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OUTSOURCING, COMPETITIVENESS AND EMPLOYMENT

EFFECTS MAPPED WITH A SECTOR MODEL OF AUSTRIAN MANUFACTURING

Starting off with the opening of the East – and accelerating with the prospective Eastern enlargement – the movement to shift production stages to Eastern Europe ("outsourcing") has been playing a crucial part in Austria's trade with Eastern Europe. The process is mapped here by way of a decline in costs for imported intermediate inputs ("import price shock" in a sector model of Austrian manufacturing. According to the theory of international trade, outsourcing (like factor-saving technological progress) curtails employment, yet at the same time also boosts both output and employment, through its cost-cutting effect.

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The theory of international trade interprets outsourcing like it does factor-saving technological progress: as having a direct employment-curtailling effect but also providing a positive output effect and a positive indirect employment effect due to cost-cutting. According to the traditional models, output prices will remain unchanged, which corresponds to the assumption of exogenously determined global market prices. This study assumes partial price setting behaviour due to specialisation, so that cost cuts will impact on price-driven competitiveness and thus on the demand for goods. The result is a positive impact on output, but also an increase of imports. Both reflect the positive output and welfare effect of outsourcing predicted by theoretical models. Shifts within the labour qualification structure and its impact on wages are not considered in this study.

The study considers, in an exemplary manner, stylised facts of the EU's Eastern enlargement on trade with Austria which have been intensely discussed ever since the opening of the East. Greater integration of CEE countries not only has positive effects on the overall economy on both sides, but also creates an "import price shock" for Austria, which is analysed here for the manufacturing sector. This shock is triggered by the reduction in the costs of imported intermediate inputs, which makes for adjustments in factor demand, in line with substitutability of relationships to other production factors.

A typical example would be the shifting of processing steps from Austria to Eastern Europe (outsourcing or "fragmentation"; Kohler, 2000, Egger – Egger, 2001, Egger – Pfaffermayr – Wolfmayr-Schnitzer, 2001). This has the same effect as factor-saving technological progress, and it both reduces employment and at the same time indirectly increases output and employment, via cost-cutting at the overall economic level (Arndt, 1997, 1999). Egger – Pfaffermayr – Wolfmayr-Schnitzer (2001) have analysed these effects using a traditional two-sector Heckscher-Ohlin model as well as more recent theories of international trade ("economic geography", vertical integration of multinationals). These models can also be used to map the adjustment of factor prices (wages) at different qualification stages, depending on the fragment of the value-added chain to be outsourced, and its impact on the labour market.

Another line of economists considers mainly the effect of outsourcing on wages paid at various qualification stages ("skilled" and "unskilled") and finds that the outsourcing of labour-intensive low-skill fragments, similar to the effect of technological progress, is biased towards higher skills ("skill-biased technological progress"; Feenstra – Hanson, 1996). The conclusions to be drawn for the labour market are thus analogous to those to be drawn by the shift in demand for skills driven by technological progress. An empirical analysis of the skill-biased shift in demand for labour ("skilled" and "unskilled") and the effect of outsourcing on the Austrian labour market is provided by Egger – Egger (2001), who indicate the effect in terms of the mechanisms underlying the labour market (perfect labour market and wage negotiation model).

With regard to output prices, the traditional Heckscher-Ohlin models use the "small-country assumption", i.e., that the outsourcing country cannot influence them; product prices are thus global market prices. *Feenstra – Hanson (1999)* deviate from this opinion in their study of the effect of outsourcing and technological progress on output prices.

The line of reasoning that cost-savings (in consequence to responses of factor demand) make for changes in output prices and thus improve competitiveness (in all markets) is also underlying this study. A prerequisite for integrating the competitive aspect in a theoretical model of international trade is having a three-country model: the country of origin, a low-cost country for outsourcing production stages, and a third country into which the products are exported. The response of output prices to changes in costs depends not only on the size of the country, but also on the fact that, due to specialisation, price setting behaviour cannot be excluded in some sectors. In this study, the feedback from competitiveness causes demand for output to rise, which in turn boosts domestic value added and employment, but also raises demand for imports, which is further accelerated by a general lowering of import prices. This feedback must be seen analogously to the positive welfare and output effect in the two-sector model with given global market prices (*Arndt, 1997, 1999*).

The total output demand is integrated in our approach, although no explicit in-depth mapping is made of the export side. Considering that domestic output prices in turn affect the price of intermediate inputs, we get a feedback loop of price effects. Not included in our analysis is the secondary feedback of labour market changes on the wages of different labour market segments.

Manufacturing is modelled using factor demand functions, which are estimated jointly with price equations for 12 manufacturing sectors. The names of variables always refer to variables within a given sector, although for reasons of space no index is given for sectors (this also applies to the formalised description in the annex). The demand block starts out from a cost function. The sector costs depend on output and on prices and quantities of input factors used: purchased materials and services ("intermediate inputs"), labour and capital. The costs are mapped using a generalised Leontief function (*Diewert, 1971, Berndt – Hesse, 1986, Morrison, 1989, 1990, Flaig – Steiner, 1990, Berndt, 1991, Meade, 1998*), which is a second-order adjustment to a given cost function, kept at a general level and relatively flexible¹. Variable input factors are intermediate inputs; capital is seen as a short-term fixed factor, and technological progress is taken into account.

