

Evguenia Bessonova, Konstantin Kozlov, Ksenia Yudaeva

**Trade Liberalization, Foreign Direct Investment,  
and Productivity of Russian Firms**

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**Бессонова Е.В., Козлов К.К., Юдаева К.В.** Эффект либерализации импорта и прямых иностранных инвестиций на российские предприятия. Препринт # WP/2003/035 Е. - М.: Российская Экономическая Школа, 2003. - 40 с. (Англ.)

Статья изучает эффект либерализации импорта и прямых иностранных инвестиций на российские предприятия. Используя данные по предприятиям за 1993-2000 года, работа находит положительный эффект на отечественные предприятия от конкуренции с импортом и с ПИИ. До кризиса 1998 года этот эффект был слабее для предприятий в отраслях со сложным технологическим процессом. Возросшая доступность импортированных или произведенных совместными фирмами комплектующих помогла увеличить производительность российских предприятий в середине 90-х, хотя девальвация рубля в 1998 снизила конкурентоспособность тех из них, кто использовал импортные комплектующие. Наконец, вход иностранных фирм в некоторых случаях ведет к увеличению общей производительности факторов для предприятий -поставщиков комплектующих. Этот эффект также был слабее после 1998 года, возможно из-за негативного влияния девальвации на иностранные компании.

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The paper studies the effect of liberalization of imports and foreign direct investment on Russian firms. Using the firm-level data from 1993-2000, the paper finds that competition with imports and with FDI exerts positive effect on domestic firms. Prior to the 1998 crisis, this effect is weaker in the case of firms located in complex industries. Increased availability of imported inputs or inputs produced by foreign-owned firms helped to improve productivity of domestic firms in the mid-1990s, although the devaluation of the ruble in 1998 temporarily made firms relying on foreign-produced inputs less competitive. Finally, entry of foreign-owned firms in some cases leads to improvements in TFP of the firms which produce inputs for foreign-owned firms. This effect also weakened after 1998, possibly because of the negative effect of devaluation on foreign-owned firms.

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The issue of the effect of trade liberalization on economic growth remains controversial both in theoretical and empirical literature. While traditional international trade literature makes clear predictions about the static effect of trade on welfare level (Helpman and Krugman (1985)), the dynamic effects are much less clear. In the case of infant industries (see, for example, Krugman (1997)), protection from international trade flows results in higher growth rates than trade liberalization. On the contrary, in the world, where firm output depends on variety of intermediate inputs, such as in Grossman and Helpman (1991), trade liberalization will speed up growth.

Import substitution was a popular paradigm of development in 1960-70, when the success of Japan and other East-Asian economies was attributed mainly to well-designed protectionists policies. However, failure of Latin American and Asian countries, such as India, to reach high growth rates using import substitution policy, undermined belief in import substitution strategies. Nowadays, creating opportunities for economies of scale and learning-by-doing is considered less important than creating correct incentives for firms to develop and to improve productivity (Krueger (1997)). Trade liberalization became a popular recommendation to countries struggling to increase their growth rates. The empirical evidence of the success of such policies is still mixed, though (at least on the macro side). The results of studies such as Sachs and Warner (1995) or Edwards(1998), who claimed that trade openness had a positive effect on growth, were recently questioned by Rodriquez and Rodrik (1999), who showed that trade liberalization and trade openness, when considered in isolation from other structural policies, have no or even negative effect on growth.

More convincing evidence of the importance of creating correct incentives comes from studies, which use micro data. A number of plant-level or industry-level studies done for various countries (Tybout et. al (1995), Harrison (1994), Krishna and Mitra (1998), Pavcnik (1999), Lawrence(1999), etc) demonstrate that protection has negative or no effect on plants' productivity, while competition with imports and trade liberalization have a positive effect. Lawrence and Weinstein (1999) question the effectiveness of protectionism and industrial policies even in such countries as Japan and Korea and provide evidence that high growth rates in these countries were mainly caused by competition with imports and the availability of imported inputs.

This paper studies the effect of trade liberalization and competition with imports and foreign direct investment on the productivity of Russian firms. A number of previous studies, including Brown and Earle (2000), and Yudaeva et al. (2001)), demonstrated the positive effect of competition with imports and foreign direct investment on Russian firms. In contrast to these previous studies, this paper makes an attempt to decompose this effect into the effects of competition, and the effect of availability of foreign-produced inputs. In the case of foreign direct

investment, we also look on the effects from foreign-owned consumers on domestic firms. There is case study evidence demonstrating that these effects can be substantial in Russia.<sup>1</sup> Almonte and Resmini (2001) find evidence of this effect in Poland, but in the earlier paper by Yudaeva et al (2001) we failed to find this effect in Russia in mid-1990s.

Trade liberalization and permission of foreign direct investment were among the most important items of the transition policy reforms package, undertaken in Russia in the early-mid 1990s. In the Soviet Union, international trade was monopolized by the state. Export contracts were signed by the state, and state committees decided upon purchases of imported goods. Due to deficits of most consumer goods, illegal imports were not considered an important problem: the federal and the local governments were mainly concerned with prevention of illegal exports, which made deficit problem even stronger. In the early 1990s, the situation changed dramatically. Firms, most of which were privatized, received full freedom regarding their export and import activities.<sup>2</sup> The so-called shuttle trade flourished: thousands of individuals and small firms became importers of consumer goods from Poland, Turkey, China and other East Asian countries. After the breakdown of CMEA trade, Russian exports of machinery declined, and primary goods started to occupy a more and more important position among Russian exports. Import penetration ratios increased to almost 50% in some consumer goods industries.<sup>3</sup>

It is well known that the decline of production at the start of Russian transition was especially long and deep even for a CIS country. Since trade liberalization in Russia was quite pronounced, a number of economists and a large share of the population strongly believes that trade liberalization was one of the most important (if not the most important) reasons for output decline. In the prospects of future WTO accession, such beliefs strengthen the position of protectionists, who claim that Russia is not ready for accession, and that accession in the current situation will mainly bring a new wave of output decline and dramatic increase in unemployment.

There is a popular belief among Russian economists and policymakers that modernization of Russian industry requires substantial investment. The underdeveloped financial sector does not allow firms to finance investment from the financial market. Therefore, it is often claimed that further trade liberalization will preserve and even increase the non-competitiveness of the Russian industry, while increased protection will allow firms to accumulate necessary funds and to “make

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<sup>1</sup> Smirnova (2002) studies the relationships of IKEA with its Russian suppliers. Earlier, the evidence of vertical spillovers from MacDonald's in Russia and Volkswagen in the Czech Republic were reported in Keren and Ofer (2001).

<sup>2</sup> The government retained control functions over export of armaments, goods which can be used both in civilian and military purposes, and some other goods.

<sup>3</sup> Strictly speaking, the overall volumes of both export and import declined in Russia in mid-1990s in comparison to late 1980s. This decline can be fully attributed to the decline in output.

themselves ready” for WTO accession. The productivity study by the McKinsey Global Institute (1999) questioned this argument, and demonstrated that important productivity gains in Russia can be achieved with very modest investment. The McKinsey study also shows that due to lack of competition, Russian firms do not have proper incentives to implement the changes aimed at increasing productivity.

