,397	0,356
it	0,037	0,080	0,080	0,073	0,078	0,121	0,151	0,173	0,213	0,153	0,069

e) CPA 18 – Wearing apparel

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	0,001	0,007	0,014	0,056	0,015	0,008	0,009	0,008	0,006	0,013	0,014
be	0,001	0,001	0,000	0,001	0,000	0,001	0,000	0,000	0,000	0,001	0,000
de	0,058	0,052	0,047	0,033	0,027	0,038	0,049	0,056	0,074	0,059	0,046
dk	0,024	0,017	0,022	0,078	0,111	0,166	0,237	0,204	0,252	0,169	0,101
es	0,000	0,000	0,000	0,001	0,000	0,002	0,000	0,000	0,000	0,000	0,000
fr	0,000	0,000	0,000	0,004	0,000	0,001	0,001	0,000	0,000	0,002	0,002
gb	0,006	0,016	0,022	0,023	0,017	0,028	0,038	0,037	0,041	0,034	0,018
it	0,006	0,018	0,008	0,015	0,022	0,023	0,022	0,017	0,033	0,015	0,004

The case of Poland (see Tables 5 and 6a-6d) is somewhat different: in a number of product groups (Coal, Textiles) Poland appears to be a relevant trade partner for several European BTM countries: for example about 20 per cent of German total coal imports come from Poland. In some trading groups country-specific relationship can be found: for instance this is the case of Polish-Italian intensive trade activity in the commodity group CPA 34 "Motor vehicles" due to industry specific investments[12]. Similarly to Austria, the main source of distortion becomes the omission of Polish-German trade relations. However, even in this case, a "satellite approach" can be a useful starting-point for a country-model construction and first simulation exercises.

Table 5 – The 5 most important export articles in Poland, in 2000 (by CPA; % on total exports of merchandises)

34	Motor vehicles, trailers and semi-trailers	11,9
27	Basic metals	8,4
15	Food products and beverages	7,1
36	Furniture; other manufactured goods n.e.c.	7,0
17	Textiles	6,5
	Total	**40,9**

[12] FIAT, Italian Automobile industry, invested a lot in Polish automobile sector: and as a matter of fact, some types of FIAT cars are now produced only in Poland ("new" Panda, Fiat500).

Table 6 - Polish market shares in the European BTM countries (%).

a) CPA 02 – Forestry

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	2,42	2,59	2,00	1,80	1,54	1,95	1,87	3,51	4,75	4,16	2,90
be	1,60	1,07	1,10	1,09	0,97	1,02	1,11	1,43	1,94	1,92	2,01
de	6,77	5,70	5,96	6,10	6,05	5,63	5,56	5,82	7,26	5,84	4,38
dk	3,06	1,85	1,73	2,02	2,08	1,75	2,12	2,40	3,13	3,25	3,76
es	0,33	0,45	0,59	0,47	0,81	1,19	1,04	1,54	1,61	1,32	1,60
fr	0,29	0,41	0,32	0,40	0,61	0,91	0,92	0,89	0,78	0,88	0,93
gb	0,45	0,10	0,26	0,17	0,17	0,19	0,16	0,21	0,35	0,43	0,50
it	0,80	1,13	1,12	1,20	1,23	1,22	0,98	0,91	1,01	0,83	0,95

b) CPA 10 – Coal, lignite; peat

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	29,25	32,56	41,82	43,93	44,09	49,18	50,95	50,48	46,94	51,80	43,12
be	2,85	2,60	1,76	2,41	1,85	0,99	3,28	3,50	0,20	3,14	3,91
de	16,28	15,95	16,17	16,91	19,89	19,39	22,41	19,91	20,22	17,62	17,75
dk	24,84	20,98	19,16	30,68	35,29	33,49	29,99	35,23	8,83	10,70	10,56
es	0,45	0,47	2,52	2,18	2,68	1,44	1,56	1,21	0,19	1,15	0,96
fr	4,72	6,58	5,06	8,29	3,94	4,93	3,43	3,81	2,51	2,64	4,68
gb	7,65	1,32	1,76	0,71	3,27	4,32	3,62	4,80	4,65	3,05	1,53
it	1,53	1,09	1,15	0,72	2,19	4,03	1,20	2,42	0,26	0,01	2,11