The cost function is used to derive demand for purchased intermediate inputs (I) and labour (L) and to determine the optimum capital stock (K^*). For modelling the price setting behaviour, a number of market situations were tested: perfect competition occurs when the price corresponds to the marginal costs derived from the cost function. In a monopolistic competition situation, a fixed mark-up (μ) is added to the marginal costs; in an oligopolistic situation, the mark-up is variable, depending on the prices for intermediate inputs. The demand for input factors, consistently obtained from the costs, together with the price equation makes up the supply block for the smaller model.

Its exogenous factors are the wage rate (w) and price index for intermediate inputs (p_I) for each sector. The latter is explained by a cost index for intermediate inputs, which is calculated from the input/output table of 1990 (broken down by domestic and imported products) and the time series for domestic prices (p) and import prices (p_M), and which thus registers feedbacks within the price system. This price index for intermediate inputs consequently plays a key role in explaining the overall price development and maps the link between sector prices and the overall price index. An import price shock is passed on to the price for intermediate inputs and thus triggers adjustments in factor demand and domestic prices, which in turn causes price-driven competitiveness to improve in the international markets.

The demand block maps the overall demand (Q) for the products of a sector. It depends on an aggregated income variable (E), the product price (p_Q) which is made up of output and import prices, and the aggregated total price index (p_E), which is used to deflate aggregated income². Total demand by sectors is then distributed consistently among an imported (M) and a domestic component (Y). To this end, a complete demand model known as Almost Ideal Demand System (AIDS) is used, which is based on cost optima-

¹ No a-priori restrictions are assumed for the substitution relationships of input factors and the effects of technological progress.

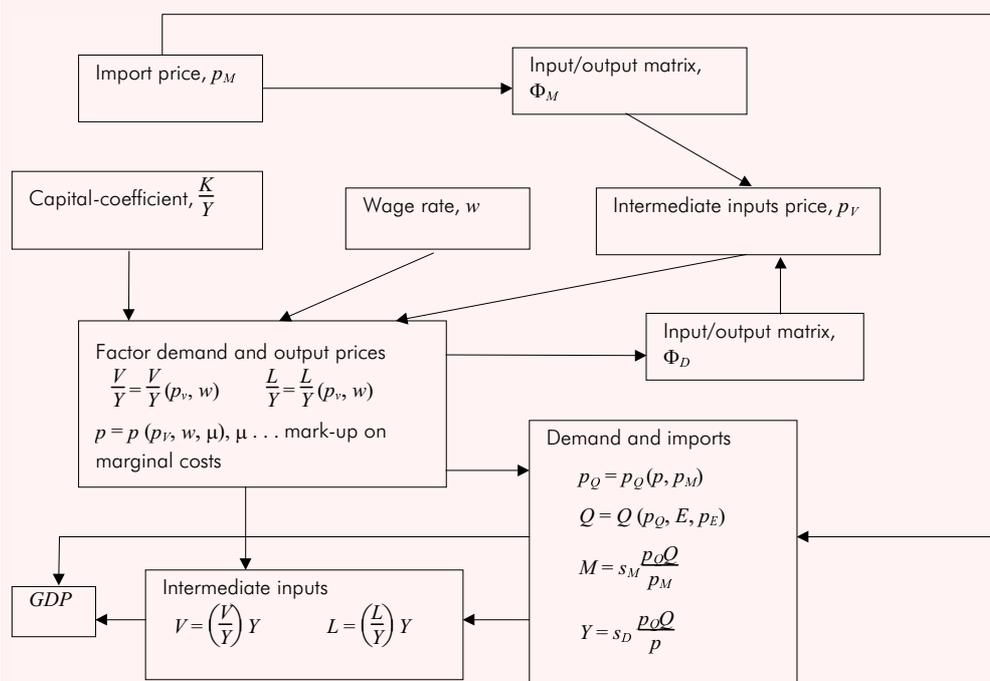
² E and p_E are the only aggregated variables; no sector index is to be applied to them.

The model

tion (Deaton – Muellbauer, 1980). The use of this system allows for a variety of feed-backs in the model.

These model blocks are combined into a sector model as outlined in Figure 1. At the level of sectors, the overall model consists of: factor demand and output prices, output prices and intermediate inputs prices (input/output matrix), demand and imports. Its main exogenous variables are: import prices, wages, capital coefficients and input/output matrices (intermediate inputs structure³. The main equations for the model blocks are provided in the annex.

Figure 1: An Austrian sector model



E . . . aggregated income variable, K . . . capital stock, L . . . demand for labour, μ . . . mark-up in pricing, p . . . output prices, p_E . . . aggregated total price index, p_M . . . import prices, p_Q . . . product price (combined from output and import prices), p_V . . . price index for intermediate inputs, Q . . . total demand for the products of a sector (M . . . imported component, Y . . . domestic component), V . . . demand for intermediate inputs, w . . . wage rate.

The analysis is generally based on the level of the 12 industries which constitute the manufacturing sectors of the 32 industries comprising the E3ME model used at EU level (Barker et al., 1999). All time series were obtained from the ONACE two-digit classification and then aggregated to the 32 E3ME industries. In some cases, the ONACE data had to be converted from the BS 68 categorisation previously used in Austria. To this end and using all information on "double" records (in both classifications) from the non-agricultural census of 1995, a special evaluation by Statistics Austria on foreign trade and information concerning the correspondence of the two classifications, a set of bridging matrices was developed (for production values, imports and employment, respectively).

