International Institute for
Applied Systems Analysis
Schlossplatz 1
A-2361 Laxenburg, Austria

Tel: +43 2236 807 342
Fax: +43 2236 71313
E-mail: publications@iiasa.ac.at
Web: www.iiasa.ac.at

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Determining Factors of Trade Specialization and Growth of a Small Economy in Transition: Impacts of the EU Opening-up on Czech Exports and Imports

Vladimír Benáček (benacek@iiasa.ac.at)
Jan Á. Víšek (visek@mbox.fsv.cuni.cz)

Approved by

Leen Hordijk
Director

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Contents

Abstract

In this paper we discuss and estimate the factors of growth and structural adjustment in small open economies in transition. Our theoretical considerations are empirically tested on Czech exports and imports in exchanges with two regions: the European Union and the rest of world. By using the export and import functions, we estimated the determining factors of trade intensities relative to the changes in aggregate demand, competitiveness, factor endowments and policy measures. It was of our special interest to analyze the outcome of the massive liberalization of trade with the EU during 1990-99. We worked with the commodity breakdown into 61 industries.

The factors acting universally in all four of our tests were the aggregate demand of the destination countries and the structure of the foreign direct investment, representing the human capital. The competitiveness of Czech imports was based generally on quality, while Czech exports to the EU competed in prices. Factor endowments, tariffs and subsidies had also their specific role in shaping the Czech specialization pattern. The appreciation of real exchange rate had only a marginal net effect on the trade balance. Further structural adjustments can be expected not only in further deepening of the Czech export commodity specialization but, due to spillovers of both exports and imports, also in the domestic production for domestic market. The intensive structural and growth incentives associated with the EU accession will bring about pressures for a new wave of restructuring of enterprises, further reallocation of existing resources and a provision of production factors that become the constraints to growth.

It is the nature of transition economies that their development, associated with fast growth and convergence to the EU GDP per capita average, will remain for a long time subjected to periodical (though attenuating) waves of adjustments. The economic volatility caused by adjustments to external shocks will be for long more intensive in transition economies than in stabilized economies. The core of fundamental adjustments rests in the changing conditions for the specialization in trade between accession and the EU incumbent countries. The degree of resistance of enterprises to pressures for restructuring coming from the trade potential is therefore reflected in the proneness of the economies in transition to macroeconomic instability (slow growth, budget deficit, structural unemployment and external imbalance). These politically sensitive developments are closely related to decision-making on a choice of macroeconomic and structural policies.

JEL classification codes: F10, F13

Keywords: International trade; foreign direct investment; competitiveness; transition; integration.

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About the Authors

Vladimir Benacek is research scholar at the Economic Transition and Integration Project of the International Institute for Applied System Analysis (IIASA). His specialization is in trade theory, international finance and transition.
Tel.: +43 2236 807 326, fax: +43 2236 71313
E-mail: benacek@iiasa.ac.at

Jan A. Visek is reader in statistics and econometrics at Charles University, Faculty of Social Sciences, Institute of Economic Studies, Prague. He specializes in robust techniques of econometric estimation.
Tel.: +4202 22112330, fax +4202 22112304
E-mail: visek@mbox.fsv.cuni.cz

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Vladimír Benáček (benacek@iiasa.ac.at)
Jan Á. Víšek (visek@mbox.fsv.cuni.cz)

1. Introduction: Trade, Growth, Competitiveness and Modeling

The problem of this paper centers on growth and the evolution of competitiveness of domestic production vis-à-vis the competition with producers from abroad. The opening up of the post-communist economies and the process of their integration into the European Union (EU) had a big impact on the structure of specialization and on growth throughout the whole of Europe. All transition economies experienced a substantial growth in their trade with the EU after the economic liberalization. For the majority of them that was a permanent trend that lasted throughout the whole of 1990s. For example, the Czech exports to the EU during 1993-99 rose from US$ 8 billion to US$ 18.4 billion. That implied an average annual growth of exports by a striking 16.3%, while Czech exports with the rest of the world grew at a normal rate of 4%. At the same time the trade creation with the OECD partners was accompanied by a large trade diversion from former partners grouped in the Council for Mutual Economic Assistance (COMECON). Trade liberalization concessions on the Czech and the EU sides have therefore opened an unprecedented window of opportunity. Their particular structural development was country specific – determined by particular local characteristics, such as factor endowments, policies and other economic factors.

The liberalization of trade had large repercussions on the whole domestic economies of transition countries by bringing with itself new strategic incentives to growth and restructuring. This automatic impact of the openness could be so strong that it dominated the economic growth. For example, we can find out that the *fast development of Czech international trade throughout the 1990s became one of the crucial constructive moments of transition in the whole Czech economy*. It is the purpose of this study to deal more closely with the theoretical, quantitative, and technical aspects of the analysis of such changes.

Taken theoretically, the developments in international trade in small open economies determine the allocation and the efficacy of the majority of domestic resources. Since the share of traded commodities produced for exports and for domestic replacement of imports on the GDP is very high in such countries, export and import functions overlap to a large extent with the empirical models proposed for the explanation of the GDP dynamics, as proposed for example by Barro (1991), Levine

and Renelt (1992), Sala-i-Martin (1996) or recently by Crespo-Cuaresma, Dimitz and Ritzberger-Grünwald (2001). The overlap can be explained on the macro identities for production (Y) and absorption (A):

$Y = C + I + G + X$

$A = C + I + G + M$

The export and import functions are relevant not only for explaining exports and imports (X, M) but also for that part of domestic production for domestic consumption (C + I + G) which is tradable. That means, some determining factors for X and M can be also potentially relevant for the allocation of resources to those domestically produced and consumed commodities where there are either alternatives to export, or where the imports compete with domestic production. In the Czech case it means the relevance for not only 65% of GDP that is exported (or imported, respectively) but also for potentially that part of C+I+G that is traded – which is estimated to additional 15-20% of GDP. Thus the location, redistribution and demise of resources for the production of at least 80% of the GDP can subject to the evolution of comparative advantages and competitive advantages estimated by export or import functions.

The general relevance of export and import functions for the growth in transition economies and their crowding-out of the standard models of growth, can be strengthened by technical arguments for the estimation of the parameters of growth. While the estimation of macroeconomic production functions depends on time series, which are usually too short, the estimation of export and import functions can benefit from more information contained in their sectoral dimension. On top of it, export and import functions are (pragmatically) superior to closed economy growth models because they can deal more naturally with the interaction of the domestic economy with the outside world. Intrinsically *asymmetric evolution of sectors* is in the core of growth dynamics. It has little meaning in closed economies where the determining factors of specialization are disregarded.

Though "competitiveness" is a word very often used in the policy statements of governments, it can be seldom found in economic textbooks [1]. In them the word "comparative advantage" is rather preferred – describing the causes of success or failure of producers' performance on world markets. However, as one gets through to the substance of comparative advantages, as explained by either the Ricardian or the Heckscher-Ohlin theories, it is not difficult to understand that "comparative advantage" and "competitiveness" need not necessarily overlap because competitiveness is a wider and more heterogeneous concept. In the Ricardian sense "the comparative advantage" means a favorable starting position in the *physical labor contents* (intensities, requirements) of a physical unit of production of one producer *relative to the labor*

[1] Paul Krugman made a very pronounced critique of this fashionable term. According to him, "competitiveness" is just "a poetic way of saying 'productivity', without actually implying that international competition has anything to do with it" (Krugman 1994, p.33). On the other hand, the economists from business circles argue that "It is widely accepted in economic literature that a country's competitiveness cannot be reduced only to GDP and productivity, because firms must cope with the political, cultural, and educational dimensions of countries, as well as their economies" (WCY, 2001). So "competitiveness" is not a concept related to a whole nation (as Krugman imputes) but it still may remain valid at a level of enterprises.

contents of the production of its competitors. In the Heckscher-Ohlin context it is *the ability of firms to adjust the structure of production to the relative factor endowments* of that particular country. Here "comparative advantage" and "competitiveness" can be taken for synonyms. On the other hand, the term "*competitiveness*", as defined in the business literature, has strictly pragmatic meaning: as *the capacity of firms to sustain their market share*, or even as their ability *to increase* their market share. Hardly anything is said there about their relative labor contents or about the factor requirements matching the endowments, even though implicitly they may be important.

Competitiveness can be also achieved by *taking advantage of the scale economies, the product differentiation, and the market power* [2]. At that point the argument may still remain within the tenets of the *new trade theories*, though its causes shifted far away from the classical theories of comparative advantages. As a crucial alternative, competitiveness can be explained by *institutional and policy factors, such as using (or abusing) the public resources in the hands of the government and by various protectionist measures* (Bayard and Elliott 1992). There the most notorious case is the subsidization of agricultural products in the EU. Its agriculture may afterwards turn from goods out-competed by imports to "successful" export commodities (Pelkmans 1997, p. 168-171). The rising social costs of such gains in competitiveness are often disregarded.

Higher competitiveness in international trading can be also achieved by the *exchange rate depreciation or by directly lowering the wage rates.* The theories behind various definitions of *real exchange rates* are perhaps the most important theoretic contributions for the explanation of "competitiveness". In its less orthodox version, an appreciation of the real exchange rate, defined as a higher growth in the price level of non-traded goods over the growth in the price level of traded goods (well structured in compliance with comparative advantages), could become a serious threat undermining the competitiveness of internationally traded production in the large segment of the economy. Further on, the imbalances on the monetary and internal side have links to problems on the external side of the real economy, as was first analyzed by Salter (1959). Various policy instruments can therefore influence the competitiveness beyond the objectively determined comparative advantages (Dornbusch 1973).

If such theoretical terms like comparative advantage, productivity, and endowments are closely related to objectively given economic fundamentals, the term "competitiveness" can have its independent meaning in relationship to economic policies and *revealed real outcomes* of such policies. On the other hand, these policies cannot be separated from economic fundamentals because they have a polar direction: they are directed either towards a support of fundamentals or against them. We can therefore judge policies in open economies as instruments for enhancing the market pressures – calling them the policies of encouragement and disciplining. Or alternatively, policies can act as instruments of discouragement and protection (see Selowsky *et al*. 2001). Therefore, competitiveness is a term describing empirical phenomena related to both fundamental determining factors and policies.

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[2] The literature most often referred to in this respect is Helpman and Krugman (1985). A textbook description is in Krugman and Obstfeld (1997). Coming to terms with these factors is a crucial condition of growth in all modern open economies.

Observed empirically, the competitiveness in foreign trade is therefore revealed as *differences in the growth rate that lead to a change in the composition of exports or imports in time,* which can be related to two structural aspects:

- the geographical (territorial) breakdown, and
- the commodity breakdown.