c) CPA 20 – Wood and wood products

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	1,71	1,57	1,61	1,58	2,19	3,25	3,96	4,86	5,49	4,03	3,03
be	2,70	2,69	2,76	2,76	2,78	2,74	3,04	3,47	4,67	4,25	3,52
de	9,65	9,90	10,89	11,81	13,33	13,07	14,35	14,69	16,03	12,97	11,02
dk	5,77	5,00	4,23	4,44	6,17	5,97	6,14	8,35	9,32	9,43	9,85
es	0,32	0,72	1,09	1,11	1,47	1,28	1,33	2,19	2,53	2,97	3,49
fr	2,13	2,15	2,54	2,74	3,01	3,41	3,23	3,57	3,51	3,68	5,45
gb	0,79	1,09	1,26	1,79	2,33	2,63	2,68	2,81	2,76	3,25	3,40
it	1,01	1,15	1,41	1,84	2,36	2,06	1,91	1,79	1,95	2,12	2,59

d) CPA 36 – Furniture; Other manufactured goods n.e.c.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
at	1,36	1,41	1,35	1,35	1,54	1,50	1,59	1,94	2,32	1,86	1,63
be	0,11	0,18	0,30	0,40	0,49	0,68	1,11	1,08	1,22	0,94	0,99
de	5,27	5,34	5,69	5,90	6,96	3,52	7,81	7,93	9,33	8,77	7,83
dk	1,87	1,94	2,28	3,03	2,66	3,15	4,54	3,11	3,45	2,71	3,02
es	0,71	0,26	0,39	0,34	0,28	0,19	0,22	0,37	0,50	0,65	0,66
fr	0,51	0,56	0,75	0,72	0,82	0,82	1,01	1,78	2,17	2,47	3,12
gb	0,17	0,18	0,20	0,20	0,30	0,39	0,59	0,76	0,98	1,17	1,13
it	0,33	0,29	0,34	0,34	0,45	0,49	0,47	0,55	0,75	0,51	0,75

6 Conclusions

This paper gives a short description on how the Austrian INFORUM model AEIOU in its early stage of development was linked to the BTM system as a satellite. It also raises the question whether the assumption of a one-way dependency which is the central idea behind the satellite approach can be justified.

The answer to the latter question will depend on whether we have the results of the entire BTM system in mind or the results of the satellite model. Seen from the perspective of the BTM system the omission of feedback effects from countries of the size and the export structure of Austria seem to be quite acceptable. The distortions will be very small in size and limited to few commodity groups.

Seen from the perspective of the national model, the satellite approach can also be fully justified if the model is used for what might be called a "standard forecasting exercise". In such a situation the BTM results provide a perfect background scenario. Exports can be modelled as a direct function of the imports of other countries, import prices also can be taken from the system. Since these estimates are coming from the BTM, they are mutually consistent.

Limitations may occur in the case of policy simulations on the national level. On the one hand, the satellite status provides a lot of flexibility. "As soon as the results of the BTM are available the satellite can stand alone" (Richter 1991, p.71). A whole range of very useful scenarios can be calculated without the necessity to run the entire system.

The following policy analysis can be seen as a good example of such a simulation. In 2007 AEIOU was used to asses the impact of a moderate shift in public expenditure from general government (technical speaking from public consumption – collective consumption) to more health related public expenditures (technical speaking to public consumption – individual consumption). The fact that the model is still a stand-alone model does probably do no harm to a policy analysis of this kind.