Data

³ Some of these variables which are exogenous in the current version of the model can be viewed as starting points which may in future be tied to endogenous variables and thus made endogenous themselves. This will certainly apply to the wage rates which could be explained in a labour market model still to be developed, and investment by sectors, which could be integrated in the factor demand function (Allen – Hall, 1997). Analogously, the model has "open ends", i.e., endogenous results which in the current version of the model have no effect on variables: employment and GDP (the difference between the sum of gross production Y and intermediate inputs V , broken down by sectors). In addition, an income cycle could be integrated in the model which would tie in wage income.

The basic data for manufacturing as broken down by the ÖNACE two-digit classification were obtained primarily from the list of variables in the national accounts prepared by Statistics Austria (ESA 1979), which were made available to and greatly appreciated by WIFO, and which are used solely for internal analysis. Employment data collected by the Federation of Austrian Social Security Institutions, and a record of employment by industries developed by WIFO in conformity with the national accounts were converted from BS 68 to ÖNACE. For international trade in goods, export and import figures broken down by the three-digit classification of BS 68 (1976-1994) and the three-digit Classification of Products by Activity (CPA; 1988-1997) were obtained from Statistics Austria and Eurostat. By applying the BS-68-to-ÖNACE conversion matrix, time series for import quantities and values could be developed for 1976 to 1997. Using unit values at the ÖNACE three-digit level, a Paasche price index-number (based on 1983) and values at constant prices were then calculated at the two-digit level.

The basic data are as follows:

- gross production values, in nominal and real terms, at 1983 prices,
- net production values, in nominal and real terms at 1983 prices,
- import of goods, in nominal and real terms at 1983 prices,
- gross fixed capital formation.

This basic stock was then used to calculate all other data required for the analysis (intermediate inputs, price indices, before-tax wage rates, capital stock, i.e., accumulated investments).

In order to calculate the cost index for intermediate inputs by industries, a matrix of technical coefficients was used, separated by imported and domestic supply, from the input/output table for 1990 at the ÖNACE two-digit level, prepared by Statistics Austria.

For 12 Austrian manufacturing industries⁴, estimates were made for the systems as shown graphically in Figure 1 and formally in the annex.

Isolated effects can be calculated by using elasticities. The simulation results of the overall model take into account all interdependencies between the model's variables and thus do not correspond to the calculations based on elasticities, which are subject to the ceteris paribus condition. The elasticities derived from the estimate equations are shown below. They are of a time-variable nature in the supply block. Time varying elasticities were calculated, and then averaged over the entire sample.

Estimated demand price elasticities always show the negative sign postulated by theory. They are rather low, confirming the findings of other studies such as those on industry in Western Germany (Hansen, 1983, Nakamura, 1986, Rutner, 1984, Stark, 1988, Flaig – Steiner, 1990, Peters – Steiner, 2000), as well as studies of the U.S. economy (Pollan, 2000, and the literature quoted therein). As an average across all industries, labour price elasticities are about -0.25 , those of intermediate inputs at -0.10 . The negative sign of price elasticities and the fact that the sum of compensated price elasticities must be zero together imply that cross price elasticities must be positive, which in turn means that the two factors are substitutes. The cross price elasticities in Table 1 show the quantity effect of changes in prices for labour and intermediate inputs across sectors. Thus a value of 0.217 in the first row of the "intermediate inputs" column means that a change of intermediate inputs prices by 10 percent will cause an increase in demand for labour in the "ferrous and non-ferrous metal" industry by 2.2 percent.

A high labour price elasticity is found in textiles, clothing and footwear, transport equipment, and metal products. On the other hand, the response to price changes by labour demand is weak in paper and printing products, non-metallic mineral products, food, drink and tobacco. The price elasticity for intermediate inputs is high in textiles, clothing and footwear, transport equipment, and rubber and plastic products, and low in food, drink and tobacco, chemicals, and paper and printing products.

The sector model for 12 manufacturing industries used here consists of factor demand functions for labour and intermediate inputs, which were estimated together with price equations, as well as an equation for product demand and an import demand system in which total sectoral demand is broken down into imported and domestic components. Estimated price elasticities of factor demand always have negative signs and are relatively low: as an average of all industries about -0.25 for labour and -0.10 for intermediate inputs. From the negative sign of those price elasticities it can be concluded that the two factors are substitutes. The (unweighted) average of income elasticities of total demand is slightly below 1, that of price elasticities is -0.6 .

Empirical findings

⁴ The 12 industries correspond to industries nos. 8 to 12, 14 to 19, and 21 of the 32 industries used by the E3ME model (Barker et al., 1999).