Our paper provides further evidence in this direction. Using industrial firms Registry data we estimated production function in 83 industries. Then we tested whether competition with foreign trade and foreign direct investment, the availability of imported materials and the presence of foreign direct investments in vertically related sectors have positive or negative effects on total factor productivity in domestic firms. Our results show that in the industries exposed to higher competition from imports and foreign direct investment, total productivity grew faster (or declined slower) than in other industries. We interpret this result as suggesting that competition with foreign goods forces domestic firms to restructure faster.

An additional explanation uses the notion of demonstration effect. In the Soviet Union, industries producing consumer goods were considered of a little importance and, therefore, they were underdeveloped and produced goods of bad quality. After trade liberalization, some such industries experienced particularly high inflows of imports. In order to survive in the new situation, Russian firms started copying foreign products. This mode of development was particularly successful in, for example, the food industry. We call this source of increase in firms’ productivity the demonstration effect.

In addition to effects from competition in the same industry, we observe positive vertical effects. In the first part of the sample, in 1994-1997, firms which used a lot of imported components were more productive than other firms. A similar effect was observed in respect of firms which used products of foreign owned firms as their inputs. It is conceivable that using imported or foreign-produced components helps to improve the quality of goods produced considerably, and our regression picks up this effect. In 1998-2000 this effect disappeared, however. The disappearance of the effect of foreign produced components does not look surprising given that in mid-1998 the ruble depreciated by about 50%. Depreciation boosted the costs of foreign produced inputs and, therefore, made these firms non-competitive for a while.

Case study evidence suggests that FDI can have a positive effect on domestic suppliers. Competition among domestic firms to supply of foreign-owned firms forces domestic firms to restructure. There are cases also of a direct influence: IKEA, for example, invested in some of its suppliers in Russia (Smirnova (2002)). We constructed a test for the presence of this effect in the

case of Russian manufacturing firms. The results confirm the hypothesis of a positive effect in the overall sample and in before and after crisis sub-samples.

The paper finds that productivity growth in response to competition with imports or foreign-owned firms is less pronounced in industries with a high complexity index. The breaking down of inter-firm relationships and lack of coordination among vertically related firms, as well as search problems can account for this result.<sup>4</sup>

The paper is organized as follows. We start with description of the data. Section 2 discusses methodology and results of estimation of production function and computing firm-level total factor productivity growth (TFP). Section 3 evaluates the effect of competition with imports and foreign direct investment (FDI) in TFP. Section 4 concludes

## Data

Our data come from three major sources. The firm level information on output, employment, capital, costs of production and wages are taken from the Russian Industrial Firms Registry, the statistical information dataset collected by Goskomstat. Some of the data are taken from the Alba dataset, which has similar origins, but sometimes different coverage. The Alba dataset also contains the balance sheets of the firms. In principle all firms with more than 100 and smaller firms with 75% of individual ownership are supposed to submit the corresponding forms to Goskomstat. Unfortunately, Goskomstat does not have enough of enforcement power to make all firms to supply the data.<sup>5</sup> As a result, a lot of firms do not provide information to the Goskomstat. New firms are particularly underrepresented in the dataset, although more and more old firms drop out from it. The data we have are for 1993-2000. The number of firms is not the same in all years, and a lot of firms, which were in the sample in the early years, dropped from the dataset by the end of the period. It is unclear, though, whether firms drop from the sample because they close down or because they just stop reporting information to Goskomstat. Since closure of medium and large old firms was a rare phenomenon in Russia in the 1990s, we believe that in most cases firms just stopped reporting to the Goskomstat.

Because of this problem with our dataset, we are unable to make any correction for firms exit, as in Pavcnik (1999). This means that our sample may be biased, but the direction of this bias is unclear. While exiting firms are most probably of a smaller productivity than those continuing to

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<sup>4</sup> Blanchard and Kremer (1997) and Roland and Verdier (1999) noticed that decline in more complex industries in Russia was deeper, and attributed this phenomenon to disorganization problems in the Russian economy.

<sup>5</sup> Currently, Goskomstat considers switching of firm-level statistics collection from Census form to a survey form.

operate, it is difficult to assess the quality of firms which stopped reporting. We can assume that the productivity of these firms is higher than on the firms, remaining in the dataset. It seems natural that younger and more successful management can decide to stop reporting to the Goskomstat, while old management will continue doing so by habit.

Another problem with this dataset is underreporting of output. Trying to hide profits, firms tend to underreport sales and overreport costs. After several interactions with tax inspectors some of this underreporting can be corrected for. However Goskomstat gets the first draft of firms' reports, so underreporting can be substantial in our dataset. Unfortunately, nothing can be done to correct for this underreporting. We have to assume that underreporting is randomly distributed among all types of firms, which may be not a very good assumption.

Information on foreign-owned firms, including information on the size of the foreign stake and country of origin of the foreign investor, comes from the Registry of Joint Ventures, also collected by Goskomstat. Before 1998, all foreign firms were present in this census, but since 1998 only firms with more than 100 employees remained in the dataset.

The main source of data on foreign trade volumes and prices of imported goods is the State Customs Committee Yearbook. This Yearbook contains information on goods imports and exports both in value terms and in physical quantities by country of origin or destination. In many cases, information on prices is also available. Since 1995, these data have been compiled from customs declarations. Trade data in earlier years were compiled by Goskomstat, presumably using firms-level data. The data from 1996 on seems to be of a better quality and more complete than data from earlier years. Price and in some cases volume information is not particularly reliable in the case of imports even in the later years. Russians customs are corrupt, and Russian importers tend to bribe corrupted officials to cheat on the value of their imports in order to save on import duties and value added tax. In the mid-1990s, a very common way of cheating was as follows: goods were assigned to a category which falls into a smaller tariff rate (turkey instead of chicken, for example). Recently tariff rates were by and large unified and the nature of cheating changed. Nowadays, Russian customs publish minimal prices at which goods can be imported. Anecdotal evidence suggests that these minimal prices are mainly used in customs declarations as prices of purchase. Due to cheating, price information in State Customs Committee data often has little relation to reality, and import volumes are severely underreported. The size of underreporting is estimated to be anything between 20 (in the mirror statistics) to 80 (according to anecdotal evidence) percent.<sup>6</sup> As in the case of production, we cannot correct for underreporting, and have to assume that it does not depend

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<sup>6</sup> Kozlov (2002) describes functioning of Russian customs, and presents different estimates of underreporting.

seriously on goods characteristics. We mainly use trade statistics to compute import ratio to production volumes. Since both numerator and denominator suffer from underreporting, the resulting ratios may be closer to the true ones.