Then our problem can be depicted by a matrix of changes in trade growth rates π_{ij} , taken separately for annual changes in exports ΔX (i.e. $\Delta X_{ijt} = X_{ijt} - X_{ij,t-1}$) and in imports ($\Delta M$):

$\pi_{ijt}^{(X)} = \Delta X_{ijt} / X_{ijt}$

$\pi_{ijt}^{(M)} = \Delta M_{ijt} / M_{ijt}$

where i = 1, 2, 3, …, m are countries as trading partners of the analyzed "home" country;
j = 1, 2, 3, …, n are commodities traded;
t = 2, 3, …, τ is the given time period (year).

The empirical estimation of the whole problem can be simplified by taking natural logarithms of the trade flows. The aim of this study will be to find out what determining factors were behind these changes in the trade flows. The analysis will be based on econometric hypothesis testing using the export and import functions applied on Czech data. The policy implications and predictions for the process of EU enlargement are also among the aims of this paper.

2. Structural Trade Changes in the Process of Opening Up

The international trade of Communist countries, under the institutional backing of COMECON, was relatively intensive. However, it lacked the support of the market mechanism for the determination of the structure of specialization at the level of standard economic agents, such as producers, exporters, and importers. The structural microeconomic problem of specialization was therefore determined at the level of bureaucratic decision-making – to a large extent outside of enterprises and microeconomics. It was then highly probable that the resultant specialization pattern would miss some of the absolutely crucial economic criteria, such as comparative advantages, efficiency, or competitiveness. The result is then obvious: the allocation of resources would be sub-optimal and, in the long run, the problems with external balance and the GDP growth would intensify.

If we look at the nature of trading among the COMECON countries until the end of the 1980s, the situation looked quite satisfactory, at least at the level of macro statistics. The trade was growing and the external imbalances were always accommodated by some administrative intervention. In all cases the trade of COMECON countries revealed signs of *preferential trading characteristics***,** so typical for countries with economies integrated under a formal (institutionally controlled) treaty. That means, they revealed features of trading where the preferential treatment of international exchanges was guaranteed for the *member states only*. No attempts were even made to hide the fact that the decision-making was grossly discretionary (administrative) and that discrimination was an obvious rule. Most surprisingly, however, the commodity breakdown of trade among the COMECON partners revealed

characteristics compatible with Heckscher-Ohlin criteria. That means, in the majority of cases, that the trade structure was compatible with endowments and scarcities in the basic productive factors (labor, capital, human capital, and natural resources) – see Benacek (1988a, 1988b, and 1989).

Once the institutions of COMECON collapsed and price and trade liberalization became a standard policy among its former member states, an intensive *trade diversion* was a natural process that followed as an aftermath. Already in 1991, negotiations began about the trade preferential arrangements offered by the European Commission to some of the post-communist countries. The Association Agreements of these economies with the EU countries, aiming at creating a free trade area at the end of the century, intensified during 1992-94. The trend of channeling the majority trade through free trade arrangements led to the creation of the Central European Free Trade Agreement (CEFTA) in 1993. Its impact was visible in an intensive trade creation among its members, often at the expense of trade diversion from countries outside the EU and CEFTA alliances. In that sense CEFTA behaved like a typical customs union (Pelkmans 1997).

Our analysis will concentrate on the comparison of developments in Czech trade with two geographical regions:

(1) EU 15 (comprising 69% of Czech exports and 64.5% of imports in 1999); (2) rest of the world that includes the remaining developed market economies (comprising 5.8% of Czech X and 11.2% M), post-communist countries (21,6% X and 20% M), and newly industrialized countries and less developed countries (4.4% X and 3.3% M).

Though the trade of the Czech Republic with the EU is dominant and steadily growing, the regional trade balances will remain subject to large changes due to expected EU accession and fluctuations in enormous capital account surpluses with market economies. Trade re-adjustments due to trade diversion and diversified intensity of trade creation with alternative trade partners will remain for long a sensitive political issue in all transition economies. The balance of trade can be brought to equilibrium by various mechanisms and policies, and we should be aware which factors could be hiding behind the dynamics of exports and imports.

3. Data and the Bias in Statistics

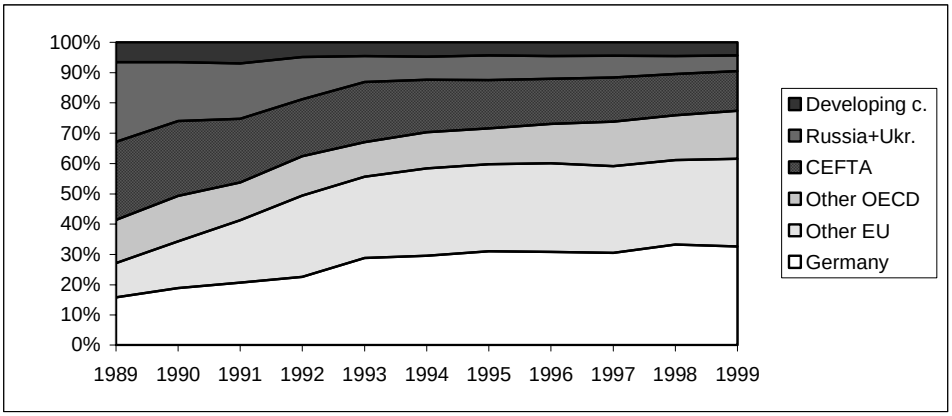
The purpose of this paper – to quantify the factors related to the intensity of trade flows with the EU after the opening up – depends to a large extent on the quality of data. Though both international and Czech trade statistics appear to be highly elaborated, their contents have many methodological problems. Extensive data overhauling and conversion must be performed before we can start with computations. First, the exports of the Czech Republic to the EU need not be the same as the imports of the EU from the Czech Republic. The differences in the national customs statistics can be subject to different commercial statuses of the trade – the first one is in the parity of FOB (free on board), the other is measured as CIF (cost, insurance and freight), where the difference is caused by transportation and insurance costs between the Czech border and the reporting country. Different periods of customs declaration can be also a source of variations in national annual statistics.

We should also consider the potential for errors or omissions, the latter being sometimes intentional due to tax evasion. Especially the statistics on the quantities of trade (e.g., in tons) are prone to errors, since not all commodities are declared in the same measures of quantities. Some data can be in a different system of nomenclature. For example, trade is usually recorded in the Standard Industrial Trade Classification (SITC) codes or the Combined Nomenclature (CN) classifications describing products, while the statistics of production and supply side characteristics is in the Statistical Classification of Economic Activity (or NACE) codes, describing activities. The researcher has no better option than to transform one system of statistics into another, an action that may become a cause for bias. On top of all this, international trade may be recorded in different currency units (US dollars or euros) than the remaining domestic statistics. The average exchange rate can bias the conversion, since the exchange rates may fluctuate daily and the given variable need not develop linearly. Last but not least, the methodological changes can lead to a serious bias in trade time series. For example, the post-communist countries adopted the World Trade Organization (WTO) statistical standards without adjusting back the time series. Thus the addition of re-export, inward or outward processing trade, and leasing can seriously damage the compatibility of data. Therefore it is highly advisable to devote sufficient time and statistical techniques to the data checking and adjustments for evident errors and omissions.

Figures 1 and 2 depict how the shares of Czech imports and exports changed over the period from 1989-1999, if we consider 6 major regions. We can see that the trade with OECD countries had the fastest positive dynamics. The trade with CEFTA and with developing countries lost its share only marginally, while Russia and Ukraine were the main losers. We can also observe that the bulk of changes occurred during 1990-94.[3] The period of 1995-1999 can be characterized as a period of geographical stabilization. The growth rates of trade remained very high (over 15% annually) but the shares of regions on the total trade changed only mildly during 1995-99. On the other hand, there were proceeding deep changes in the industrial structure of trade. *This is an important moment to be realized for our analysis, since our seven-year period of 1993-99 is composed of two parts: 1993-94, when trade diversion prevailed, and 1995-99, when the trade creation was dominant.*

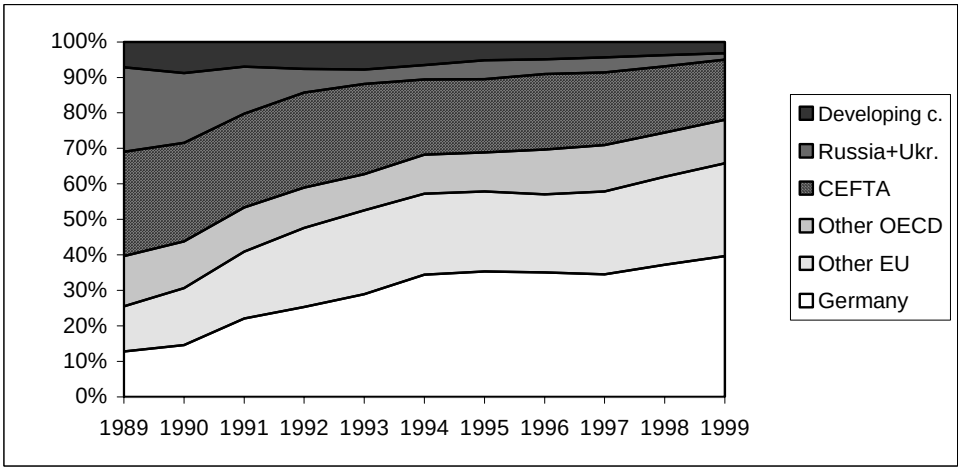
[3] A similar structural change is revealed in the Hungarian structure of trade (Darvas and Sass 2001). In a more detailed examination we can see that it was Germany that became the main winner in the long-run battle for the Czech market. German-speaking territories (Germany, Austria, and Switzerland) make up more than half of the Czech trade turnover. In 1971 it was just below 10%.

Figure 1. Share of Czech imports received by economic regions in 1989-99.



Source: trade statistics of Czech Statistical Office adjusted for changes in methodology

Figure 2. Share of Czech exports accepted by economic regions in 1989-99.



Source: ibid

There is a consistency problem when we work with time series in an environment that is subject to intensive qualitative changes, such as an economic transition. A priori we cannot exclude a case that during the studied period the nature of economic agents changed to such a degree that the underlying trade was subject to different behavioral patterns. An artificial amalgamation of disparate time periods and disparate groups of industries (or enterprises inside of industries) could then result in a weak statistical significance of estimated behavioral characteristics. Mixing two populations of data into one dataset for testing, each of which responds differently to the explanatory variables, can be dangerous. This problem can intensify if the data are composed of industries of two types: those developing under the pressure of FDI and international competition and those resisting the restructuring (for example, in an expectation for a bailout from the government or other implicit subsidies). Special

statistical methods were developed in order to reveal such situations. One of them is, for example, robust statistics (Visek 1996). For more information about such applications on problems of international trade see Benacek and Visek (1999 and 2001). From this aspect, this study was not concluded. The logical next step would be to concentrate more on the problems with data and behavioral inconsistencies.