Table 1: Cross and own price elasticities of factor demand

		Labour	Intermediate inputs
Ferrous and non-ferrous metal	Labour	-0.217	0.217
	Intermediate inputs	0.077	-0.077
Non-metallic mineral products	Labour	-0.108	0.108
	Intermediate inputs	0.058	-0.058
Chemicals	Labour	-0.164	0.164
	Intermediate inputs	0.034	-0.034
Metal products	Labour	-0.425	0.425
	Intermediate inputs	0.218	-0.218
Agricultural and industrial machinery	Labour	-0.292	0.292
	Intermediate inputs	0.119	-0.119
Electrical goods	Labour	-0.257	0.257
	Intermediate inputs	0.100	-0.100
Transport equipment	Labour	-0.431	0.431
	Intermediate inputs	0.149	-0.149
Food, drink and tobacco	Labour	-0.137	0.137
	Intermediate inputs	0.032	-0.032
Textiles, clothing and footwear	Labour	-0.629	0.629
	Intermediate inputs	0.281	-0.281
Paper and printing products	Labour	-0.098	0.098
	Intermediate inputs	0.041	-0.041
Rubber and plastic products	Labour	-0.243	0.243
	Intermediate inputs	0.139	-0.139
Other manufactures	Labour	-0.220	0.220
	Intermediate inputs	0.097	-0.097

It should again be noted that these elasticities measure only *ceteris paribus* responses and ignore all feedbacks. The overall model presented above thus provides more in-depth information on the expected effects of an import price shock than individual elasticities. Accordingly, the overall effect can be mapped only by model simulations, the findings of which cannot be ascertained on the basis of the elasticities.

Output elasticities of employment demand (rate of change of the labour demand in response to a 1 percent output change) are, in part, clearly below 1, whereas demand for intermediate inputs is above 1 in all industries considered (Table 2). This result is plausible insofar as, for a given capital stock, short-term adjustment to output variations occurs mainly through a change in demand for intermediate inputs.

Across all industries, the results show mark-ups based on statistically significant parameter values ranging from 15 to 35 percent.

Table 2: Output elasticities of factor demand

	Intermediate inputs	Labour
Ferrous and non-ferrous metal	1.472	0.739
Non-metallic mineral products	1.438	0.849
Chemicals	1.257	0.813
Metal products	1.705	0.460
Agricultural and industrial machinery	1.238	0.505
Electrical goods	1.257	0.869
Transport equipment	1.113	0.896
Food, drink and tobacco	1.008	0.966
Textiles, clothing and footwear	1.059	0.887
Paper and printing products	1.223	0.985
Rubber and plastic products	1.307	0.591
Other manufactures	1.161	0.633

Demand is mapped using singular approaches (see the annex) and then consistently distributed between imports and domestic production using the complete model (AIDS). The estimated income and price elasticities of total demand are summarised in Table 3. The (unweighted) average is slightly below 1 for income elasticities and around -0.6 for price elasticities. No measurable effect of price changes on demand can be found in the ferrous and non-ferrous metal industry.

Table 3: Income and price elasticities of total demand Q

	Income elasticity	Price elasticity
Ferrous and non-ferrous metal	0.64	–
Non-metallic mineral products	0.56	–0.62
Chemicals	1.03	–0.95
Metal products	0.88	–0.22
Agricultural and industrial machinery	1.16	–0.85
Electrical goods	1.68	–1.18
Transport equipment	1.93	–0.58
Food, drink and tobacco	0.12	–0.15
Textiles, clothing and footwear	0.36	–0.06
Paper and printing products	1.05	–0.57
Rubber and plastic products	1.06	–1.45
Other manufactures	0.52	–0.37
Unweighted average	0.92	–0.64

In order to determine the expected effects of the EU's Eastern enlargement on the competitive situation of the Austrian economy, an exemplary simulation for an "import price shock" was made using the model described here. This simulation must not be seen as a projection of the development following Eastern enlargement, but provides a general view of the effects of a shock (based on assumptions) as might occur in the wake of the EU's Eastern enlargement.

To this end, the "ex-post" simulation tool was chosen, which, compared to an "ex-ante" simulation, has the merit of doing without the need for a projection because actually observed data provide the basic scenario. The simulation period covers the years 1990-1994. Since the approach used here provides time-variable elasticities, with the exception of the equations for total demand, the results are based on the response parameters obtained after the opening of the East, which already include information on the effects of greater integration of Eastern Europe.

Figure 2: Simulation of an "import price shock"

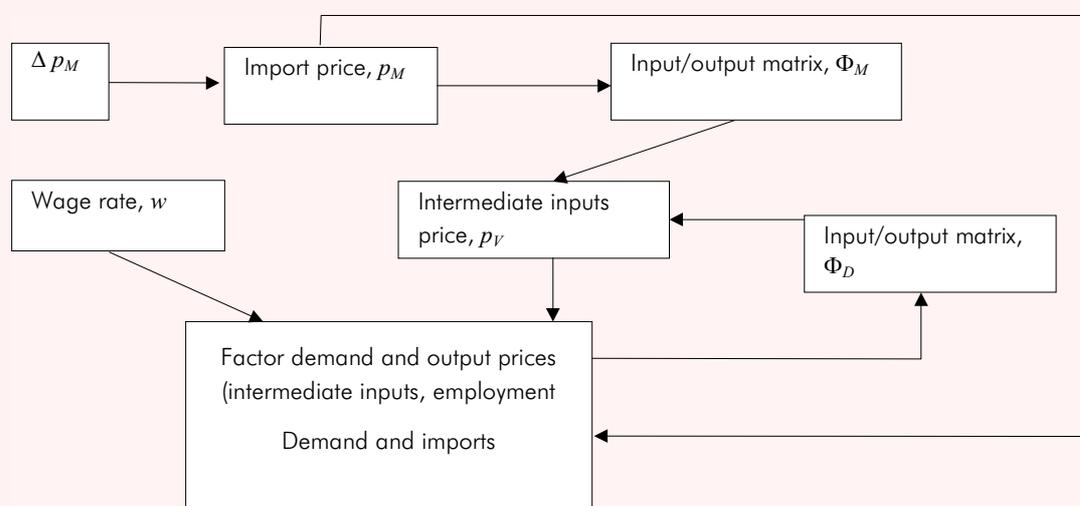


Figure 2 shows the course of such an "import price shock". Driven by a host of different motifs (i.a., greater legal security), Eastern enlargement enhances the incentive to outsource abroad. The value-added chain in Austrian companies is broken up and part of it (the production stage) shifted to the EU accession candidates in Eastern Europe. This process may also be linked to direct investments made in these countries. As a result, value added domestically is partly substituted by imported intermediate inputs (= outsourcing).