For most goods, import and export data are available in 4 digit HS classification, and for a large number of goods we have 6 (or even 9) digit HS data. One of the most complicated data problems for this paper was matching trade and firm level data. Firm data contains the code of the industry, to which the firm belongs, assigned according to the OKONH industry classification, developed in the Soviet Union. There is no official correspondence code between OKONH and HS classifications. Therefore, we had to use firm-level data on the range of goods produced in each firm to construct the correspondence code between the two databases and to construct the shares of imports in industry production. Information on prices is often not reliable, so we used physical volumes whenever possible to construct the shares of import in production. The appendix describes the matching procedure in more details. Since both trade statistics and firm level statistics on the range of goods produced contain a lot of missing variables, we had to fill in some of the missing variables with the numbers for neighboring years. Without this procedure, the range of goods on which ratios of imports to production are computed would have been very unstable from year to year. We mainly use the ratios of imports to production with filled missing values in our computations. We reestimated some specifications using original data instead, and it did not change the results significantly.

Input-output matrices, price data, regional characteristics, industrial production and other data were obtained from various Goskomstat publications.

## **Production Function Estimation**

Following the literature, we obtain firm-level TFP data by estimating production functions. Like some of the previous papers, which use the same datasets, such as Brown and Earle (2000), we do not compute value added and use total sales as a right-hand-side variable. In the Alba dataset we have some information on costs of production, but, unfortunately, this information is available only for the years prior to 1998, and then for 2000. There is no cost of production data for 1998-99. Another problem is that costs in our data are reported as a proportion of output. Since most of firms would like to inflate their costs in order to decrease taxes, there are many values for costs, which are higher than 1, particularly in 1997. Given all these data problems, we decided to use total sales as a dependent variable in this paper.

The Industrial firms' census dataset contains all information in current rubles. To make the data comparable across years we constructed deflators for, approximately, each 5-digit OKONH



industry.<sup>7</sup> Yearly deflators were constructed by weighting monthly PPIs by monthly industrial production as reported by Goskomstat. Capital deflators were obtained in a different way. The value of a firm's capital stock is subject to revaluation as of 1 January. Hence, the reported figures on the end-of-year and beginning-of-the-year value of capital stocks differ by the revaluation coefficient. We computed these revaluation coefficients and used them as deflators for the capital stock.

The production function is estimated separately in each of the 83 industries. The list of industries and the number of firms is reported in Table 1. Production function coefficients can differ across these groups of industries. We chose translog production function specification because it allows for non-linearities of factor inputs, which are likely to present on the industry level. The estimated equation has the following form:

$$\ln Y_t = \alpha_0 + \alpha_L \ln L_t + \alpha_K \ln K_t + \alpha_t t + \alpha_{KK} (\ln K_t)^2 + \alpha_{LL} (\ln L_t)^2 + \alpha_{tt} t^2 + \alpha_{LK} \ln L_t \ln K_t + \alpha_{Lt} \ln L_t \cdot t + \alpha_{Kt} \ln K_t \cdot t$$

Where:  $Y$  refers to total sales,  $L$  stands for the year average employment,  $K$  is the year average level of capital. We estimated the equations using OLS, fixed and random effect specification. We dropped outliers (1% of observations from each side) from the estimation sample. Hausman tests point to the fixed effect estimation as preferable to the OLS and random effect, although, since our data suffer from considerable measurement errors, OLS estimates can be more accurate. As we mentioned before, we cannot control for selection bias due to exit of firms from business and from the dataset due to non-reporting. However, there are arguments for assuming that all types of firms (both more and less productive than the average) can drop out from the dataset, so we hope that the bias due to non-correction is not large.

The TFP growth rates were then calculated using the following procedure, suggested in Jorgenson (1995):

$$\ln(A_{t+1}/A_t) = \ln(Y_{t+1}/Y_t) - \bar{\eta}_K \ln(K_{t+1}/K_t) - \bar{\eta}_L \ln(L_{t+1}/L_t)$$

$$\text{where } \bar{\eta}_K = (\eta_{K,t+1} + \eta_{K,t})/2, \bar{\eta}_L = (\eta_{L,t+1} + \eta_{L,t})/2,$$

$$\eta_{K,t} = \frac{\partial \ln Y_t}{\partial \ln K_t} = \alpha_K + 2\alpha_{KK} \ln K_t + \alpha_{LK} \ln L_t + \alpha_{Kt} t,$$

$$\eta_{L,t} = \frac{\partial \ln Y_t}{\partial \ln L_t} = \alpha_L + 2\alpha_{LL} \ln L_t + \alpha_{LK} \ln K_t + \alpha_{Lt} t.$$

On Figure 1 we report changes in the marginal products labor and capital, and elasticities of the production function over labor and capital ( $\eta_{L,t}, \eta_{K,t}$ ) averaged over 2-digit OKONH industries.

<sup>7</sup> Some of the industries correspond to 4-digit, rather than 5-digit industries.

We use random effect estimation results for construction of the graph, although the results for other estimation methods are very similar to this. As it follows from the graph, our estimated coefficients of the production function are quite plausible. Capital elasticity is usually quite low, while labor elasticity is quite high. The most capital intensive industry is the fuel industry, while the most labor intensive industries are the construction materials, food, and timber, paper and woodworking industries. Elasticities are more or less stable across years, with the exception of the fuel industry, which became much more capital intensive between 1996 and 2000.

Table 3 reports average TFP growth rates of 2-digit OKONH industries, obtained using various estimation methods.<sup>8</sup> It is clear from the table that all estimation methods produce quite similar estimates of TFP. The correlation coefficient between TFP growth rates obtained using different methods is above 94% (Table 4).

The estimation shows the following dynamics of TFP over the transition decade. TFP was declining across all firms and industries from 1993 to 1998 (see Figure 2). Starting from 1999, TFP began to increase in some of the industries. Similar TFP dynamics are documented in the macro studies (Dolinskaya (2001)).

### **Effects of foreign trade and FDI on Russian firms.**

Abolition of the state monopoly in trade in the early 1990s resulted in a significant increase in foreign competition for most Russian manufacturing firms. As our computations (see Table 5.1) show, the increase in the ratio of imports to production was particularly high in industries producing consumer goods (light, furniture, electronics and some other machine-building industries), where the quality of the goods produced by Russian firms was seriously lagging behind international standards. Domestic production of some such goods declined dramatically, and in some cases firms changed their specialization or closed down.<sup>9</sup> At the same time, in many cases, the increase in foreign competition was accompanied by massive improvements in the quality of goods produced by domestic firms, and the appearance of new domestic firms which were able to successfully compete with foreign producers.<sup>10</sup>

The main question is, of course, which of these two processes dominated, i.e. whether most import competing firms had to closed down, or were able to restructure. Another interesting problem is to find factors, which influence firms' ability to adjust to foreign competition.

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<sup>8</sup> Summary statistics for value added, labor and capital are reported in tables 2.1-2.3.

<sup>9</sup> Russian classification of industries OKONH failed to trace the changes in firms' specialization. We found a lot of cases in our dataset, when firms were mainly producing goods others, than the one, which are included in the definition of their OKONH industry. Relatively small ratios of import to production in such industries as electronics can be explain by this fact.

<sup>10</sup> Food processing is a good example of such an industry.

We begin answering these two questions by presenting some simple graphical evidence. We divided all sectors into five groups according to the level of their exposure to foreign trade:

- export oriented (with export share more than 30%, import share less than 30% and a low intra-industry trade index),
- import competing (with import share more than 30%, export share less than 30% and a low intra-industry trade index),
- import competing with high import shares (a subgroup of import competing industries with import share more than 80%),
- with high intra-industry trade (IIT index more than 50%), and
- non-traded.