4. Specification of Models for Empirical Testing of Imports and Exports

Our basic import and export models for the empirical testing by the ordinary least squares (OLS) regression technique were derived from the theory of international economics. Unfortunately, there is not just one theory of trade and specialization. Econometric studies dealing with the estimation of factors influencing the commodity structure of international trade had to tackle this problem by using a number of exogenous variables that do not come from just one theoretical school of trade specialization (see Pain and Wakelin, 1997) or Aturupane et al., 1997). Luckily, the parallel paradigms seem to concentrate on *alternative* aspects of the causal forces leading to trade. For the imports, we have tested which factors were active in determining the value and the structure of imported commodities in SITC groups aggregated by two-digit classification i = 1, 2, …, 61 during the seven years t = 1993 through 1999. In accordance with the Keynesian theory, imports (M_{it}) of the Czech Republic were considered a function of Czech aggregate demand, represented here by gross domestic product (GDP) in nominal dollars, since the trade is also considered in nominal dollars. Thus this variable reflects the potential of the purchasing absorption of the aggregate domestic demand. Similarly, the exports were tested as a function of GDP in nominal dollars in the partner countries.

The crux of the problem here is that GDP is a macroeconomic variable, while trade is essentially a microeconomic concept because its most important feature rests in specialization. GDP is thus unable to determine tradeoffs in specialization. Economic theory solved this problem by bringing industry-specific exogenous factors to the fore. Relative factor endowments of production, combined with industry-specific factor requirements ("intensities"), both measured by capital per labor ratios, became the exclusive determining factors in the Heckscher-Ohlin models of trade specialization. We shall keep this trade paradigm in the center of our analysis. It is traditionally assumed that the Czechia is a country relatively better endowed with labor, if the international comparison of the K/L endowments is made as a trade-weighted average with trading partners. Relative to the EU, it is expected that Czech exports should be biased toward intensive-intensive products. We cannot be as certain about the sign with the accession countries or with the rest of the world. Our test is therefore a test of the relevance of factor proportions in determining the trade patterns. The classical Heckscher-Ohlin paradigm is here extended to the influence of human-capital endowments, changing demand and pricing patterns, and the distortions set by policy-instruments (e.g. tariffs, subsidies or exchange rates), following some of the ideas by Leamer (1995).

Exports and imports are thus primarily determined by the supply side where individual unit-value isoquants are "hanged" in the capital/labor (K/L) requirements space where prices are exogenous - determined on world markets. Isoquants are

therefore moving along its factor-requirement lines according to the prices set by competing with foreign competitors. Their economic criterion is determined by unit-value isocost lines, which may be also sector specific and determined jointly by marginal product in given sector and endowments. The productivy gap (relative to foreign competition) is a function of human capital that is not present uniformly in individual industries. The human capital in our models is represented by foreign direct investment (FDI)

Thus the intensities of trade (exports or imports) can be strongly influenced by the presence of FDI, namely the FDI industrial stock (Benacek *et al*., 2000). Together with the relative factor requirements (K/L), this variable characterizes the industry-specific supply side of production. It can act as a proxy for human capital in given industry: managerial skills, the ability to penetrate world markets, and the quality of the physical capital. In the export function, the presence of a large FDI stock in an industry should boost its exports, since FDI location is attracted by comparative advantages and by the potential for growth they offer. The relationship is less obvious in the import function. We can assume that, in the long run, FDI can be a *substitute* for imports in the given category of products ***i*** and its sign should thus be negative. At the same time, however, FDI can be a *complement* to imports of inputs and machines to the given production in the short run. It can be especially our case because our time span of 1993-99 is rather short and its SITC two-digit classification of products is still too gross [4]. On top of that, FDI can also boost imports of inputs in the subcontracting industries. As a result, we cannot be certain a priori about the expected sign of FDI in the import function, even though FDI can be assumed to be an instrument for balance of trade improvements and exchange rate appreciation.

On the other hand, in accordance with the neo-classical theory of trade, imports can be also considered a function of *relative unit prices.* Namely, we should relate domestic and foreign unit prices. In difference to pure supply factors, prices are an outcome of the interaction with the demand side. Thus prices can be grossly different from the costs of production and their incorporation into the list of exogenous variables is justified.

Here a discussion can be raised about which prices should be concretely compared. Either we can take the internal prices at home relative to the internal prices abroad, as is done in the literature describing the evolution of trade from autarchy. Such statistics unfortunately do not exist. Alternatively we could compare the domestic export prices with the export prices of our foreign competitors. That is again a problem since there are too many varied competitors all over the world and we are not sure which of them are the relevant ones. Last but not least, because we deal with tradable commodities in highly open and competing economies, we could compare the domestic export prices with *the prices of domestic imports*, which was finally the case in this study. It is assumed that these two prices represent competing products. A similar

[4] This is characteristic for the intra-industry trade that is becoming very intensive in Czechia. But it could be also a case of inter-industry trade where the inputs are classified in the same industry as its output, for example, it can be in imports of car components and exports of assembled cars; similarly in exports of electrical equipment and imports of electrical machines, etc.

option was taken, for example, in the seminal papers by MacDougall, 1951 and 1952. If the model is exponential (e.g. of the Cobb-Douglas type),[5] then its coefficient represents the "elasticity of substitution" of world consumers (importers) of the given product between our country's exports and the production of our competitors. A review of the problem is provided in Harberger, 1957).

Here we were challenged by methodological problems concerning both the numerator and the denominator:

a] Since neither the unit prices for aggregated SITC groups of products nor even the time series of their inflators are available, the analysts are obliged to resort to substitutes. In our case we used *values of exports and imports (in US$) per ton* of given products as proxy variables for unit prices. This is evidently a second best option that has only pragmatic justification. However, its bias as a representative of unit prices can be significant.

b] Unit prices based on values per ton can have an ambiguous interpretation since they reflect both the *costs* (i.e., the price competitiveness of two otherwise identical products) and the *quality*. In the latter case, if the prices differ, the products are differentiated. In case of a vertical differentiation the products look only seemingly similar because they belong to "vertically" different consumer baskets due to different quality (e.g., to up-market and down-market products). According to various studies, vertical differentiation dominates the trade among industrial countries (Fontagné *et al*. 1998). If our indicator of relative prices changes in time, we may interpret that in two ways: first we may assume that there was a "vertical" shift in relative quality and not in relative costs, since the law of one world price precludes such competition. But the law of one price has its clear limits. Thus we may take a second assumption where the competition is based only on changed prices without any recourse to shifts in quality. Both of these important alternative aspects should be estimated in our empirical analysis.

c] Problem of relative price competitiveness can be even better revealed if the differentiation is horizontal. There the products belong to a similar category of quality, but otherwise they need not identical in their prices or costs.

The problems mentioned under b] and c] are associated with representation. The measurement of comparative advantages, in the strictest sense of the Ricardian theory, is subject to two different price comparisons (see Brenton *et al*., 1997, p. 15 and 23):

- relative prices of two identical products from two countries (before the trade starts) and
- terms of trade of two different products from two countries (when the trade exists).

In the first case, we compare *identical products* from two countries, where the relationship PX_{it}/PM_{it} can be applied only for *autarchy*, since the opening-up of trade

[5] Taken concretely we could "explain" the intensity of Czech exports to the EU by a model:

$\mathbf{X_{it}^{EU} = A\ (PX_{it}^{(EU)} / PM_{it}^{(EU)})^{B}}$ where A is the constant term and B is the coefficient of the elasticity of substitution between the purchases of commodity i produced in the Czech Republic and in the EU. PX and PM are price indices of Czech exports to the EU and Czech imports from the EU, respectively.

equalizes prices of identical products and the product with local comparative disadvantage is not traded by that country.

In our estimated models the condition of export product homogeneity and its perfect substitutability by imports is therefore infringed because in any of our 61 SITC product groups we compare two bundles (vectors) of products subject to an unpredictable degree of variety. Though such relative prices have hardly any meaning in the given year, we can at least interpret their changes in time because our relative price index becomes actually an *index of terms of trade* – and that is a concept that has definitely its economic relevance. In other words, in the variable PX_{it}/PM_{it} we are located in a space defined from an index of price competitiveness between two perfectly homogenous products (competing in prices under horizontal differentiation), up to an index of classical terms of trade derived from barter between two completely different (and mutually non-competing) products. Though these concepts have a different theoretical interpretation, their changes in time still retain one or the other aspect of competitiveness.

All three of our caveats a], b], c] are serious. We know we are measuring some important features of competitiveness, however, the complications in interpretation of the signs make our conclusions rather uncertain. The conclusions must be very cautious, especially if the price variable is statistically significant. We offer some clues for getting out of the tangle by accepting some simplifications that have a high degree of credibility. We once again repeat that it is not the absolute values in the price variables that matter in our regressions, but their *annual changes during 7 years*. For example, in the model of Czech exports to the EU we test the price variable PX_{it}/PM_{it}. After taking the natural logarithms we can separate them and get $Ln(PX_{it})$ and $Ln(PM_{it})$. If the sign of the first variable is statistically significant and *negative*, then export price decreases in time are compatible with more intensive exports. The case that higher exports would be compatible with decreases in their quality can be logically excluded. Therefore, we can judge that it was the *price (cost) competitiveness* in Czech exports that was the dominant feature in their penetration on the EU markets.

On the other hand, if the coefficient for PX had a *positive sign*, that would indicate the dominance of Czech *quality competition*. Higher exports are compatible only with improvements in quality that are reflected in price increases. The complication is that, if at the same time the coefficient of PM is also positive. Then we can say that, with high probability, the Czech "average" export growth happened *in spite* of the EU's rising quality. Thus both competitions in quality were successful, for example, due to well-chosen differentiation of products.

An additional information can be potentially derived from the previous results – i.e., when both coefficients were positive – what was the prevailing tendency among 61 industries. Of course, there could exist some less successful Czech industries that lost their competitiveness in exports because they were not able to offset the rising quality in the EU domestic products by their own quality improvements. Their only short-run strategy for survival would be to lower the export prices [6]. As an addition to our

[6] Such result can now also have an impact on policies for a longer period: the loosing industry can survive either by decreasing their costs (by increased productivity or by decreased labor costs) or investing into a quality improvement or, alternatively, by pressing for a devaluation or

analysis, we could separate by robust methods of estimation those industries that are competing in prices from those competing in quality.

Another problem to discuss is if both price variables are statistically insignificant. Then we would end up in a shadow area: both the price and the quality competitions seem to be irrelevant in their impact on trading. That is logically untenable (once the price or quality changes did occur), because the competition should have one or the other form. It is not very credible that the elasticity of demand to price or quality changes would be zero. Either we conclude (1) that our price data were wrongly measured and therefore they were not correlated with the real factors of competitiveness, or (2) that our data consisted of two mutually balanced mixed populations of products that, in their relationship to unit prices, behaved in opposite directions. For example, one subpopulation was subject to price competition while the other subpopulation was subject to quality competition. Again, a robust technique of estimation can be used to separate the subpopulations.