On the other hand, a policy simulation assuming effects on the prices of domestic production and thus changes in the competitive position of the various tradable commodities in the domestic and international markets cannot be carried out without considerable loss of

consistency. In such a simulation important feedback effects are ignored. Analyses of this type require a fully integrated system.

The evaluation of the EU enlargement effects on Italy with a stand-alone model and with the full system has clearly shown the shortcomings of a satellite approach for this kind of policy simulations. In two studies by Bardazzi and Grassini (2003, 2004) the effect of the direct Italy-CEEC relationship with regard to trade with Italy and the influence on Italy obtained from the more significant impact of the EU15-CEEC trade were compared.

In the first case, two countries, Italy and the CEEC were considered; in the second one, there were two countries – EU15 and CEEC –, with Italy constituting a single region of the EU. This second alternative permitted to measure the indirect effect of the Eastern European enlargement on Italy. Furthermore, there was a third option where the trend in the composition of the CEEC imports was taken into account. This experiment provided evidence that in the case of Italy – which whilst it is not on the Eastern EU border is nevertheless not far from it – the indirect impact on the GDP growth rate resulted to be even more important than the direct one. The transmission of the increase generated by enlargement appeared to be as important as the direct trade with the new entrants. Since the effect of the rising exports induced by a growing demand for goods by the CEEC was preserved along the simulation period, it was shown that the increase was doubled by the indirect effect and that the specialization in CEEC imports generated a further increase in the GDP rate of growth; so that, the total increase amounted to a factor of circa 2.6 with respect to that found in the case of Italy-CEEC.

Generally speaking the satellite approach is only acceptable if a clear asymmetry in the degree of dependency is given: that is to say when the country under consideration is heavily dependent on demand and prices from the rest of the world (as represented by the BTM) whereas the rest of the world is not dependent on the demand and the prices of the country under consideration. This asymmetry or one-way-dependency has to exist on the level of all industries/commodity groups distinguished.

In any case the satellite status of a model always will not be more than a second best solution: it can be suggested if feedback effects can be ignored like in the case of Austria and if the state of development of the model does not allow a full integration, i.e. if the price side of the model is missing and if the model does not produce investment and capital stock by industries.

Linking a model as a satellite thus seems to be a recommendable general strategy for models for small countries in an early stage of development.

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Annex

Table 1 Commodity classification of AEIOU

	CPA	
1	01, 05	Products of agriculture and fishing
2	02	Products of forestry
3	10	Coal and lignite
4	11, 13	Crude petroleum, natural gas, metal ores
5	14	Other mining and quarrying products
6	15	Food products and beverages
7	16	Tobacco products
8	17	Textiles
9	18	Wearing apparel, furs
10	19	Leather and leather products
11	20	Wood and products of wood
12	21	Pulp, paper and paper products
13	22	Printed matter and recorded media
14	23	Coke, refined petroleum products
15	24	Chemicals, chemical products
16	25	Rubber and plastic products
17	26	Other non-metallic mineral products
18	27	Basic metals
19	28	Fabricated metal products
20	29	Machinery and equipment n..c.
21	30	Office machinery and computers
22	31	Electrical machinery and apparatus
23	32	Radio, TV and communication equipment
24	33	Med., precision, opt. instruments, watches, clocks
25	34	Motor vehicles, trailers and semi-trailers
26	35	Other transport equipment
27	36	Furniture other manufactured goods n..c.
28	37	Recovered secondary raw materials
29	40.1	Electrical energy
30	40.2, 40.3	Gas, steam and hot water
31	41	Water, distribution services of water
32	45	Construction work
33	50	Trade and repair services of motor vehicles etc.
34	51	Wholesale and comm. trade serv., ex. of motor vehicles
35	52	Retail trade serv., repair serv., ex. of motor vehicles
36	55	Hotel and restaurant services
37	60, 61	Land and water transport and transport via pipeline services
38	62	Air transport services
39	63	Supporting transport services travel agency services
40	64	Post and telecommunication services
41	65	Financial intermediation services (ex. insurance serv.)
42	66	Insurance and pension funding services
43	67	Services auxiliary to financial intermediation
44	70	Real estate services
45	71	Renting services of machinery and equipment
46	72	Computer and related services
47	73	Research and development services
48	74	Other business services
49	75	Public administration services etc.
50	80	Education services
51	85	Health and social work services
52	90	Sewage and refuse disposal services etc.
53	91	Membership organisation services n.e.c.
54	92	Recreational, cultural and sporting services
55	93	Other services
56	95	Private households with employed persons
57		Commodity taxes
58		Commodity subsidies