Figure 3 shows changes in value added, total factor productivity, labor and capital in the 5 groups of firms. Import-competing industries, particularly those, where the share of imports comprises more than 80%, were among the best ones in increasing total factor productivity and capital accumulation. As we mentioned before, we cannot control for firms closure. The evidence on firms, which remained in the dataset seems to suggest that, import competition is an important factor, which forces Russian firms to restructure.<sup>11</sup> Below, we use regression methods to decompose this effect into the pure effect of import competition and the effect of improvements in the quality of inputs.

In addition to liberalization of imports, in the late 1980s, inflows of foreign direct investment in Russia were also allowed. It is well known that Russia is lagging behind other transition economies in terms of attracting FDI. Nonetheless, the share of production by foreign-owned firms has reached significant amounts, particularly in recent years (see Table 7). As Yudaeva et al (2001) show, competition with FDI plays an important role in improving domestic firms' productivity, particularly in regions with high human capital. Below, we use regression analysis to more formally evaluate the effect of increased access to foreign goods on productivity of domestic firms.

## **Regression results**

To get more precise evidence on the effect of trade openness and liberalization of FDI on Russian firms, we used regression analysis. We tested for the effect of the following variables:

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<sup>11</sup> Following Pavcnik (1999), we constructed a formal test of this hypothesis. We regressed firm TFP growths on the controlling variables described below, on time trend, on dummies for export-oriented, import-substitution, and intra-industry trade industries, and on interaction terms of these dummies with the time trend. Only for the import-substituting industries the interaction term was positive and significant, suggesting that TFP growth rates in these industries increases with time faster than in the rest of the industry.

1. Competition with imports, measured by the ratio of imports to production of the same good. The effect of competition can be both positive and negative. The former result is possible, when competition forces domestic firms to restructure, and the latter result implies that competition mainly leads to driving domestic firms out of the market.
2. Competition with FDI, measures by the share of production of foreign-owned firms in the total production of the industries, in a breakdown available in input-output matrix. As in the case with the effect of import competition, this effect can be both positive and negative.
3. The availability of imported inputs. For each firm, we compute a proxy of this effect using the following formula:  $imi_i = \sum_j shi_j * io_{i,j}$

where  $imi_i$  is the share of imported inputs in total inputs, used in production of industry  $i$ ,  $shi_j$  is the import/production ratio in industry  $j$ ,  $io_{i,j}$  is the share of industry  $j$  in the total inputs, used in industry  $i$ . The  $io_{i,j}$  coefficients are taken from the input-output matrix.

4. The presence of foreign-owned firms in the industries, producing inputs for the firm. As in the case of imported inputs, we expect this effect to be positive: the better are inputs, the better is the quality of the final product, and, therefore, the higher is the TFP of the firm. The proxy for this effect is computed using a formula similar to the one for the availability of imported inputs proxy.
5. The presence of foreign-owned firms in the industries, which consume products of the firm (consuming industries). Several case studies (Smirnova (2002), Keren and Ofer (2000)) demonstrated that entry of foreign-owned firms leads to improvements in the quality of suppliers. The effect can be indirect: in order to supply goods to the foreign firm, domestic producers attempt to increase the quality of their products. The direct influence, when a foreign producer invests in its suppliers or help them with improvements of the design of their products, has also been observed in Russia. We computed a proxy for this effect using the following formula:  $fdic_i = \sum_j shfdi_j * ioc_{i,j}$ , where  $fdic_i$  is the proxy for FDI in the

industries, which use products of industry  $i$  as inputs,  $shfdi_j$  is the share of production by foreign-owned firms in industry  $j$ , and  $ioc_{i,j}$  is the share of production of industry  $i$ , used as inputs in industry  $j$ .

Unfortunately, we were able to compute this proxy only for the industrial foreign-owned firms. It would be extremely interesting exercise to do it for the service sector, if the corresponding data on domestic firms were available.

Since we use total sales instead of value added to estimate TFP, our results for the variables 3 and 4 can be biased in the following way. Increase in the prices of foreign inputs can be directly reflected in the prices of final output. This can lead to positive coefficient at the foreign inputs variables. We use exchange rate deflated by regional CPIs as an additional control variable in order to partially overcome this problem.

In addition to these variables, we use the following controls. It may be more difficult for large firms to improve their TFP (or they may face higher pressure from the local government to not shed labor), and we try to measure this effect by including log of employment in the regression. In the case of capital-intensive production processes, improvements in TFP may require higher investment in capital, and this effect is controlled for by including the capital-labor ratio. Industry structure can have effect on firm's incentives to restructure (Brown Earle (2000), Djankov and Murrell (2001)). In particular, monopolies or firms facing less domestic competition can have weaker incentives to restructure. There are two proxies for this effect in our regressions: a 5-digit industry Herfindahl-Hirschman index, and the share of the firm in total sales of its 5-digit industry and region. Finally, we use the standard deviation of PPI in the industry as a measure of uncertainty. Tables 6.1-6.4 provide summary statistics for all these variables in each 2-digit industry.

As a dependent variable, we used various TFP estimates, obtained using the methodology described above. We also experimented with different methods of estimation: fixed effect, random effect, and OLS regression. Since, as we mentioned before, the import penetration variable has a lot of missing values, we estimated regressions using both original import penetration data, and import penetration data where missing values were replaced with numbers for neighboring years. The results do not depend on the type of the variable we use, so we report only the results for the second variable.<sup>12</sup> Tables 7.1-7.5 report the results.<sup>13</sup> In the overall sample, all 5 import- and FDI-related effects are positive and significant in all specifications, with the exception of FDI among suppliers in the fixed effect specification. However, the results of estimation of this equation in sub-samples for 1994-1998 and 1999-2000 are somewhat different. In the sub-sample for the earlier period, most of which precedes the 1998 financial crisis in Russia, we observe the same results as for the overall sample. All trade and FDI-related variables are positive and significant in all specifications. In the post-crisis period, though, the effects of imported components and FDI in the inputs sector became negative and significant in random effect and OLS specifications. This result can be easily explained by the devaluation of the ruble, which happened in 1998: foreign-produced inputs became

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<sup>12</sup> Results for the original import penetration variable are available upon request.

<sup>13</sup> Import penetration variable for natural resource extraction industries is taken to be equal to zero, because most of import in these sectors represents transit of natural resources from CIS countries to the EU via Russian territory.

too expensive, and firms, which relied on such inputs, lost some of their competitiveness in comparison to firms relying on domestic inputs only. Somewhat surprisingly, the coefficients of the import competition and FDI among consumers variables are negative and significant in the fixed effect estimations for the 1999-2000 sample. Since the sample length in this case is very small, this finding may just confirm the fact that output and productivity growth right after the crisis was dependent more on domestic factors and demand for export than on import competition.