Consequent to this shift, producers obtain lower-cost imports, which has the same effect as a cut in import prices. Given the intermediate inputs structure as shown in the input/output table, this import price cut first of all impacts directly on the price of intermediate inputs in the industries. Subsequently and for a given wage rate, the relative factor prices (wages, intermediate inputs prices) will change, as well as factor demand *per output unit*, in line with industry specific factor demand functions. Accordingly, demand for

intermediate inputs would increase due to the shift of production (outsourcing), and demand for employment would be reduced.

Nevertheless, this would be only an initial effect, at *ceteris paribus* conditions recognising only substitutability relations. Lower domestic employment is going along with increased employment in the CEECs. The theoretical models usually assume that outsourcing relates mainly to production stages which use lower-skilled labour and thus pay lower wage rates. Accordingly, the change in relative factor prices results not just in aggregated employment effects but also in a demand shift within the skill spectrum.

Yet, looking only at the effects caused by factor demand neglects crucial feedbacks at the macroeconomic level. An import price shock and outsourcing trigger changes in costs and output prices. This study emphasises the effect of outsourcing on the competitive situation of Austrian business in all markets. The price cuts will change total demand, imports and domestic output in a number of ways. First of all, the price for total demand will decline, which in turn will fuel demand. The change in output price, in combination with the change in import price, will make for a redistribution of demand among imports and domestic output. The import price thus will be, on the one side, an input price (intermediate inputs) and, on the other side, an output price (demand). Competitiveness will rise due to the lower costs for intermediate inputs, while at the same time demand for domestic goods (private consumption) will be squeezed by cheaper imports. The new output level will then determine the level of factor demand (labour, intermediate inputs). Combined with the import effects on consumption, this can be interpreted as the upper limit for potential import effects. It would be useful to investigate whether Eastern enlargement will trigger any marked import effects on consumption at all. Current regulations for direct imports lead us to expect that such effects will be concentrated on some product groups (e.g., tobacco) and thus won't be a general phenomenon. Another approach to quantifying the import effects would be to assume additional imports only for the demand of intermediate inputs but not for private consumption. Due to the lack of a time series for imported and domestic intermediate inputs, our model has opted for a compromise, according to which part of the additional intermediate inputs and other additional demand is assumed to be imported.

Another assumption made for the simulation concerns the scope of the import price shock. *Baldwin – Francois – Portes* (1997) project a decline in real trade costs⁵ by about 10 percent in the wake of Eastern enlargement. In a first assumption for our simulation, imports are imputed to become cheaper by this percentage. Since changes in trade costs include not just changes in import prices and, moreover, since not all Austrian import prices are affected by the costs of trade with the applicant countries in Eastern Europe, this value should be seen as exemplary only. Alternatively, a decline of import prices by only 5 percent is simulated as an additional option.

When imports become cheaper by 10 percent, prices for intermediate inputs in the chemicals sector will drop considerably, by almost 11 percent. The effects are of similar scale in paper and printing products, and in rubber and plastic products. Intermediate inputs will become cheaper by about 4 percent in the sectors of ferrous and non-ferrous metal, agricultural and industrial machinery, textiles, clothing and footwear. In the other industries, input prices will decline by about 1.0 to 3.2 percent, in total by about 4.4 percent. Lower input prices will have a direct effect on output prices; prices for total demand depend on changes in import and output prices. Generally, the effects of output prices are slightly lower than those of input prices, at altogether –4.2 percent. Price changes for total demand (altogether –6.2 percent) are between those for imports at 10 percent and the relevant output price effect. If we equate the output price effect to the effect on export prices, we get a substantial improvement in terms of trade, which would, in a corresponding theoretical model, be the basis for a positive welfare effect.

⁵ The decline in real trade costs comprises direct effects on import prices (import duties, non-tariff trade barriers) and the impact of stiffer competition from the presence of more import competitors.

Table 4: Effects of an import price shock (–10 percent): prices

	Intermediate input prices	Output price, production Percentage change	Output price, demand
Ferrous and non-ferrous metal	–3.8	– 3.8	– 6.0
Non-metallic mineral products	–2.1	– 1.9	– 3.0
Chemicals	–10.8	–14.9	–12.5
Metal products	–1.4	– 0.7	– 3.6
Agricultural and industrial machinery	–4.1	– 4.0	– 7.0
Electrical goods	–2.0	– 1.7	– 4.7
Transport equipment	–1.9	– 1.4	– 6.6
Food, drink and tobacco	–0.8	– 0.6	– 1.6
Textiles, clothing and footwear	–4.0	– 2.6	– 7.3
Paper and printing products	–9.9	– 7.1	– 7.8
Rubber and plastic products	–8.6	– 8.7	– 9.5
Other manufactures	–3.2	– 2.8	– 5.3
Total	–4.4	– 4.2	– 6.2

Such price changes will cause a reaction in total demand, which may be interpreted as a rise in price-driven competitiveness. These changes in demand will range at +0 and +13 percent, depending, i.a., on how strongly the total demand price will change in a given sector as compared to the average price for total demand and how a sector will respond to the rise in total demand (income elasticity). Responses are strongest in transport equipment, chemicals, rubber and plastic products, and agricultural and industrial machinery.