Table 2 Final demand

Private Consumer Expenditures (PCE)
- Nationals (Austrian in Austria)
- Foreigners (Tourism)
- Private non profit institutions

Public consumption
- Individual Consumption
- Collective Consumption

Capital formation
- Residential buildings
- Other buildings
- Machinery and equipment by activities NACE 01 to 37, NACE 45 (agriculture, manufacturing, construction)
- Machinery and equipment by activities NACE 40 and 41 (utilities)
- Machinery and equipment by activities NACE 50 to 55 (trade, hotel, restaurants)
- Machinery and equipment by activities NACE 60 to 65 (transportation)
- Machinery and equipment by other activities
- Transportation equipment by activities NACE 01 to 05 (agriculture, forestry)
- Transportation equipment by activities NACE 10 to 55 (manufacturing, trade)
- Transportation equipment by activities NACE 60 + 61 (transportation land, water)
- Transportation equipment by activities NACE 61 + 62 (transportation air)
- Transportation equipment by other activities
- Productive livestock
- Intangible fixed assets by NACE 92
- Intangible fixed assets by all other activities

Other final demand
- Acquisitions less disposals of valuables
- Changes in inventories

- Exports, merchandise goods
- Exports, services

- Imports, merchandise goods
- Imports, services

Table 3 Value added

- Compensation of Employees
- Social Security Contributions of employers
- Other Taxes on Production
- Other Subsidies on Production
- Depreciations
- Operating Surplus, net

Table 4 AEIOU commodity groups covered by BTM forecast (sec.ttl)

01AgricF	; 1	"Products of agriculture and fishing"
02Forest	; 2	"Products of forestry"
10CoalLP	; 3	"Coal and lignite; peat"
11CruOre	; 4	"Crude petroleum, natural gas, metal ores (1)"
14MinQua	; 5	"Other mining and quarrying products"
15FoodBe	; 6	"Food products and beverages"
16Tobacc;	; 7	"Tobacco products"
17Textil	; 8	"Textiles"
18Appar	; 9	"Wearing apparel; furs"
19Leather	; 10	"Leather and leather products"
20Wood	; 11	"Wood and products of wood"
21Paper	; 12	"Pulp, paper and paper products"
22PrintM	; 13	"Printed matter and recorded media"
23RefPet	; 14	"Coke, refined petroleum products"
24Chem	; 15	"Chemicals, chemical products"
25RubbPl	; 16	"Rubber and plastic products"
26GlassC	; 17	"Other non-metallic mineral products"
27BasMet	; 18	"Basic metals"
28MetPrd	; 19	"Fabricated metal products"
29MachEq	; 20	"Machinery and equipment n.e.c."
30OfMach	; 21	"Office machinery and computers"
31ElecMA	; 22	"Electrical machinery and apparatus"
32RadCEq	; 23	"Radio, TV and communication equipment"
33MedIns	; 24	"Med., precision, opt. instruments; watches, clocks"
34MotVeh	; 25	"Motor vehicles, trailers and semi-trailers"
35OthTra	; 26	"Other transport equipment"
36FurOth	; 27	"Furniture; other manufactured goods n.e.c."
37Recov	; 28	"Recovered secondary raw materials"
40Elec	; 29	"Electrical energy"