The results for different subgroups of industries (export-oriented, import-competing, non-tradable, and with high share of intra-industry trade) are as follows. The results for import competing industries are similar to the ones for the industrial sector as a whole. In fact, they provide even stronger evidence of the validity of our initial hypothesis of positive influence of imports and FDI on domestic firms. All trade- and FDI-related variables are positive and almost always significant in the overall sample and the sub-sample of 1994-1998. In the 1999-2000 sample coefficients at imported inputs and FDI-produced inputs became negative, which is not surprising in the post-crisis sample.

The results for other sectors are less straight forward. In the exporting industries, strange results are obtained in the case of FDI. The effect from FDI in the same sector is negative and significant in the overall sample and the first sub-sample, although it becomes positive and significant in the latest sub-sample. This finding may be a consequence of the privatization program, which could have limited the entry of foreign firms in the most successful sectors.

In the case of firms from the sectors, characterized by high intra-industry trade, most of coefficients at the variables, measuring import and FDI influence are insignificant. The results for non-traded industries are broadly similar to the results for the overall sample.

In all regressions, the coefficients of the control variables almost always coincide with our intuition. Productivity growth on larger firms or firms with higher capital/labor ratios was smaller than on other firms. High uncertainty, measured by price variance, is correlated with slower productivity growth in the first sub-sample (1994-1998). In the second sub-sample this relation became not so strong, maybe because of the overall decline in inflation. Firms in the sectors with larger concentration ratios experienced higher growth of productivity, although in most of cases the firms' market share is negatively related to productivity. Real exchange rate depreciation is associated with strong TFP decline in the first sub-sample, which may reflect the effect of 1998 crisis.

### **Complexity and reaction to competition**

It is well known that during the transition period Russian specialization was shifting more and more into primary goods production away of production of more complex products. Blanchard and

Kremer (1997) attributed this relatively deeper decline in more complex industries to disorganization of the Russian economy. They claim that in more complex industries, the breaking down of relationships between firms had a more detrimental effect on growth than in the less complex ones. Roland and Verdier (1999) suggest that search problems are more complicated in more complex industries, which can also affect their output pattern. Additionally, we can claim that in more complex industries restructuring can be slower, because it requires coordination of the restructuring efforts of many firms.

We tested whether restructuring in response to import and FDI competition was slower in more complex industries. The level of complexity was computed from input-output matrixes using methodology, suggested by Blanchard and Kremer (1997). We included in the regression the complexity variable itself and its cross-term with other dependent variables. In the regression for all industries and periods, the complexity variable itself and cross term with the share of imports are, surprisingly, positive and significant, while cross term with FDI share is negative and significant (Table 8.1). However, in the first sub-sample the situation looks different: both complexity and its cross-term with import competition are negative and often significant. The results for import competing industries are very similar: complexity is negative and significant in the first sub-sample, while in the second sub-sample and the overall sample it is positive and strongly significant (Table 8.2). The cross-term of complexity and import competition is positive, but not significant in all specifications, while the cross-term with FDI is positive and significant in the first sub-sample, but negative and significant in the second sub-sample.

These estimation results suggest that poor coordination between firms in different industries was an important factor which slowed restructuring in complex industries prior to the 1998 financial crisis. However, this effect disappeared after the crisis. Moreover, after the crisis import competition has no or even positive effect on the restructuring of complex industries.

## Conclusions

In view of forthcoming Russian accession to the WTO, the issue of the effect of trade liberalization on Russian economy became a topic of a vivid discussion. A number of economists, politicians and businessmen claim that only strengthening protection, instead of further liberalization of foreign trade, will help to restructure the Russian economy. This paper provides the evidence to the contrary: increased competition with foreign goods or goods, produced by foreign firms, leads to faster restructuring of domestic firms, either because of improved incentives, or because of better opportunities for reverse engineering, or both. Moreover, we show that after the 1998 crisis this result holds even in the more complex industries, which suffered from disorganization in the early transition period.

There are a number of other factors which help to increase the benefits of trade and FDI liberalization. The list of such policies includes improvements in the financial sector, regional bureaucracy or labor mobility. More research is needed to reveal the influence of these factors on the ability of firms to restructure.

The 1998 crisis weakened the position of firms which relied on foreign-produced inputs or worked for foreign-owned companies. This factor did not allow us to give a decisive answer on the question of how important these two channels are for improvements in Russian firms' TFP. Evidence from the later periods will help to shed light on this issue.



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## **Appendix: Construction of import/output ratios.**

Since there is no official code of correspondence between HS and OKONH classification, we used firm level data on the physical volumes and values of production of each good to construct firm-specific import/production. By comparing goods names, we constructed correspondence code between domestic production and HS classifications for each good. Then individual I/P ratios were computed separately for each good. For homogeneous commodities physical volumes were taken. When information on physical volumes was not available, I/Ps were computed in monetary terms (if available).

At the next step we computed firm-level I/P ratio by weighting individual goods ratios by the degree of presence of particular commodities in enterprise's output. This weighting procedure can suffer from endogeneity problem, if enterprises change their production pattern in response to changing import pressure. To overcome this endogeneity problem, weights should not change from year to year. In this case, the only change in variability of I/P ratio would be change in individual I/P ratios of each good. We computed weights in the following way. We summed up production of each good on each firm over all years, for which information is available, and then computed weights in production of each good using this aggregated production levels. Summing up production volumes was often not straightforward, because firms do not report the volumes of their production consistently. On some goods, they report production in physical volumes, and for others they do it in current rubles. Therefore, we needed to use prices for those goods, where production volumes were available in physical volumes only. For 1999, we have information on export prices, which we used for constructing weights in all firms/years. We transferred ruble volumes of production into the dollar ones using current exchange rates, and then computed weights using production volumes in dollars.

Import/production ratios for industries were constructed in a similar way to I/P ratios of firms. In this case, volumes of goods production were summed up for the entire industry.

**Table 1**  
**Industry List and Number of Firms in the Sample<sup>14</sup>**

Code	Industry Name	1993	1994	1995	1996	1997	1998	1999	2000
1	Electricity	501	572	603	582	483	821	889	471
2	Oil and gas	89	96	80	77	60	155	177	60
3	Coal	141	217	193	174	130	181	194	109
4	Peat	173	141	105	60	46	79	68	53
	<b>Metallurgy</b>								
5	Ferrous	238	251	250	211	149	240	245	158
6	Non-ferrous	109	115	109	93	53	80	88	49
	<b>Chemical and petro-chemical</b>								
7	Chemical	447	453	433	338	220	405	421	229
8	Petrochemical	149	150	148	113	85	137	134	88
	<b>Machinery</b>								
9	Equipment for energy sector and metallurgy	98	95	82	66	48	90	95	54
10	Mining equipment	45	49	44	41	34	50	48	36
11	Lifting and transportation machinery	80	83	80	72	38	75	80	61
12	Railroads machinery	52	53	51	47	32	54	60	38
13	Electro-technical equipment	441	446	412	355	222	385	408	275
14	Equipment for chemical and oil machinery	137	139	137	126	83	135	134	106
15	Machine-tool construction	157	150	151	115	75	123	122	91
16	Tool-making industry	118	129	129	103	64	124	143	66
17	Equipment for inter-industry production activities	88	95	99	77	49	94	98	46
18	Instrument-making industry and computer engineering	326	312	276	241	142	244	245	157
19	Automobile and bearings industries	262	266	265	224	151	269	286	162
20	Tractors and agricultural machinery	229	236	237	168	134	186	204	146
21	Equipment for road construction and public utilities sectors	208	200	199	162	102	171	173	127
22	Textiles equipment	87	79	69	56	27	58	56	31
23	Equipment for food industry and mixed fodder industry	100	101	88	68	41	71	72	49
24	Other technological equipment and household devices and machines	93	101	91	68	47	68	70	33
25	Sanitary and gas equipment	92	97	93	71	43	74	84	45
26	Aircraft industry	115	100	89	74	44	15	0	2
27	Defense industry	147	140	139	129	83	8	0	8
28	Shipbuilding industry	110	103	93	78	52	4	0	2
29	Radio industry	141	124	109	92	49	4	0	0
30	Communication means industry	122	107	95	83	39	6	0	2
31	Electronic industry	347	261	252	212	112	11	0	21
32	Other machinery industries	90	86	78	58	34	3	0	8
33	Production of metal constructions	192	206	199	158	90	150	151	108
34	Production of assembled buildings and metal goods	337	326	298	206	133	219	241	154