Table 5: Effects of an import price shock (–10 percent): demand

	Demand	Imports Percentage change	Production
Ferrous and non-ferrous metal	+2.8	+7.0	+1.2
Non-metallic mineral products	+0.4	+2.5	–0.5
Chemicals	+11.7	+11.0	+12.2
Metal products	+6.5	+23.1	+0.3
Agricultural and industrial machinery	+7.2	+16.8	–0.5
Electrical goods	+5.7	+13.7	+0.8
Transport equipment	+13.0	+19.4	+3.8
Food, drink and tobacco	–0.5	+3.5	–1.0
Textiles, clothing and footwear	+1.9	+10.1	–9.4
Paper and printing products	+5.7	+6.5	+5.5
Rubber and plastic products	+10.4	+16.4	+5.1
Other manufactures	+4.9	+13.7	+0.4
Total	+5.4	+11.0	+1.5

This total demand effect is distributed among additional imports and additional domestic output and depends on the relative change in output and import prices. As noted above, the import price has a double effect: on the one hand it impacts on the domestic output price and the demand for domestic products, on the other hand it has effects on the relative price of imports (import prices in terms of output prices) – a rise in output prices will thus trigger additional demand for imports. Consequently, imports will rise, and the rise will be considerable (by up to 23 percent) in some sectors. The resultant total effect on domestic output is thus much lower than the demand effect and in some cases (textiles, clothing and footwear, food, drink and tobacco, agricultural and industrial machinery, non-metallic mineral products) even negative.

These massive import effects also result from consumption and not just from production outsourcing. A separate simulation was run based on the assumption that additional imports will be generated only by outsourcing rather than consumption; in this case, the positive effects on domestic output are much higher. In this sense, the simulation described here maps the maximum possible outflow of domestic demand by additional imports. With imports becoming cheaper, this may be viewed as a positive welfare effect for domestic consumers.

Table 6: Effects of an import price shock (–10 percent): demand for production factors

	Intermediate inputs	Percentage change	Employment
Ferrous and non-ferrous metal	+1.9		–1.3
Non-metallic mineral products	–0.4		–0.5
Chemicals	+14.7		–0.3
Metal products	+0.6		–0.2
Agricultural and industrial machinery	–0.1		–1.4
Electrical goods	+1.2		–0.1
Transport equipment	+4.4		+1.7
Food, drink and tobacco	–0.9		–1.0
Textiles, clothing and footwear	–8.9		–9.7
Paper and printing products	+6.4		+2.4
Rubber and plastic products	+8.6		–1.3
Other manufactures	+0.9		–0.6
Total	+2.2		–1.1

Demand for intermediate inputs and labour is, on the one hand, coupled to the output level and, on the other hand, dependant on the relative factor prices (input price, wage rate). A decline in input prices causes substitution between labour and intermediate inputs, which can be interpreted as outsourcing of production stages. The model simulations show that this substitution effect is greater than the contrary output effect. As an average of sectors, employment decreases by 1 percent, with the exception of transport equipment, and paper and printing products, which have positive employment effects.

Since output across the sectors on average rises by about 1.5 percent and employment falls by 1 percent, the result is a rise of productivity by 2.5 percent caused by the import price shock. Increases in productivity can outbalance long-term price-driven competitive disadvantages.

An import price shock of a size of imports becoming cheaper by only 5 percent has, as expected, lower effects, and in this scenario employment falls by just 0.5 percent.

As noted above, the model simulation performed here is of an experimental character. The effects calculated are based on a comparison of actual figures for 1990 to 1994 to a scenario that assumes an import price shock. Any analysis of outsourcing effects caused by the EU's Eastern enlargement would have to be based on a fundamental scenario which provides for a (future) globalised world where, due to the mobility of capital and the resultant optimisation of locations, outsourcing phenomena will occur at an international level. Any (in this sense) realistic comparison of "globalisation without Eastern enlargement" and "globalisation with Eastern enlargement" would certainly show with greater clarity the competition-strengthening effect of Eastern enlargement on the Austrian economy, since domestic producers, thanks to their geographical proximity to CEE countries are in a better position to implement strategies of fragmenting the value-added chain and of setting up international supply chains at lower transport and transaction costs than their international competitors. The ability of domestic producers to set up cross-border production networks across short distances provides them with an opportunity to preserve and enhance their competitive position even within the scope of progressing globalisation.

These effects were quantified in this study for Austrian manufacturing. Cheaper imports, which may be the result of declining real trade costs (Baldwin – Francois – Portes, 1997), are an incentive to outsource production. Lower import prices are passed on to input, output and consumer prices (price of overall demand) and improve the terms of trade. This in turn has positive demand effects and at the same time raises imports. According to this study, imports will rise due to outsourcing (intermediate inputs) and additional final demand, which can be seen as the upper limit for potential import effects. Occasionally, the import effect will be greater than the demand effect so that domestic output might even shrink. On the other hand, the import effect may also be interpreted as a positive welfare effect. Positive output effects from outsourcing confirm the theoretical concept of the factor-saving effect of outsourcing (Arndt, 1997, 1999, Egger – Pfaffermayr – Wolfmayr-Schnitzer, 2001).