The real exchange rate RER_i should be included in the list of explanatory variables, provided we could assume that both the PM and the PX variables (measured in US$) were *not* already fluctuating as a function of the exchange rate changes, that would cause multicollinearity. If the fluctuations were present, it would imply that all nominal exchange rate changes would be immediately transferred into the price changes. For PM, this situation can be fully excluded because the Czech Republic is a small country and as such, it is a price taker. On the other hand, the variable PX (in US$) is not autonomous because depreciation could influence the level of export prices. However, as is known from the previous analyses of elasticities of supply and demand for a small economy,[7] a devaluation of 10% will hardly imply a decrease in the dollar export price by more than 6%. Then, also, the worsening in the terms of trade must be less than proportional to the rate of devaluation. Since the dollar export price response to exchange rate changes can be assumed low and since the behavior of both exporters and importers is influenced mainly by the *changes of prices in domestic currency* (that are far from being perfectly correlated with exchange rate changes), then the inclusion of the real exchange rate in our model is justified. We should expect a positive sign for the coefficient of the variable RER_i [8] in imports and a negative sign for exports.

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for a subsidy. It is obvious that the last two policies of competitiveness are economically inferior to the former two.

[7] Here we have touched upon the Marshall-Lerner-Robinson condition and the behavior of economic agents in nominal exchange rate changes. In this particular case we deal with their impact on the terms of trade. If the elasticity of foreign demand for Czech exports were well above unity (as the studies imply - see Tomsik, 2000), then even if the expected export supply elasticities would be in the range of 0.5 – 1.2, still the decreases in export prices would be small.

[8] The real exchange rate was defined as: $RER_t = ((NER_t / NER_{1995}) / (P^{CZ}_t / P^*_t))^{-1}$, where t=1993, …, 1999, NER are nominal exchange rates of Czech Korunas per one EUR or USD, and P are Czech and foreign consumer price level indices. Its higher value means a real appreciation, which should be associated with lower exports and higher imports. In reality, Czech koruna, relative to euro-currencies, was generally appreciating in real terms throughout 1993-99 while both imports and exports were rising sharply.

Let us turn our attention to the explanatory variables that deal with pure institutional interferences with imports. Tariffs (Tar_{it}) are the most common trade policy instruments. They represent an important barrier that impedes the penetration of imports on the domestic market. It is our task to find out how Czech trade behaved as the tariffs with the EU were gradually lifted throughout 1992-99, while they were kept with the majority of non-EU countries. We will estimate this influence by the coefficient of elasticity that should have a negative sign.

The tariff, however, may not be the most important institutional instrument influencing the intensity of trade flows. The competitiveness of the domestic economy can be artificially increased by *subsidies*. For example, subsidies can increase the price competitiveness of domestic producers vis-à-vis competing imported goods as much as they can help exporters. With the exception of subsidies for agriculture, the subsidies provided to the Czech economy directly from public budgets were quite low. On the other hand, the *implicit quasi-subsidies* provided by the semi-state banking system were huge. They were hidden in soft credit lines that in many cases were not expected to be disbursed (fully or partially) at the time of maturity. By May 2000, 34% of all accumulated bank credits were classified, which amounted to approximately US$10 billion (15% of GDP). As the banking insolvency threatened to destabilize the whole Czech economy, the bad debts were either converted into securities and purchased by the State Consolidation Bank or directly bailed out by the state institutions. The commercial banks and some large corporations were thus directly subsidized for their losses by the Ministry of Finance, Czech National Bank, or the National Property Fund. The debtors of the commercial banks were then subsidized indirectly (implicitly).

Inter-enterprise indebtedness represented another source of implicit subsidies, representing nearly US$8 billion. The usual rule was that a successful enterprise ended up in a position of a creditor, while a less competitive producer became a net beneficiary of such a scheme. The third form of implicit subsidization of enterprises was offered by waiving their taxes, social security, and health insurance payments or the installments for the privatization of state property. In aggregate for the 10 years of transition, these three unofficial (but officially widely tolerated) sources of relief represented at least US$30 billion (approximately a half of the Czech GDP). Since their recipients recruited mostly from declining industries, which cannot be assumed to abound in comparative advantages, the implicit subsidies represented a potential defense against import competition in the given industry. We will estimate the intensity of implicit subsidies (S_i) by a proxy of accumulated net stock of debts in given industry *i*. In order to exclude the bias of different sizes of industries, we weighted this variable by the value added in industries. We would expect a negative sign of this variable in the import function. On the other hand, implicit subsidies increase the competitiveness in exports, too, and the sign of this variable in the export function should be positive.

At this closing stage of our model specification, we should solve the following problem: up until this moment the absolute values of trade flows have been "explained" either by dummies (such as GDP or real exchange rate) or by intensities (indices) unrelated to the size of industries. The only exception was the variable for the stock of FDI, which in fact is only loosely related to the "size" of a given industry. Intensities of trade flows by commodity groups are definitely subject to the size of given industries

that were defined to a large extent arbitrarily.[9] Therefore, we should add to the given list a variable that could explain better both the import "pull" and the export "push" caused by the size of the productive capacity in industries. Value added can be chosen for that purpose [10]. The variable of net output could take the role of domestic production, as used in the gravity equations for explaining export "push" by domestic supply. In order to avoid the problems with missing indices of inflation, we used the indices of value added structure (i.e. shares on the total net production) as the final variable.

The basic models for empirical testing are therefore defined as imports and exports that are a function of following factors representing the mix of supply variables, demand variables and policy variables:

$$M_{it}^{w} = \Phi_{M}^{w}(GDP_t,\ VA_{it}/VA_t,\ PM_{it}^{w}/PX_{it}^{w},\ K_{it}/L_{it},\ FDI_{it},\ RER_t^{w},\ Tar_{it}^{w},\ S_{it}/VA_{it},\ \varepsilon_{it}^{w})$$

$$X_{it}^{w} = \Phi_{X}^{w}(GDP_t^{w},\ VA_{it}/VA_t,\ PX_{it}^{w}/PM_{it}^{w},\ K_{it}/L_{it},\ FDI_{it},\ RER_t^{w},\ Tar_{it}^{w},\ S_{it}/VA_{it},\ \varepsilon_{it}^{w})$$

where

i = 1, 2, …, 61 are commodity groups at SITC two-digit classification

t = years 1993 through 1999

w = regions from where the imports originated or to where the exports were directed: $w \in \{EU, RW\}$, i.e. the EU and the rest of world

M_{it}^{w} = Czech imports from w (in US$)

X_{it}^{w} = Czech exports to w (in US$)

GDP_t = Czech nominal GDP in US$ measuring the aggregate demand absorption capacity;

GDP_t^{w} = nominal GDP in US$ for countries importing Czech products measuring their aggregate demand absorption capacity;

VA_{it}/VA_t = industrial structure of value added in industry *i* on total value added (in %) ;

PM_{it}^{w}/PX_{it}^{w} = relative prices in import equation measuring the competitiveness in prices or in quality;

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[9] The alternative to working with absolute values of imports or exports, that are subject to the arbitrariness in the size of industry, is to normalize them by dividing trade intensities by value added in industry or by using indices of growth or various revealed comparative advantages. Then even an industry of a negligible size can become as important as the main industry. This modification of the model would have, however, a different interpretation and its link to the task of trade intensities and GDP growth would be further complicated. We therefore did not normalize the trade flows.

[10] An alternative to value added would be to use the material inputs. Exports and imports (or domestic import replacements) of an industry are a composite category that includes both the value added in the given industry plus the cumulated intermediate inputs from the previous stages of production. Along with the inputs of capital and labor we should therefore also keep track how the inputs of energy and material are related to the competitiveness of exports or imports (the latter relative to the domestic import replacements). Our models are would be then able to emulate the KLEM production functions working with capital, labor, energy and material inputs.

PX_{it}^{w} / PM_{it}^{w} = relative prices in export equation measuring the competitiveness in prices or in quality;

K_{it}/L_{it} = capital (in constant prices of 1997) per labor characterizing the domestic technologies;

FDI_{it} = foreign direct investment stocks (in US$);

RER_{t}^{w} = effective real exchange rate index based on CPI and related to currencies of given trade partners (an increase in RER is interpreted as appreciation);

TAR_{it}^{w} = Czech tariff rates for imports from w or average tariffs levied by countries w on Czech exports;

S_{it}/VA_{it} = implicit subsidies per value added in 1997 (in %);

ε_{it}^{w} = random term.

The functions Φ^{w} will be estimated as a function with coefficients as exponents. Such a model can be linearized by taking natural logarithms of all variables. This modification actually turns the model based originally on absolute values to a model based on growth. Its coefficients can be thus interpreted as coefficients of elasticities.

5. Results of Empirical Tests of Czech Trade with the EU

Model of Czech Imports from the EU

The data for empirical testing are for 61 commodity groups (industries) of the Czech economy in time series of 1993-99. The data available is therefore a combination of cross-section and time-series statistics for more than just one object (industry). Therefore we could not estimate the model as a classical panel. Data were arranged as a segmented "panel", which means that we created consecutive sections of 61 blocks, one for each industry, each containing a sequence of 7 rows for individual years. Economic information about every industry (block), described by indices ***i***, was therefore contained by columns, each of them representing one variable – starting from import values and continuing for the explanatory variables: Czech GDP, import and export prices (they were separated after taking their logarithm), value added, capital per labor, subsidies per value added, FDI stocks, tariff rates, and the index of real exchange rate.

In the initial step we estimated the regression coefficients by the OLS method after taking logarithms of all variables. The first problem of estimation was associated with heteroscedasticity, which, as indicated by the White test, was at the margin of tolerance. Standard error and t-statistics were therefore adjusted in accordance to the weights given by the White procedure. This adjustment was performed automatically on all our results.

Unfortunately, after comparing the extremely low value of the D-W statistics [11] with its critical values, we also found the presence of serial correlation due to strong

[11] It is necessary to admit that in the segmented panel data the D-W statistics cannot be measured perfectly. One seventh of the D-W statistics (due to 7 years of observation) is based

autoregressive dependence in disturbances. A cyclical pressure seemed to be present, otherwise explained neither by the model nor by some methodological inconsistencies in the data collection. This periodical fluctuation lasted systematically for two or more years and pushed up or pulled down the imports from the path determined by the exogenous variables. We have found this pressure present in all Czech data for trade with both partners. The removal of serial correlation was, however, a more tenacious problem where we succeeded only partially [12]. Our main liability in correcting for autocorrelation was a danger that our model was not fully specified. A missing "Ricardian" variable of total factor productivity could be behind our problem. Nevertheless, we attempted to filter-out the autocorrelation by internalizing it by the parameter RHO, i.e. by estimating the pattern in the autocorrelation: $\varepsilon_t = \rho^* \varepsilon_{t-1} + u_t$. As another non-destructive alternative for remedial measures, in chapter 7 we also estimated our models in a form of first differences of all variables, cross-checking our results. At this preliminary stage of estimations we did not dare to apply any of the more sophisticated techniques on our incomplete data (e.g. the Cochrane-Orcutt transformation) because, as Mizon (1995) warns, the damage caused by such transformations can be greater than any gains.