<sup>14</sup> In most cases, industry in this list correspond to a 5-digit OKONH industries. Although, if the number of firms in a 5-digit industry was too small, several 5-digit industries were combined into one industry.

**Table 1 (continued)**

Code	Industry Name	1993	1994	1995	1996	1997	1998	1999	2000
35	Metal goods for non-production use	97	103	101	66	28	69	63	42
36	Repair of machinery and equipment	1301	1798	1957	1404	945	1650	1752	1047
	<b>Timber, paper and woodworking industry</b>								
37	Timber cutting industry	2068	1526	1331	1069	774	1039	1055	497
38	Timber (sawing) industry	357	350	326	233	185	259	289	119
39	Timber processing industry (not incl. sawing)	387	387	362	257	173	290	310	158
40	Production of furniture	607	643	608	403	258	427	418	249
41	Other timber processing industries	239	118	103	60	46	77	81	45
42	Cellulose paper, and timber-chemical industry	201	188	187	150	93	160	164	115
	<b>Construction materials industry</b>								
43	Cement, asbestos-cement goods and soft roofing and hydro-isolating materials industry	92	87	88	75	51	84	86	73
44	Assembled reinforced concrete and concrete constructions and products industry	1077	1048	970	733	514	724	712	489
45	Wall materials industry	736	683	655	469	335	504	489	273
46	Construction ceramics and polymeric materials industry	57	59	58	51	23	57	67	26
47	Non-ore construction materials industry	328	306	279	201	147	218	228	142
48	Facing materials, porous fillers, lime and gyps materials industry	153	153	150	114	73	125	124	66
49	Heat-isolating materials, asbestos, materials from non-metal ores industry	162	164	153	124	73	131	140	71
50	Glassware, chinaware, faience industry	166	165	156	117	85	130	135	85
	<b>Light industry</b>								
51	Primary processing of flax and wool	184	172	188	145	123	140	136	121
52	Cotton, linen, wool and silk industries	371	372	330	273	174	307	310	216
53	Non-woven materials, hemp, net-making industry	55	53	51	46	21	42	41	33
54	Fancy goods textile	65	66	58	47	20	43	43	35
55	Knitted wear industry	281	323	324	227	131	227	220	125
56	Felting industry	61	59	54	35	32	44	45	29
57	Sewing industry	1213	1437	1621	1186	823	1319	1367	726
58	Leather industry	156	152	134	103	69	96	94	67
59	Fur industry	59	69	69	48	45	60	61	31
60	Footwear industry	225	268	304	221	143	244	251	123
61	Other textiles	69	61	54	43	28	42	44	33
	<b>Food industry</b>								
62	Sugar industry	96	95	90	70	47	88	86	68
63	Baking industry	1653	1618	1574	1170	851	1313	1220	832
64	Confectionery industry	400	369	340	216	142	224	233	148
65	Pasta making	60	58	58	48	33	50	52	34
66	Oil and fat industry	86	91	86	66	43	80	82	57
67	Fragrance and cosmetics	30	31	28	21	9	25	26	20
68	Spirits industry	93	100	92	87	50	92	99	72
69	Liqueur and vodka industry	120	122	118	107	82	162	181	93

**Table 1 (continued)**

Code	Industry Name	1993	1994	1995	1996	1997	1998	1999	2000
70	Wine industry	133	130	116	81	57	111	116	71
71	Beer industry	260	250	219	159	120	171	174	110
72	Non-alcohol beverages industry	80	91	88	53	37	84	95	35
73	Fruit and vegetable industry	298	271	244	173	123	199	194	123
74	Other food industries	176	152	131	108	67	106	116	82
75	Meat and poultry industry	706	728	668	508	356	560	533	329
76	Butter, cheese and milk industry	1611	1547	1454	946	729	1037	1068	852
77	Fish industry	383	380	354	276	158	238	269	116
	<b>Other</b>								
78	Microbiology industry	41	38	33	29	21	35	33	28
79	Flour-grinding and cereals industry	277	284	276	251	170	282	298	214
80	Mixed fodder industry	159	188	201	169	93	172	171	139
81	Medical industry	155	153	152	143	93	166	183	102
82	Polygraphic industry	716	613	920	776	540	832	807	639
83	Other industrial productions	413	488	561	452	300	551	576	304
	<b>Total</b>	<b>24774</b>	<b>24686</b>	<b>24250</b>	<b>18607</b>	<b>12727</b>	<b>19875</b>	<b>20323</b>	<b>12549</b>