The effects on employment are generally negative due to the low increase in output (substantial rise in imports), and positive only in two sectors (transport equipment, paper and printing products). At a total of –1.1 percent measured against the rate at which intermediate inputs become cheaper (–4.4 percent), the negative employment effects

Concluding remark

can be viewed as minor only. This results from the positive feedback of increased production compensating the factor substitution effect.

In order to obtain, from our model, an exemplary simulation of an import price shock in the wake of integrating the accession candidates in the EU, it was assumed that imports of the 12 sectors would be cheaper by 10 percent; this assumption is based on *Baldwin – Francois – Portes (1997)*, who expect the real trade costs to decline by 10 percent as a result of Eastern enlargement.

Because of the intermediate inputs structure as shown in the input/output table, a decline in import prices will first affect the price of intermediate inputs within sectors. Given the wage rate, this will change the relative factor prices (labour will become more expensive relative to the intermediate inputs); demand for intermediate inputs will rise due to outsourcing, while demand for employment will decline.

Looking solely at the effects triggered by factor demand nevertheless neglects macro-economic feedbacks which are of prime importance. The import price shock and the shift in demand will cause changes in costs and output prices. A decline in import prices by 10 percent causes intermediate inputs to become cheaper by altogether 4.4 percent. This decline in input prices will have a direct impact on output prices, which will drop by altogether 4.2 percent. The change in prices for total demand (altogether –6.2 percent) will range between the reduction of import prices by 10 percent and the respective output price effect. This means a substantial improvement of the terms of trade, which in theoretical models would provide the foundation for a positive welfare effect.

Due to the massive import reaction (also in private consumption) the effects on domestic output will be much lower than the demand effect, and even negative in some cases (textiles, clothing and footwear, food, drink and tobacco, agricultural and industrial machinery, non-metallic mineral products). If we assume that additional imports will be triggered solely by outsourcing (but not by private consumption), we get much higher positive effects of cheaper imports on domestic output. In this sense, the simulation described here shows the maximum possible outflow of domestic demand through additional imports. Due to cheaper imports, this can in turn be viewed as a positive welfare effect for domestic consumers. For the industries covered by the study, output on average rises by about 1.5 percent and employment declines by 1 percent. Positive employment effects will be found only in transport equipment and paper and printing products.

In order to explain factor demand and output prices (p), which constitute the supply block, the generalised Leontief cost function (*) was chosen as a launching point. Intermediate inputs and labour (index i, j) as variable input factors are combined with capital which is fixed in the short term (k), taking into account technological progress (t):

$$(*) \quad G = Y \left[\sum_i \sum_j \alpha_{ij} (p_i p_j)^{1/2} + \sum_i \delta_{it} p_i t^{1/2} + \sum_i \gamma_{it} p_i t \right] + Y^{1/2} \left[\sum_i \beta_{ik} p_i \chi_k^{1/2} + 2 \sum_i \gamma_{ik} p_i t^{1/2} \chi_k^{1/2} \right] + \sum_i p_i \gamma_{kk} \chi_k$$

As possible price setting alternatives fixed and variable mark-ups (μ) were tested.

In the demand block, sector demand is distributed among imports and domestic output, using the so-called AIDS (Almost Ideal Demand System) approach. Altogether, these parts make up a small sector model of the Austrian macroeconomy, where demand by sectors is included only in a rudimentary manner, by way of a total demand equation which accounts for price and income elasticities of the sectors.

Below the main relations of the model are shown formally.

In order to derive factor demand from the cost function, Shephard's lemma is used, according to which partial derivatives of the cost function with respect to the factor prices (p_V, w) provide the respective input quantities (V, L). A derivative of the cost function with respect to the intermediate input price (p_V) produces demand for intermediate inputs (V), a derivative with respect to wage level (w) produces demand for labour (L).

As shown from (1) and (2), the relation between intermediate inputs and outputs (intermediate input coefficient) and between labour and output (labour coefficient) is accordingly explained by a constant, the price relations between input factors, the capital coefficient, a trend variable which reflects the technological progress not tied to the capital stock and interaction terms:

Annex

Factor demand and output prices

$$(1) \left(\frac{V}{Y}\right) = \alpha_{VV} + \alpha_{VL} \left(\frac{w}{p_V}\right)^{1/2} + \delta_{Vt} t^{1/2} + \gamma_{tt} t + \beta_{VK} \left(\frac{K}{Y}\right)^{1/2} + 2\gamma_{tK} t^{1/2} \left(\frac{K}{Y}\right)^{1/2} + \gamma_{KK} \left(\frac{K}{Y}\right),$$

$$(2) \left(\frac{L}{Y}\right) = \alpha_{LL} + \alpha_{VL} \left(\frac{p_V}{w}\right)^{1/2} + \delta_{Lt} t^{1/2} + \gamma_{tt} t + \beta_{LK} \left(\frac{K}{Y}\right)^{1/2} + 2\gamma_{tK} t^{1/2} \left(\frac{K}{Y}\right)^{1/2} + \gamma_{KK} \left(\frac{K}{Y}\right).$$

Price setting is assumed as a fixed (monopolist competition) or variable (oligopoly) mark-up to marginal cost derived from the cost function.