In the next step we therefore applied the AR procedure of TSP and estimated the full model again. The coefficient ρ quantifies the intensity of the autoregressive factor in the error term of the model. By eliminating exogenous variables that were either statistically insignificant or were sources of an evident colinearity among explanatory variables, we arrived at the results of the final model:

$$\ln(M_t) = \beta_1 + \beta_2 \ln(PM_t) + \beta_3 \ln(\frac{S_t}{VA_t}) + \beta_4 \ln(FDI_t) + \beta_5 \ln(GDPcz_t) + \beta_6 \ln(RER_t) + \varepsilon_t$$

where $\varepsilon_t = \rho^* \varepsilon_{t-1} + u_t$

Its estimated coefficients and statistical characteristics are shown in Table 1.

As we can see, the regression results brought us to the conclusion that tariffs, capital per labor endowments, value added, and unit prices of Czech exports should not be considered significant variables for "explaining" the changes in the commodity structure and intensity of growth in Czech imports from the EU. We can therefore presume that Czech import tariff concessions (as a weighted average, they represented a decrease of approximately 4 percentage points on costs) were so small, relative to other much stronger factors, that their structural impact on the stimulation of the EU imports was insignificant. The role of implicit subsidies was more important in that respect.

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on wrong data – that means on data from two different industrial blocks and therefore also out of the time sequence. However, if we also assume that the nature of this disturbance is random, then the bias cannot pose a major threat to the significance of the D-W statistics.

[12] Autocorrelation of residuals can aggravate the estimation if some important variable (in this case a dummy) was not included in the tests. Since the specification error, as we hoped, was not our case, we could proceed with remedial measures for the removal of autocorrelation. Otherwise there is a high probability that regression coefficients would be biased and inconsistent. We used TSP (alternatively the estimation can be done by STATISTICA) as the computational instrument and especially its AR procedure, which offered the user a sufficient control over the procedures correcting for autocorrelation.

What is more relevant as a conclusion, is that *Czech domestic prices (represented by the Czech export prices) were definitely not a competitive threat to the EU imports*. Czech domestic production, including the export production that is subject to comparative advantages, is so different from the EU imports that the EU imports seem to be an exclusive trade. Its competitors are not generally among the domestic producers but come mainly from outside – i.e., from other imports.

Table 1. Estimation of imports from the EU.

Variables	Estimated parameters	Standard error	t-statistics	P-value
Intercept	3.5573	2.6999	1.317	[.188]
Ln PM	0.3592	0.0514	6.992	[.000]
Ln S/VA	0.3617	0.0791	4.574	[.000]
Ln FDI	0.3805	0.0374	10.162	[.000]
Ln GDP_{CZ}	1.1779	0.3372	3.492	[.000]
Ln RER	2.1195	0.9059	-2.339	[.019]
ρ	0.8052	0.0303	26.582	[.000]

Std. error of regression	= 0.6894	Adjusted R-squared	=	0.833
R-squared	= 0.8350	Durbin-Watson	=	2.058

One of the most surprising findings of our model is that Czech imports from the EU have not been concentrated on capital-intensive products. Their dependence on factor contents has become typically neutral to the capital-labor classification. The rising dominance of machines and transport equipment over the imports of intermediate material products (especially chemical and metallurgical ones) during the second half of 90s actually shifted the classical Heckscher-Ohlin criteria for specialization to the arena of human capital where the EU countries have a clear comparative advantage. Unfortunately we could only indirectly test the importance of the human capital for determining the import structures.

The *dominant role of the human capital in the Czech imports from the EU* can be derived from the statistical significance of import prices that have a *positive sign*. Taken strictly from the Ricardo-Haberler position, where the cost-price competitiveness is shaping the specialization pattern, the positive sign of this variable would be an untenable paradox: the higher the growth in unit prices, the more competitive will be the imports relative to domestic products.[13] Wdowinski and Milo (2001) arrived at a similar observation in their price model for Poland. Under such circumstances we must abandon the Ricardian assumptions and turn to *modern theories of trade*. There the competition is in quality, the products are differentiated, and the rivalry between imports and their domestic substitutes is subdued. The higher the quality of imports

[13] This phenomenon could be explained by the Giffen paradox of consumption, where higher price attracts higher demand, especially in combination with preferences for more expensive (luxurious) products. That could happen as real incomes rose after the transformation shock in 1991-92. Though acceptable for some commodities, such behavior is difficult to take as rational for the whole Czech economy, where the majority of imports are intermediate products and machines.

relative to domestic products, the more competitive they are. This implies in a dynamic context that gains in competitiveness can be achieved in the first place by improvements in quality (including the market servicing, brand-name, good-will, market power, etc.), despite the rising prices that reflect these changes. Then it is no surprise to find out that prices of domestic competitors, which in some commodity groups were at a half of the prices of their alleged competitors from the EU,[14] did not pose a major threat to the EU imports.

Another important finding of our model is that the *income elasticity of the Czech demand for imports is 18% higher than unity*. This would mean that any growth of GDP would require more than proportional absorption of imports from the EU. Czech restructuring is revealing here a built-in property of accelerating its imports from the EU, as the economy strengthens. While during 1993-99 the average growth of imports from the EU was 14%, the expected growth need not decrease in time. This could be sustainable only if the exports could accelerate even faster, and/or if the imports from the rest of world were crowded out by EU imports. Otherwise, the Czech economy would be exposed to "go-stop" policies, where any growth would be constrained by external disequilibrium and by a need to resort to restrictive policies for bringing the economy onto a sustainable path at a lower GDP growth.

FDI became an important factor shaping the intensity and the structure of Czech imports. The structure of FDI stocks can be treated as an indicator revealing the business sector expectations for growth, development, and exports. On the other hand, FDI boosts imports of both machinery and material inputs and its over-all effect on the balance of trade can be subject to fluctuations that start from net trade deficit, turning only slowly to the trade surplus.

Implicit subsidies reflect the institutional distortions in defending the survival of industries endangered by import competition. According to the theory of trade, defending the industries lacking comparative advantages is a counter-productive activity, and tariffs are the preferred least distortional measures. In the Czech case, their lack was substituted by soft loans. The higher was the threat of imports (in another words the higher were the comparative disadvantages in the given sector), the higher were the subsidies per value added. Unfortunately, this instrument seems to be not only distortional but also inefficient in its aims, as its positive sign reveals. It did not increase the competitiveness of these industries in fighting imports and therefore imports from the EU were not curtailed by them. Such subsidies could only postpone the restructuring of enterprises.

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[14] According to industrial statistics of unit prices, used in the basket of commodities for the estimation of purchasing power parity, Czech prices of allegedly identical products, including traded commodities, were lower by approximately 25%. The purchasing power parity estimations for 1996 up-valued the Czech GDP 2.3-fold, which means that, on average, the Czech prices were at a mere 44%, if compared with "identical" products at the US price level. The index would decrease to a mere 41% if the German price level were taken as a benchmark. Extremely low prices of Czech non-tradables are the cause for such discrepancies. As our model shows, the price competition of Czech products is not the most efficient way to fend off the German competition. It is the quality competition that matters.

The significance of real effective exchange rate implies that the real appreciation has been pushing up the imports. The elasticity of that relationship is higher than unity and it is evident that a real depreciation could be potentially an important instrument for relieving the balance of trade deficit. On the other hand, the real appreciation can seriously hit domestic production for exports. However, real appreciation could be sustainable if both domestic import-competing production and exports gained in productivity proportionally to the losses in competitiveness caused by exchange rate appreciation, without a parallel compensation in increased wages. Such appreciation could be also an ex-post compensation for the gains in competitiveness of domestic production due to both decreases in unit costs and increases in quality. We may say that a parallel mix of all three of these changes could be an optimal instrument for a fast growth expressed in the dollar GDP per capita.

Model of Czech Exports to the EU

By following similar procedures in dealing with the export function for the EU we came to the following final empirical specification of the model:

$$\ln(X_t) = \beta_1 + \beta_2 \ln(PX_t) + \beta_3 \ln(VA_t) + \beta_4 \ln(\frac{K_t}{L_t}) + \beta_5 \ln(\frac{S_t}{VA_t}) +$$

$$+ \beta_6 \ln(FDI_t) + \beta_7 \ln(GDPeu_t) + \varepsilon_t$$

where $\varepsilon_t = \rho^* \varepsilon_{t-1} + u_t$

Its estimated coefficients and statistical characteristics are indicated in Table 2.

Table 2. Estimation of exports to the EU.

Variables	Estimated parameters	Standard error	t-statistics	P-value
Intercept	-2.7832	4.0267	-0.691	[.489]
Ln PX	-0.0963	0.0492	-1.956	[.050]
Ln VA	0.4206	0.0593	7.092	[.000]
Ln K/L	-0.5936	0.1185	-5.010	[.000]
Ln S/VA	0.3001	0.0778	3.859	[.000]
Ln FDI	0.1376	0.0429	3.203	[.001]
Ln GDP_{EU}	1.8273	0.4546	4.019	[.000]
ρ	0.8519	0.0259	32.915	[.000]
Std. error of regression	= 0.6657		Adjusted R-squared	= 0.837
R-squared	= 0.8394		Durbin-Watson	= 2.082

As we can see, the regression results brought us again to a conclusion that unit prices of the EU exports to the Czech Republic (represented here by the variable PM) should not be considered significant variables for "explaining" the changes in the commodity structure and the intensity of growth in Czech exports to the EU. In another words, a change in the prices of the EU products is not a relevant variable for explaining the Czech export competitiveness or even the whole Czech manufacturing production.

The competitiveness of Czech exports is associated with two features, as the negative sign for the variable of export prices indicates.

First, *Czech exports to the EU are concentrated in products with lower ton prices*. That also implies lower value added contents per product, which may be also caused by *lower quality* and therefore lower selling price. Second, the *gains in competitiveness have been based on price competition* – higher exports have been achieved by price concessions relative to prices of competitors. Unfortunately, as was mentioned above, the competitors to Czech exports were not among the domestic EU producers. They could come from other transition countries or from developing countries. The competition among them is generally not in quality but in unit prices for standardized commodities. This is a paradox: the gains in exports (and the GDP growth) can be reached by low pricing policies or undervalued exchange rates, which on the other hand impair the terms of trade and decrease the potential for GDP growth. Although this is not a full-fledged case of *immiserizing growth* (see Bhagwati (1967)), there still exists a tendency not to dissociate the trade gains via price reduction from it either. A more satisfying answer for targeting growth would be in the gains in the quality of exports that could improve both the Czech terms of trade and the export competitiveness.