**Table 2.1 Real output (in 1993 mn rubles). Summary Statistics**

		1993	1994	1995	1996	1997	1998	1999	2000
<b>Electricity &amp; Fuel</b>	<b>mean</b>	2022.7	1433.8	1177.7	1114.0	1065.5	970.2	985.3	1259.0
	<b>st. dev.</b>	3621.6	2962.0	2604.3	2634.2	2627.9	2527.5	2565.9	2798.6
	<b>obs.</b>	904	1026	981	893	719	1236	1328	693
<b>Metallurgy</b>	<b>mean</b>	2986.8	2237.7	1986.6	2054.1	1934.6	1777.0	1950.5	2431.3
	<b>st. dev.</b>	4497.0	3916.4	3863.5	3924.0	3797.9	3556.1	3984.7	4459.6
	<b>obs.</b>	347	366	359	304	202	320	333	207
<b>Chemical &amp; petro-chemical</b>	<b>mean</b>	2119.4	1518.0	1367.0	1220.5	1420.4	1085.9	1157.7	1646.4
	<b>st. dev.</b>	3571.7	3127.8	2869.3	2525.0	2853.2	2571.5	2518.3	3330.4
	<b>obs.</b>	596	603	581	451	305	542	555	317
<b>Machinery</b>	<b>mean</b>	677.7	349.0	270.2	238.5	219.2	173.1	204.4	269.3
	<b>st. dev.</b>	1612.1	1028.3	994.5	878.9	749.5	635.5	741.2	841.6
	<b>obs.</b>	5612	5985	5913	4620	2941	4410	4585	2917
<b>Timber, paper &amp; woodworking</b>	<b>mean</b>	250.4	194.7	163.0	139.5	116.9	136.2	167.8	231.2
	<b>st. dev.</b>	715.6	709.6	669.7	523.3	503.3	588.4	743.6	955.9
	<b>obs.</b>	3859	3212	2917	2172	1529	2252	2317	1183
<b>Construction materials</b>	<b>mean</b>	260.5	169.7	138.3	117.7	103.3	109.0	125.0	167.0
	<b>st. dev.</b>	473.7	367.7	315.3	271.3	293.2	291.5	314.4	451.2
	<b>obs.</b>	2771	2665	2509	1884	1301	1973	1981	1225
<b>Light</b>	<b>mean</b>	507.4	201.5	111.3	78.9	70.5	64.2	74.8	107.5
	<b>st. dev.</b>	1173.3	535.3	322.1	215.7	203.8	178.5	221.6	280.8
	<b>obs.</b>	2739	3032	3187	2374	1609	2564	2612	1539
<b>Food</b>	<b>mean</b>	437.3	273.5	209.3	219.9	174.4	199.1	229.3	286.4
	<b>st. dev.</b>	1016.2	782.1	628.9	731.1	504.0	696.4	879.5	920.5
	<b>obs.</b>	6185	6033	5660	4089	2904	4540	4544	3042
<b>Other</b>	<b>mean</b>	580.5	384.9	215.0	172.4	147.9	141.2	151.2	162.3
	<b>st. dev.</b>	1285.0	956.6	596.2	465.3	408.9	434.3	606.7	481.1
	<b>obs.</b>	1761	1764	2143	1820	1217	2038	2068	1426
<b>Total</b>	<b>mean</b>	594.8	377.2	292.1	279.3	263.1	251.5	281.7	353.0
	<b>st. dev.</b>	1593.0	1249.5	1116.7	1110.0	1089.2	1073.0	1177.9	1314.3
	<b>obs.</b>	24774	24686	24250	18607	12727	19875	20323	12549

**Table 2.2**  
**Labour. Summary Statistics**

		1993	1994	1995	1996	1997	1998	1999	2000
<b>Electricity &amp; Fuel</b>	<b>mean</b>	903	819	757	729	735	648	599	878
	<b>st. dev.</b>	2314	1628	1620	1477	1551	1569	1423	1694
	<b>obs.</b>	904	1026	981	893	719	1236	1328	693
<b>Metallurgy</b>	<b>mean</b>	1504	1413	1455	1740	1852	1511	1394	1829
	<b>st. dev.</b>	2205	2153	2393	3121	3164	2938	2736	3310
	<b>obs.</b>	347	366	359	304	202	320	333	207
<b>Chemical &amp; petro-chemical</b>	<b>mean</b>	1203	1108	1045	1143	1377	920	809	1113
	<b>st. dev.</b>	1761	1675	1645	1764	2179	1560	1336	1582
	<b>obs.</b>	596	603	581	451	305	542	555	317
<b>Machinery</b>	<b>mean</b>	1004	717	598	575	600	361	328	413
	<b>st. dev.</b>	1868	1535	1455	1266	1524	843	723	870
	<b>obs.</b>	5612	5985	5913	4620	2941	4410	4585	2917
<b>Timber, paper &amp; woodworking</b>	<b>mean</b>	314	315	279	287	267	235	236	316
	<b>st. dev.</b>	462	525	508	533	584	432	418	542
	<b>obs.</b>	3859	3212	2917	2172	1529	2252	2317	1183
<b>Construction materials</b>	<b>mean</b>	285	264	250	259	273	229	226	272
	<b>st. dev.</b>	402	373	363	360	521	342	297	403
	<b>obs.</b>	2771	2665	2509	1884	1301	1973	1981	1225
<b>Light</b>	<b>mean</b>	484	365	267	247	241	199	196	247
	<b>st. dev.</b>	744	607	488	436	494	376	404	462
	<b>obs.</b>	2739	3032	3187	2374	1609	2564	2612	1539
<b>Food</b>	<b>mean</b>	176	171	160	176	209	162	168	193
	<b>st. dev.</b>	294	288	253	268	616	227	235	259
	<b>obs.</b>	6185	6033	5660	4089	2904	4540	4544	3042
<b>Other</b>	<b>mean</b>	233	204	148	144	170	127	128	149
	<b>st. dev.</b>	396	349	289	280	481	238	244	278
	<b>obs.</b>	1761	1764	2143	1820	1217	2038	2068	1426
<b>Total</b>	<b>mean</b>	505	427	368	378	397	295	283	353
	<b>st. dev.</b>	1185	1010	967	953	1115	798	729	867
	<b>obs.</b>	24774	24686	24250	18607	12727	19875	20323	12549

**Table 2.3**  
**Real Capital (in 1993 mn rubles). Summary Statistics**

		1993	1994	1995	1996	1997	1998	1999	2000
<b>Electricity &amp; Fuel</b>	<b>mean</b>	3606.4	3979.0	3718.2	3149.7	3676.1	3041.3	2963.6	4808.7
	<b>st. dev.</b>	9568.7	9930.3	10635.3	8521.0	10515.9	9620.4	9400.2	12728.1
	<b>obs.</b>	904	1026	981	893	719	1236	1328	693
<b>Metallurgy</b>	<b>mean</b>	2164.8	2714.3	2783.4	3453.4	3287.2	2708.4	2423.8	3095.8
	<b>st. dev.</b>	4019.9	5878.9	5670.2	7515.2	7242.0	6169.3	5721.3	6250.0
	<b>obs.</b>	347	366	359	304	202	320	333	207
<b>Chemical &amp; petro-chemical</b>	<b>mean</b>	2537.9	2817.2	2694.4	2713.3	3203.0	2396.5	1868.2	2507.6
	<b>st. dev.</b>	6193.2	6472.5	6089.4	5700.4	5917.9	5549.2	3987.8	4718.9
	<b>obs.</b>	596	603	581	451	305	542	555	317
<b>Machinery</b>	<b>mean</b>	978.3	684.4	661.1	685.0	634.9	429.8	391.4	488.6
	<b>st. dev.</b>	6178.1	1983.0	2177.2	2097.8	1712.9	1241.0	1228.1	1338.2
	<b>obs.</b>	5612	5985	5913	4620	2941	4410	4585	2917
<b>Timber, paper &amp; woodworking</b>	<b>mean</b>	231.8	264.0	258.7	272.8	242.0	214.3	190.3	291.6
	<b>st. dev.</b>	984.7	1298.0	1217.5	1255.8	1214.1	1071.4	921.4	1253.8
	<b>obs.</b>	3859	3212	2917	2172	1529	2252	2317	1183
<b>Construction materials</b>	<b>mean</b>	331.5	292.7	292.7	291.5	283.3	268.5	254.6	332.1
	<b>st. dev.</b>	839.6	589.9	624.1	555.0	615.6	535.6	446.6	711.5
	<b>obs.</b>	2771	2665	2509	1884	1301	1973	1981	1225
<b>Light</b>	<b>mean</b>	548.6	158.5	135.0	143.9	127.2	124.5	113.9	144.7
	<b>st. dev.</b>	3529.6	536.7	402.0	413.7	375.6	341.1	311.6	332.5
	<b>obs.</b>	2739	3032	3187	2374	1609	2564	2612	1539
<b>Food</b>	<b>mean</b>	218.6	200.5	182.8	195.9	171.5	176.4	200.9	236.9
	<b>st. dev.</b>	1341.8	989.3	818.0	825.1	429.4	540.0	621.6	716.2
	<b>obs.</b>	6185	6033	5660	4089	2904	4540	4544	3042
<b>Other</b>	<b>mean</b>	243.3	238.7	180.2	184.6	170.7	156.8	158.4	197.7
	<b>st. dev.</b>	836.9	783.4	488.7	461.7	446.6	375.5	376.6	448.2
	<b>obs.</b>	1761	1764	2143	1820	1217	2038	2068	1426
<b>Total</b>	<b>mean</b>	650.3	591.8	555.1	584.3	612.9	516.8	494.9	651.1
	<b>st. dev.</b>	3974.2	2813.4	2860.4	2709.8	3130.8	2905.9	2808.3	3489.4
	<b>obs.</b>	24774	24686	24250	18607	12727	19875	20323	12549