Fixed mark-up:

$$(3) p = [1 + \mu] \left[\alpha_{VV} p_{\bar{V}} + \alpha_{LL} w + 2\alpha_{VL} (p_V w)^{1/2} + \delta_{Vt} p_1 t^{1/2} + \delta_{Lt} p_2 t^{1/2} + \gamma_{tt} (p_V + w) t + \right. \\ \left. + 1/2 \left(\beta_{VK} p_V \left(\frac{K}{Y}\right)^{1/2} + \beta_{LK} w \left(\frac{K}{Y}\right)^{1/2} + 2\gamma_{tK} (p_V + w) t^{1/2} \left(\frac{K}{Y}\right)^{1/2} \right) \right].$$

Variable mark-up:

$$(4) p = [1 + \mu] (p_M, w, p_V, t) \left[\alpha_{VV} p_{\bar{V}} + \alpha_{LL} w + 2\alpha_{VL} (p_V w)^{1/2} + \delta_{Vt} p_1 t^{1/2} + \delta_{Lt} p_2 t^{1/2} + \right. \\ \left. + \gamma_{tt} (p_V + w) t + 1/2 \left(\beta_{VK} p_V \left(\frac{K}{Y}\right)^{1/2} + \beta_{LK} w \left(\frac{K}{Y}\right)^{1/2} + 2\gamma_{tK} (p_V + w) t^{1/2} \left(\frac{K}{Y}\right)^{1/2} \right) \right].$$

The intermediate input price is endogenised by the fixed input structure of intermediate input demand for a given sector, represented in the matrices ϕ_M and ϕ_D ⁶ calculated from the input/output table as of 1990, which together with the import prices and domestic prices provide for an intermediate input cost index:

$$(5) p_V = p_M \phi_M + p \phi_D.$$

Total demand (equation (9)) is proportionally (s_M, s_D) distributed among imports (equation (6)) and domestic demand (equation (7)), where the crucial factors are price developments (p_M, p) and the development of total nominal demand (QN). The relations (10) and (11) are identities, which produce imports (M) and domestic output (Y):

$$(6) s_M = \left(\frac{P_M M}{QN}\right) = \alpha_M + \gamma_{MM} \ln p_M + \gamma_{MD} \ln p_D + \beta_M \ln \left(\frac{QN}{p_Q}\right),$$

$$(7) s_D = \left(\frac{p Y}{QN}\right) = \alpha_D + \gamma_{MD} \ln p_M + \gamma_{DD} \ln p + \beta_D \ln \left(\frac{QN}{p_Q}\right),$$

$$(8) \ln p_Q = s_M \ln p_M + s_D \ln p,$$

$$(9) \ln Q = \alpha_1 + \alpha_2 \ln \left(\frac{P_Q}{P_E}\right) + \alpha_3 \ln \left(\frac{E}{P_E}\right),$$

$$(10) QN = p_Q Q, \quad M = \left(\frac{s_M QN}{P_M}\right), \quad Y = \left(\frac{s_D QN}{P}\right),$$

$$(11) GDP = \sum_m Y_m = \sum_m Y_m \left(\frac{V_M}{Y_M}\right).$$

⁶ Where D is for domestic and M for imported supplies.

Intermediate input price

Demand and imports

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Outsourcing, Competitiveness and Employment

Effects Mapped with a Sector Model of Austrian Manufacturing – Summary

In order to generate an exemplary simulation of an "import price shock" consequent to integrating the accession candidates into the EU, the model assumed that import of the 12 products defined would be cheaper by 10 percent; this assumption was based on *Baldwin – Francois – Portes (1997)*, who expect the real trade costs to decrease by 10 percent as a result of the EU's eastern enlargement. (This decrease of real trade costs comprises direct effects on import prices – import duties, non-tariff trade barriers – and the consequences of keener competition due to a larger number of import competitors.)

Given the intermediate input structure as outlined in the input/output table, lower import prices first affect the prices of purchased materials and services across industries. This in turn affects the relative factor prices at given wages (labour becomes more expensive compared to the intermediate inputs), and causes demand for intermediate inputs to grow and demand for employment to fall.

However, if we consider solely the effects caused by factor demand, we will ignore an important macroeconomic response. The import price shock and shift in factor demand will in turn change the costs and output prices. A decline in import prices by 10 percent means that overall intermediate inputs will be cheaper by 4.4 percent. This decrease in input prices will directly affect output prices, which will overall fall by 4.2 percent. The change in prices for overall demand (–6.2 percent) will range between the reduction of import prices by 10 percent and the respective output price effect. This means a substantial improvement of the terms of trade which provides the foundation for a positive welfare effect in the relevant theoretical models.

Because of the massive import response, the impact on domestic output will be much less significant than the effect on demand and may conceivably be negative in some cases (textiles, clothing and footwear, food, drink and tobacco, agricultural and industrial machinery, non-metallic mineral products). If we assume that additional imports are triggered solely by outsourcing (and not by private demand as well), we get much higher positive effects of cheaper imports on domestic output. In this sense, the simulation experiment described here indicates the maximum possible outflow of domestic demand by additional imports; when imports become cheaper this can in turn be viewed as a positive welfare effect for domestic consumers. On average, the output across the industries considered will rise by about 1.5 percent, and employment will fall by 1 percent. Positive employment effects are found only in transport equipment, and paper and printing products.