Czech exports to the EU have been concentrated in intensive-intensive products, which has been a tradition since the late 19th century (Benacek, 2001). Contrary to the analysis of imports from the EU, we cannot find much evidence from our results confirming the importance of human capital in export competitiveness.

Another finding of our model of crucial importance is that the *income elasticity of the Czech demand for exports was 83% higher than unity*. This would mean that any growth of GDP in the EU would lead to a more than proportional absorption of imports from the Czech Republic. Alternatively, a recession in the EU would not only cause serious problems in Czech exports, but also spill the recession over to the Czech economy nearly instantly. However, since the estimated income elasticities of exports are higher than those of imports, the impact of growth in both economies on the Czech balance of trade may not lead to a serious disequilibrium, even if the Czech growth were slightly higher than the growth in the EU.

FDI has a positive impact on the structure of Czech exports. However, its coefficient of elasticity (0.138) is lower than that for FDI in the model of imports (0.381). That is again a paradox, since the impact of FDI on exports (as opposed to imports) is expected to remain in the given industry without having large spillovers outside of it. This again raises the *question of whether FDI could be a provider of net exports in the short run* or whether it actually contributes to the trade deficit.

Implicit subsidies have not only been used as an instrument for the survival of industries without comparative advantages, but also for the support of industries with intensive exports. Here the positive sign signals that this "policy" had a more intensive impact on industries than it was in the case of subsidizes for import substitution. As is explained in more detail in the Appendix, its distortional impacts on the allocation of exports, domestic sales and the terms of trade caused a sub-optimal allocation of resources.

The statistical significance of the structure of value added in industries is a signal that a rise in output in some domestic industry can have a pushing effect on

exports, as is known from the gravity models (see Hamilton and Winters 1992 or Brenton *et al.* 1997, p. 159). The causal link can also be reversed: the increased exports have a feedback effect on further development in the industry, as is known from the Linder's hypothesis of representative demand.

6. Results of Empirical Tests of Czech Trade with the Rest of the World

As in the previous models, the problem with autocorrelation of residuals was also present in data for Czech trade with the non-EU countries, which we will call "the rest of the world." Therefore, in our third equation we had to apply again the AR technique of estimation. In a step-wise testing, we have excluded from the list of explanatory variables those that were either statistically insignificant or that were correlated among themselves so strongly that the multicolinearity could bias the estimation.

It is useful to realize that the "rest of the world" absorbs 36% of Czech imports and 31% of exports. This trade is effected with a heterogeneous mixture of countries with widely different patterns of trade dynamics: non-EU developed countries (with trade sharply rising), EU accession countries (with trade slowly rising, except for Slovakia), other transition economies (with trade sharply falling) and developing countries (with trade stagnating). Behavioral heterogeneity of data subpopulations can potentially cause problems with estimation because the "average" response to some variable can become a result of the evening out of counteracting tendencies, which remain hidden until the data set is separated into more homogeneous subpopulations. Our estimation at this stage of research, however, did not proceed further in that direction.

Model of Czech Imports from the non-EU Countries

The final specification of our empirical model contained the following variables:

$$\ln(M_t) = \beta_1 + \beta_2 \ln(PM_t) + \beta_3 \ln(\frac{K_t}{L_t}) + \beta_4 \ln(FDI_t) + \beta_5 \ln(Tar_t) + \beta_6 \ln(GDPcz_t) + \varepsilon_t$$

where $\varepsilon_t = \rho * \varepsilon_{t-1} + u_t$

The coefficients and their statistical properties are presented in Table 3. We can see that prices of domestic products (represented by PX), real exchange rate, value added in industry, and implicit subsidies were not statistically important factors. In contrast to the model of imports from the EU, this case shows two other factors to be active: tariffs and factor endowments. *The nature of imports from the non-EU countries and their conditions for specialization are evidently different from the imports from EU.*

Table 3. Estimation of imports from the rest of world.

Variables	Estimated parameters	Standard error	t-statistics	P-value
Intercept	0.4481	0.3739	1.198	[.231]
Ln PM	0.0946	0.0406	2.327	[.020]
Ln K/L	0.2609	0.0948	2.753	[.006]
Ln FDI	0.1427	0.0232	6.144	[.000]
Ln TAR_{CZ}	-0.4237	0.0747	-5.675	[.000]
Ln GDP_{CZ}	0.8154	0.0670	12.175	[.000]
ρ	0.8827	0.0231	38.245	[.000]
Std. error of regression	= 0.5477	Adjusted R-squared	= 0.862	
R-squared	= 0.8641	Durbin-Watson	= 1.929	

The income elasticity of imports from the rest of the world is the dominant variable in this regression. Its value *is less than unity* (0.8154), which means we should expect the share of these imports on the Czech import total to decrease over time. This impact will partially cushion the much higher income elasticity of imports from the EU. We can also expect that *after the EU accession, the imports from the countries not associated with the EU will be particularly severely hit.*

Because of its positive sign, the interpretation of the variable of import prices is the same as it was for imports from the EU. The role of competition in quality is dominant. However, the coefficient of 0.0946 is so close to zero that we have a strong suspicion that it may have been influenced to a large extent by a clash with price competition, which would be characteristic for Czech imports from developing and transition countries.

Imports from the non-EU countries are subject to *comparative advantages in capital-intensive production*, which is to a large extent associated with natural resource-intensive products. The influence of FDI is positive, even though it is much weaker than in the imports from the EU. Finally, an impact of *tariffs that impeded imports* was present. That is an important result, confirming the fact that Czech tariffs were an efficient instrument for the support of domestic production. With an entry into the EU the Czech tariffs against the non-EU members will have to be superseded by a differently structured EU tariffs. That will have an effect on the reallocation of Czech import-competing production.

Model of Czech Exports to the non-EU Countries

This model has revealed some unexpected properties, confirming that *Czech exports to the rest of the world performed under very different determining conditions than was the case of exports to the EU.* While the latter equation was the most complex of all, the equation for exports to the non-EU countries was the simplest. We have found that the intensity and structure of these exports was caused by only two factors – external aggregate demand and the FDI:

$$\ln(X_t) = \beta_1 + \beta_2 \ln(FDI_t) + \beta_3 \ln(GDP\,rw_t) + \varepsilon_t$$

where $\varepsilon_t = \rho^* \varepsilon_{t-1} + u_t$

The coefficients and their statistical properties are described in Table 4.

The income elasticity of Czech exports to the non-EU countries is extremely high and dominates this trade. There was a tendency for exports to rise uniformly in all industries at the double speed of foreign aggregate demand. Unfortunately, many of the countries in this region had problems with growth that very soon led to rising trade deficits due to very slack exports. The role of FDI stock was important, as in all previous equations. However, it was weaker in both export functions than what was estimated for the equation of imports from the EU. All remaining factors, which quantified the role of factor endowments, price, and quality competition, as well as the human capital or policy instruments (such as real exchange rate appreciation, tariffs, or subsidies), were excluded as marginal.

Table 4. Estimation of exports to the non-EU countries.

Variables	Estimated parameters	Standard error	t-statistics	P-value
Intercept	0.5428	0.4359	1.245	[.213]
Ln FDI	0.1608	0.0272	5.907	[.000]
Ln GDP_{RW}	2.1214	0.0771	27.523	[.000]
ρ	0.8820	0.0227	38.913	[.000]
Std. Error of regression	= 0.6625		Adjusted R-squared	= 0.843
R-squared	= 0.8438		Durbin-Watson	= 1.996

We can judge from the above results that Czech exports to the non-EU countries and particularly the country's industrial specialization, in contrast to the imports from these countries, have not proceeded too far. We can expect that a more *profound change in the structure of exports to non-EU countries will have to come in the future*. That also means that the domestic industrial structure is still awaiting adjustment to the foreign demand on these markets. This may not be an unfavorable development. The postponed adjustment could be a rational policy in the case of exports to countries in transition, which were not stabilized throughout the 1990s. However, after the year 2000, the time for adjustment has been approaching.

7. Correction by First Differences of All Variables

There are several alternative techniques that can be used in "correcting" the estimation for the presence of autocorrelation. The optimal solution is, of course, to make sure that there was not a variable or a dummy omitted in our list of explanatory variables. Actually that could have been the case because at this stage of research we missed data necessary for the estimation of total factor productivity, as required for the inclusion of quasi-Ricardian comparative advantage assumption in our model of trade specialization.

If the DW statistics in models estimated without the autoregressive term is quite close to zero, we infer that the hypothetical parameter ρ must be close to unity. In that case the taking of first differences of our variables can lead to best linear unbiased estimator of coefficients (with no constant term). Actually this was our situation when we tested first our models by OLS with logarithms in all variables and without the AR routine. The DW statistics varied between 0.4 and 0.5 in all four estimations. Therefore, as our second approach in dealing with the autocorrelation of residuals, we estimated the following series of models based on first differences of all variables. In case of imports from the EU the model was as follows:

$$M_{i,t} - M_{i,t-1} = a(GDP_t - GDP_{t-1}) + b(VA_{i,t} - VA_{i,t-1}) + c(PM_{i,t} - PM_{i,t-1}) + d(PX_{i,t} - PX_{i,t-1}) +$$
$$+ e(K/L_{it} - K/L_{i,t-1}) + f(FDI_{i,t} - FDI_{i,t-1}) + g(RER_t - RER_{t-1}) + h(TAR_{it} - TAR_{i,t-1}) +$$
$$+ j(DE/VA_{i,t} - DE/VA_{i,t-1}) + \varepsilon_{i,t}$$

where {a, b, c, d, e, f, g, h, j} are estimated coefficients.

We should be aware that the model with first differences measures a different problem than what we did in our previous analysis. It assesses what are the factors associated with the **absolute changes** in variables in time, while previously (due to logarithms taken of all variables) we tested what were the factors behind the **growth (and relative changes)** in variables. As these alternative model specifications are not identical, also their estimated coefficients and the list of significant variables in these two alternative specifications cannot be identical.

Table 5. Estimation of imports from the EU (first differences)

Variables	Estimated parameters	P-value	
FDI	515.7	[.000]	
GDP cz	6.63	[.000]	
K/L	-131.9	[.030]	Adjusted R^2 = 0.272
VA	7136	[.001]	Durbin-Watson = 1.90

In comparison with Table 1 there newly appeared two important variables: capital per labor requirements and value added share on total net production, The former implies that the labor-intensity of imports, what is a paradox, because Czech exports are also labor intensive. The latter implies that the extent of growth in the domestic industry that competes with imports is positively associated with the growth in imports. Domestic production is not crowded-out by imports. The variables of RER, implicit subsidies and import prices were not recognized as statistically significant. However, we can see from the decreased R^2 coefficient that now there was much more variation in the data that remained unexplained.

Table 6. Estimation of exports to the EU (first differences)

Variables	Estimated parameters	P-value	
FDI	465.2	[.005]	
GDP eu	87.19	[.000]	
K/L	-169.8	[.037]	Adjusted R^2 = 0.172
VA	11234.4	[.000]	Durbin-Watson = 1.91

What is most surprising on the characteristics determining exports to the EU, is that they are the same as it was in the case of imports. This suggests that the intra-industrial trade has been deepening intensively during 1993-99. Czech exports are even more labor-intensive than imports form the EU and FDI need not be a net contributor to trade balance. These results are highly compatible with the findings in Table 2, whose additional variable of export prices was not highly significant and that one of implicit subsidies could not be taken as a fundamental for future developments.

Table 7. Estimation of imports from the non-EU countries (first differences)

Variables	Estimated parameters	P-value	
GDP cz	3.13	[.000]	Adjusted R^2 = 0.182
MP	2.66	[.020]	Durbin-Watson = 2.03

Table 8. Estimation of exports to the non-EU countries (first differences)

Variables	Estimated parameters	P-value	
GDP rw	13864	[.000]	
RER	-11680	[.000]	Adjusted R^2 = 0.126
VA	3042.8	[.001]	Durbin-Watson = 2.19

The estimations of the models for the non-EU countries are the least revealing from what we have done to this moment. Both the export and import functions shrunk into a form used widely by macroeconomists where trade is a function of GDP and relative prices (here represented by RER or PM). Concentration on information contained in the increments to our variables meant in this case heavy losses in the analytical cognitive power of our models.

We can see that by taking first differences we have solved nearly perfectly the problem of autocorrelation in residuals but there was also a price to be paid: the estimations are weaker in their explanatory power, if measured by the lower coefficient of determination. We have also lost the possibility of using coefficients as elasticities. Our further research should go back to the full data that contain both the information accumulated in the past and the information relevant for current marginal changes.

Our empirical tests described in chapters 5 through 7 were far from being fully satisfying. For example, we had problems with the autocorrelation of residuals (and their measurement), with a reversed sign of RER in the function of imports from the EU and at the end the explanatory power of our models sharply declined. We could not exclude a case that a missing variable could be disguised behind these it. In addition, the problems could rest in the nature of our data. There could be unreliable time series full of contaminated data or even the objects of our studies could behave in an irregular way. The years of our analysis (1993-99) were years when the enterprise sector was subjected to several shocks coming from the trade contacts with abroad (trade destruction, diversion and creation) that were associated with bankruptcies and a need to reallocate the resources. The behavior of enterprises (sectors) could have been thus highly irregular, where constructive developments might be mixed with opaque behavior of sectors in distress caused by a loss of foreign markets, import penetration, unsolved ownership shocks or a lack of the access to credits that were conducive to the production demise.

Therefore a special estimation technique had to be applied in order to test if our economic agents (industries) behaved in a unique uniform pattern or if there were several alternative patterns of behavior. The existence of parallel behavioral patterns could be taken for a sign of progressing transformation and their attenuation could point to a convergence of the productive sector to a stabilized market economy. The estimation technique applied for this purpose was called “least trimmed squares” and it was developed by one of the co-authors of this paper.

8. Robust Estimation by the LTS Method

When looking for determinants of some (response) variable, econometricians frequently considered a (linear) regression model and they employed typically all available data, in the sense that they selected some variables from the available ones but they used all available cases. In other words, when searching for factors, which have significant influence on a response variable, we were prepared to accept only a model, which is valid for **all observations simultaneously**. Any interference with the “natural distribution” of the data is usually taken by economists as “data mining”, and thus a practice worth the deepest contempt. Surprisingly, this purism in the belief of immaculate data is not shared by natural scientists.

It is evident that in the real life we may be challenged more than often with situations when a part of our data will represent either a **contamination** or our data can be **a mixture of two (or more) different populations**. To distinguish between them by means of an intuitive clustering may be rather difficult. This situation can be of a special importance in transforming economies where a multi-speed development of various segments may become a rule. Asymmetric **qualitative changes** can result in a situation where the economy is subject to heterogeneous behavioral patterns.

In the next round of estimations we have applied our own variant of a robust technique based on least trimmed squares that we have already successfully tested on data analyzing Czech exports for 1994 (see Visek (1994), (1996) and (1999)).

Robust methods of estimation of regression coefficients have been recently designed especially for solving the problems of heterogeneous patterns in data sets. The reason why these methods were not much used in the past was given by the extreme

requirements of the method on both the memory and the speed of computers. Even now, when the Pentium processors offer a great computing comfort, the speed of one estimate prolongs to approximately 20 minutes. In the paper we have applied our own variant of a robust technique, namely the least trimmed squares (LTS). The corresponding estimator allows to adjusting breakdown point [15] and hence it is flexible for the pre-processing of data, as well as for their final study. First of all, let us recapitulate the method of the estimator. We shall consider the following linear regression model:

$$Y_i = X_i^T \beta^0 + \varepsilon_i, \qquad i = 1,2,....,n$$

where Y_i is the value of response variable for the i-th case, $X_i \in R^p$ is the vector of factors (or, if you want to call them explanatory variables for the i-th case), β^o is the vector of regression coefficients and finally ε_i is the random fluctuation (for the i-th case). Then for an arbitrary $\beta \in R^p$ we shall denote by $r_i(\beta) = Y_i - X_i^T \beta$ the i-th residual at β. Further, we shall use $r_{(i)}^2(\beta)$ for the i-th order statistics among the squared residuals, i.e. we will have $r_{(1)}^2(\beta) \le r_{(2)}^2(\beta) \le .... \le r_{(n)}^2(\beta)$. Finally, let us define the least trimmed squares estimator of regression coefficients by the extremal problem:

$$\beta^{\{LTS\}} = \arg\min\{\sum_{i=1}^{h} r_{(i)}^2(\beta)\} \qquad (1)$$

where $n/2 \le h \le n$ and the minimization is performed over all $\beta \in R^p$ (see e.g. Rousseeuw and Leroy [1987]). In other words, in this extremal problem we are looking for such an argument $\beta \in R^p$ for which sum of *h* smallest squared residuals is minimal, however, it is given only implicitly which indices have been taken into account. In a similar way, i.e. by an appropriate extremal problem, practically all robust estimators with high breakdown point (as the *least median of squares* ($\beta^{\{LMS\}}$)**,** *S-estimator*) are defined . We shall, however, restrict ourselves on $\beta^{\{LTS\}}$. It follows immediately from (1) that $\beta^{\{LTS\}}$ takes into account only h observations and the rest of them come into the game only through the fact that they have to have the squared residuals larger or equal to $r_{(1)}^2(\beta^{\{LTS\}})$**.** Under rather general conditions $\beta^{\{LTS\}}$ is consistent and asymptotically normal (see Rousseeuw and Leroy (1987) or Visek (1999)).

It is intuitively clear that to carry out the minimization in (1) is possible only in some (simple) cases, e.g. when the number of observations is approximately than 20. In all other cases we try to find an approximation to the precise solution of (1). It appeared that the algorithm, which was based on deriving this approximate solution over the

[15] The breakdown point is a characteristic of statistical estimators, which indicates how large part of data may represent contamination without breaking the estimator, i.e. without causing a very large (or in the case of estimating the scale, very small) value of estimator. E.g. using arithmetic mean as the estimator of location we would assume that it gives a value somewhere at the center of the cloud of data. Nevertheless, it is easy to see that single (very) large value among the data may cause an arbitrary large deviation of the arithmetic mean from the center of (the bulk of) data; compare this behavior with the behavior of median.

residuals of $\beta^{\{LMS\}}$ [16], need not give good results [17]. Nowadays we have at hand an algorithm for evaluation of $\beta^{\{LTS\}}$ which proved to be more reliable. Moreover, it allows to create an idea how much the structure of data is intricate (see again Víšek (1996)). Of course there is a question how to select *h*. Rousseeuw and Leroy (1987) showed that putting $h = [(n+1)/2] + [p/2]$ (where $[a]$ denotes the integer part of *a*), we obtain maximal breakdown point, namely $([(n-p)/2]+1)/n$. However, in practice it appears that we do not need maximal breakdown point and we can select *h* (much) larger. We usually select *h* ``sufficiently'' small to reach acceptable determination of model (say R^2 about 60%).

Sometimes the situation is such that when we record scale estimates for different values of *h*, we notice that rapid decrease of scale estimate for decreasing *h* at one point stops or the decrease becomes mild with respect to the initial steep one. If, moreover, the h_0 which was selected according to these two rules, is such that for *h*'s nearby this h_0 the models are stable in coefficients, we can assume that we have separated data on the proper part and something else which may be considered to be contamination or another population, governed by another model, if any. Of course, the boundary is usually vague and only exceptionally sharp.

Experimental Estimation of the Model for Exports to the EU

We have tested the LTS estimation on our model of exports to the EU. The results indicated in Table 2 were taken as a benchmark for a "correct" behavior. Then we have tested a hypothesis, which industries behaved most differently from that benchmark. We had a suspicion that there were two alternative economic relations present:

A/ Price competitiveness versus quality competitiveness between the domestic and the foreign products.

B/ Capacity of the supply side to respond positively to aggregate demand.

In that case the model would be mixing into one exogenous variable (i.e. the relative prices) two different populations, as to their behavioral patterns are concerned. In this procedure tested for an existence of subpopulations of industries, the development of which would be based on opposing strategies. The next question then would be: how efficient or rational the opposing strategies could be?

Indeed, our experiments have shown that our data set is consists of tree subpopulations: the main one with 38 industries, the complementary one with 21 industries and two industries (chocolate and natural gas) that behaved as autonomous outliers. It should be mentioned that the differences in behavior in the first two

[16] In accordance with Rousseeuw and Leroy (1987) and program PROGRESS or S-PLUS (which was for a long time assumed to be efficient),

[17] See Hettmansperger and Sheather (1992) and Visek (1996).

subpopulations were uniform in given industries practically in all tested years [18]. The normal regressions were again run separately on the pooled subpopulations.

The coefficients of the main subpopulation had the following characteristics:

Table 9. Estimation of exports to the EU (main subpopulation – after LTS)

Variables	Estimated parameters	t-statistics	
ln (PX)	0.643	10.486	
ln (FDI)	0.364	9.147	
ln (Tariff cz)	-0.379	-7.734	
ln (VA)	0.818	29.993	
ln (K/L)	-0.276	-5.784	Adjusted R^2 = 0.863
ln (Y^{EU})	9.703	5.402	Durbin-Watson = 1.513

The results are quite similar to coefficients indicated in Table 2. The problem with autocorrelation nearly disappeared and a high R^2 was reached without keeping the variable RHO in the equation. The core of Czech exports in the 90s were primarily determined by a high positive elasticity to EU income. A 1% rise in GDP of EU resulted in 9.7% increase of Czech exports. Export intensities are again correlated with value added in industries. An autonomous 1% growth in net production in some industry was associated with a 0.82% growth in its exports. This was in addition to the "pull" effect of the EU aggregate demand. The most interesting finding is in the positively-signed coefficient of export prices. Thus high dynamics in these sectors were compatible with quality improvements. All the estimated characteristics can be associated with a fast export-driven and highly efficient development.

Unfortunately, not all Czech exports shared these characteristics, what became visible after the estimation of the complementary subpopulation of industries. Their variable of export prices was negative (-0.334), what implied a reliance on exports of products of lower quality or a need to decrease prices in order to keep them competitive. The dependence of these exports on aggregate demand in the EU was not found significant and their export was associated with the presence of high domestic tariffs in these industries (coefficient –0.73). We can therefore infer that Czech tariff rates really reflect the degree of comparative disadvantages. Unfortunately, a large part of Czech exports came from industries protected by high tariffs, what is definitely a situation that would require further restructuring in the pattern of specialization.

[18] Thus for the vast majority of industries we could exclude the cases that some industry behaved at the beginning according to the patterns of one subpopulation and then in later years switched into the behavior of the alternative subpopulation.

9. Conclusions

a) The aim of this research was to analyze the economic factors behind the opening up of the EU and their impacts on the Czech territorial and commodity structures of both exports and imports. In the paper we assessed the mechanisms of adjustment of trade and its specialization pattern with both the EU and the non-EU partners.

b) Taken from a methodological point of view, our empirically tested models, based on economic theory, represent not only the determining factors of the industrial specialization, but also an analysis of the competitiveness of domestic production and the potential of growth.

c) The empirical testing of export and import functions in a breakdown of 61 commodity groups was challenged by problems with the quality and availability of data that could serve as reliable proxies for determining factors of trade specialization used in economic theories.

d) In all four estimated functions we had to solve the problems with autocorrelation of residuals, revealing that all Czech trade was subject to intensive temporary fluctuations, autonomous from the regularities explained by standard economic factors.

e) There were two key explanatory variables common to all four trade functions: the aggregate demand (represented by GDP of the destination country) and the FDI (representing human capital). Contrary to intuition, the impacts of FDI were the most intensive on imports from the EU, what supports the explanation that FDI was the main driver of sharply increasing intra-industrial specialization.

f) The income elasticity was the most intensive variable for exports to the non-EU countries, followed by exports to the EU. The income elasticity of imports from the non-EU countries was less than unity and it was moderately higher than unity for imports from the EU countries.

g) Imports from both territories were based on competition in quality, even though this competition was much more pronounced in imports from the EU. Human capital in the key variable that determines both the structure of Czech specialization (high-quality imports exchanged for lower-quality exports) and its dynamics (where human capital is the engine of Czech growth of exports).

h) Czech exports to the EU compete in prices. Unfortunately, this is not an optimal strategy for high growth and development based on R&D. This finding has serious implications for economic and structural policy-making, with an objective for promoting the competition in quality based on the development of human capital.

i) Though the intra-industry trade was prevailing in 1999, the Czech trade specialization pattern is deeply imbedded in the endowments hypothesis. In that respect Czech and EU relative endowments of labor and capital seem to be close to each other, resulting in a tendency to trade labor-intensive products in both directions.

j) It is a question when and to what extent the changing Czech endowments (fast growing capital per labor rate and skilled labor crowding-out simple labor) will require a new wave of restructuring in the export industries. The results of our study

indicate that Czech exports to both studied territories may soon require further restructuring in order to become compatible with market requirements and with the trade structure pertinent to developed economies. The quality gap relative to the EU products is too large. Investments into domestic human capital, high inflows of FDI, high domestic rate of savings and a policy encouraging the integration of domestic producers with international marketing networks are preparing ground for such fundamental changes.

k) The dismantling of tariff and non-tariff barriers in the trade with EU was the most significant policy instrument promoting trade.

l) High implicit subsidies (and implicit taxes) to producers coming from the possibility of tolerated debt defaults and government bail-outs became an important unofficial policy factor influencing both the export performance and the domestic resistance to import penetration.

m) The impact of real exchange rate on trade dynamics was found to be of low statistical significance (with the exception of imports from the EU). Thus its impact on the trade balance throughout 1993-99 was only marginal. We found that developments in individual pricing for explaining trade were more important than what were the global pressures coming from the continuously appreciating real exchange rate.

n) Our tests for an invariant efficient behavior of industries by means of robust statistics of least trimmed squares have shown that until 1999 there were still too many domestic producers who did not behave in compliance with comparative advantages. This can be explained by the fact that restructuring of the Czech industrial sector has not yet been completed and the degree of restructuring differed widely among industries or even among enterprises of the same industry. There were still too much of inefficiency in production and rigidities in the structure of specialization.

The present analysis is just an initial step to further research, that follows the pure microeconomic theory of trade and goes beyond the traditional aggregated trade models, as practiced by macroeconomic modeling or by gravity models of trade. At this stage we tested the quality of data, specification of models, estimation techniques, explanatory power of our estimations and the potential for policy recommendations. We found that the models offer a wide scope of new approaches to hypothesis testing, taken both from the theoretical and the technical (econometric) points of view. Its policy conclusions also point to the existence of less conventional aspects of trade, growth and restructuring that may become of fundamental importance for decision-making not only in widely integrated small transition countries.

APPENDIX: Implicit Subsidies and Their Impact on Exports

As it was mentioned, implicit subsidies played an important role in the performance of Czech enterprises. Their flows originated mainly as:

- Loans provided by the semi-state commercial banks which turned gradually to classified credits, bad debts and bailouts of the banks by the Consolidation Bank, State Budget, National Bank, Fund of National Property, etc;
- Commercial credits provided by suppliers;
- Unpaid taxes, social security or health insurance payments;
- Unpaid disbursements of the debts arising from privatization.

Implicit subsidies were not only used as an instrument for the support of industries without comparative advantages, but also for the support of industries with intensive exports. It is known that subsidies have distortional impacts on the allocation of exports. Its deadweight losses cause a sub-optimal allocation of resources. This argument is explained in figure 3 below.

Figure 3 depicts a situation of a domestic producer whose given commodity has an output located in A, satisfying both domestic demand D_d and the total demand which includes also the foreign demand D_f. Export is thus the difference between Q_t^0 and Q_d^0. The world price is originally at P^0. Then this exporter receives an implicit subsidy (S) that can bring her costs an advantage in competitiveness, what can be described by a shift in the supply curve S_d down to the position S_d-S. The output can now shift from Q_t^0 to Q_t^1 and export X^1, what is possible only if this producer goes down with her price on world markets from P^0 to P^1 – as is shown in point B.

However, the real efficiency in production was not changed, so the production will have to be allocated in point C, what is possible only due to a subsidy. The social inefficiency of the subsidy is as follows: the whole value of the subsidy C^1CBP^1 is a social cost (borne by the bank which will never recover the granted soft credit). However, the subsidy benefits the domestic and foreign consumers, who gained in consumer surplus P^0ABP^1. The producer also gained in her producer surplus C^1CGP^0. What remains is the triangle of ABC, which represents the deadweight losses due to inefficient allocation of resources AGC and social costs ABG wasted in production beyond the demand and its consumers' surplus.

In case the subsidy has no impact on the world price, the terms of trade will not worsen and the deadweight loss shrinks to the triangle AGC. In all cases there is a positive impact on exports, which could increase to X^1. In the latter case the export gains are higher the more elastic is the supply curve. In our econometric test we have found that the gains in exports due to implicit subsidies were very small, since the elasticity of such a response was mere 0.3, what also indicates that the elasticities of Czech export supply curves were rather low in their total. The economic problem is straightforward: the impact of implicit subsidies on the national economy was evidently negative in the aggregate, since it slowed-down the adjustment of enterprises to market signals and “helped” so to the less efficient and morally more hazardous enterprises. The seemingly positive externality of subsidies to higher export competitiveness was

compensated by a too high price that the community had to pay for supporting "privileged" enterprises, which hardly deserved such a discretionary treatment.

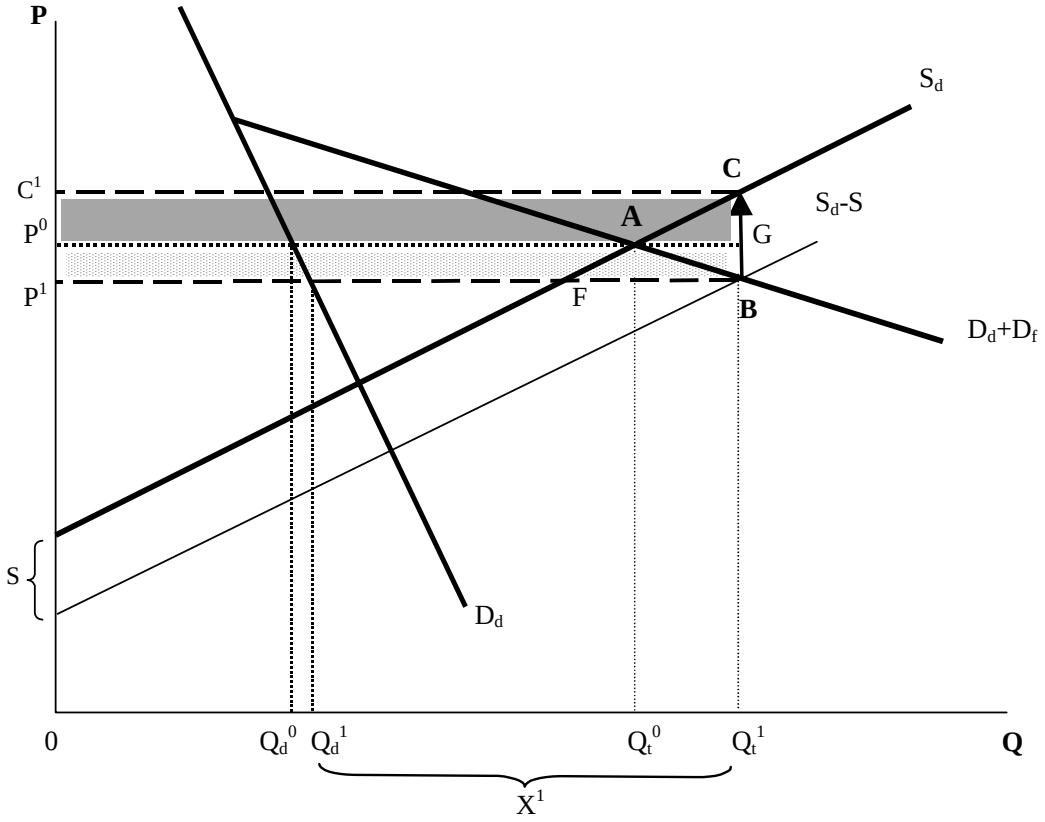

Figure 3: Impact of an implicit subsidy on prices, domestic sales and exports in a country that can influence the world prices.

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