**Table 3**  
**Total Factor Productivity Growth Estimates**

		1994			1995			1996			1997			1998			1999			2000		
<i>Industry Name</i>		<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>	<i>fe</i>	<i>re</i>	<i>ols</i>
Electricity & Fuel	mean	-0.21	-0.22	-0.07	-0.07	-0.07	-0.08	-0.09	-0.10	-0.01	-0.01	-0.02	0.05	0.05	0.05	-0.03	-0.03	-0.04	-0.21	-0.22	-0.07	-0.07
	st.dev.	0.47	0.48	0.41	0.41	0.43	0.45	0.44	0.45	0.42	0.42	0.43	0.39	0.38	0.39	0.39	0.39	0.40	0.47	0.48	0.41	0.41
Metallurgy	mean	-0.25	-0.25	-0.22	-0.21	-0.21	-0.12	-0.12	-0.13	-0.03	-0.03	-0.02	0.09	0.09	0.10	0.03	0.03	0.02	-0.25	-0.25	-0.22	-0.21
	st.dev.	0.47	0.47	0.40	0.39	0.38	0.52	0.54	0.56	0.49	0.50	0.51	0.49	0.48	0.48	0.37	0.36	0.36	0.47	0.47	0.40	0.39
Chemical & petro-chemical	mean	-0.11	-0.11	-0.23	-0.23	-0.23	-0.03	-0.04	-0.05	-0.11	-0.11	-0.11	0.13	0.13	0.13	-0.02	-0.02	-0.02	-0.11	-0.11	-0.23	-0.23
	st.dev.	0.45	0.46	0.47	0.47	0.47	0.54	0.56	0.57	0.50	0.51	0.52	0.54	0.54	0.54	0.45	0.44	0.44	0.45	0.46	0.47	0.47
Machinery	mean	-0.23	-0.22	-0.26	-0.24	-0.23	-0.03	-0.02	-0.01	-0.05	-0.03	-0.01	0.13	0.14	0.15	0.11	0.11	0.12	-0.23	-0.22	-0.26	-0.24
	st.dev.	0.49	0.50	0.50	0.50	0.51	0.51	0.52	0.55	0.47	0.48	0.50	0.49	0.51	0.53	0.43	0.44	0.45	0.49	0.50	0.50	0.50
Timber, paper & woodworking	mean	-0.20	-0.20	-0.24	-0.22	-0.22	-0.16	-0.15	-0.15	-0.12	-0.12	-0.11	-0.02	-0.01	-0.01	-0.06	-0.05	-0.05	-0.20	-0.20	-0.24	-0.22
	st.dev.	0.46	0.46	0.44	0.44	0.44	0.50	0.51	0.51	0.52	0.52	0.52	0.54	0.54	0.54	0.43	0.43	0.43	0.46	0.46	0.44	0.44
Construction materials	mean	-0.23	-0.22	-0.28	-0.26	-0.26	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06	0.04	0.04	0.05	0.03	0.04	0.04	-0.23	-0.22	-0.28	-0.26
	st.dev.	0.40	0.40	0.41	0.41	0.42	0.45	0.46	0.47	0.44	0.45	0.46	0.46	0.46	0.47	0.38	0.38	0.39	0.40	0.40	0.41	0.41
Light	mean	-0.37	-0.38	-0.35	-0.32	-0.32	-0.15	-0.13	-0.13	-0.19	-0.16	-0.15	-0.04	-0.02	-0.02	-0.01	0.00	0.01	-0.37	-0.38	-0.35	-0.32
	st.dev.	0.56	0.56	0.54	0.55	0.56	0.60	0.61	0.62	0.58	0.60	0.61	0.55	0.56	0.58	0.51	0.51	0.52	0.56	0.56	0.54	0.55
Food	mean	-0.30	-0.30	-0.25	-0.25	-0.25	-0.13	-0.14	-0.14	-0.12	-0.12	-0.12	-0.09	-0.10	-0.10	-0.08	-0.08	-0.08	-0.30	-0.30	-0.25	-0.25
	st.dev.	0.42	0.42	0.45	0.45	0.45	0.51	0.53	0.54	0.47	0.48	0.49	0.53	0.54	0.54	0.50	0.51	0.51	0.42	0.42	0.45	0.45
Other	mean	-0.28	-0.27	-0.17	-0.14	-0.13	-0.11	-0.10	-0.10	-0.08	-0.05	-0.03	-0.14	-0.13	-0.13	-0.09	-0.09	-0.09	-0.28	-0.27	-0.17	-0.14
	st.dev.	0.41	0.42	0.42	0.43	0.44	0.42	0.47	0.52	0.39	0.42	0.44	0.45	0.48	0.49	0.40	0.44	0.45	0.41	0.42	0.42	0.43
Total	mean	-0.26	-0.26	-0.25	-0.24	-0.23	-0.10	-0.10	-0.10	-0.10	-0.09	-0.08	0.00	0.00	0.01	-0.01	-0.01	-0.01	-0.26	-0.26	-0.25	-0.24
	st.dev.	0.47	0.47	0.47	0.47	0.48	0.51	0.52	0.54	0.48	0.49	0.51	0.51	0.52	0.53	0.46	0.46	0.47	0.47	0.47	0.47	0.47

**Table 5****Total Factor Productivity Growth. Correlations between fixed effects, random effects and OLS estimations.****1994**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9817	1	
TFP, ols	0.9486	0.9844	1

**1995**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9869	1	
TFP, ols	0.9681	0.9925	1

**1996**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9903	1	
TFP, ols	0.9779	0.9957	1

**1997**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9871	1	
TFP, ols	0.9676	0.9934	1

**1998**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9882	1	
TFP, ols	0.9697	0.9935	1

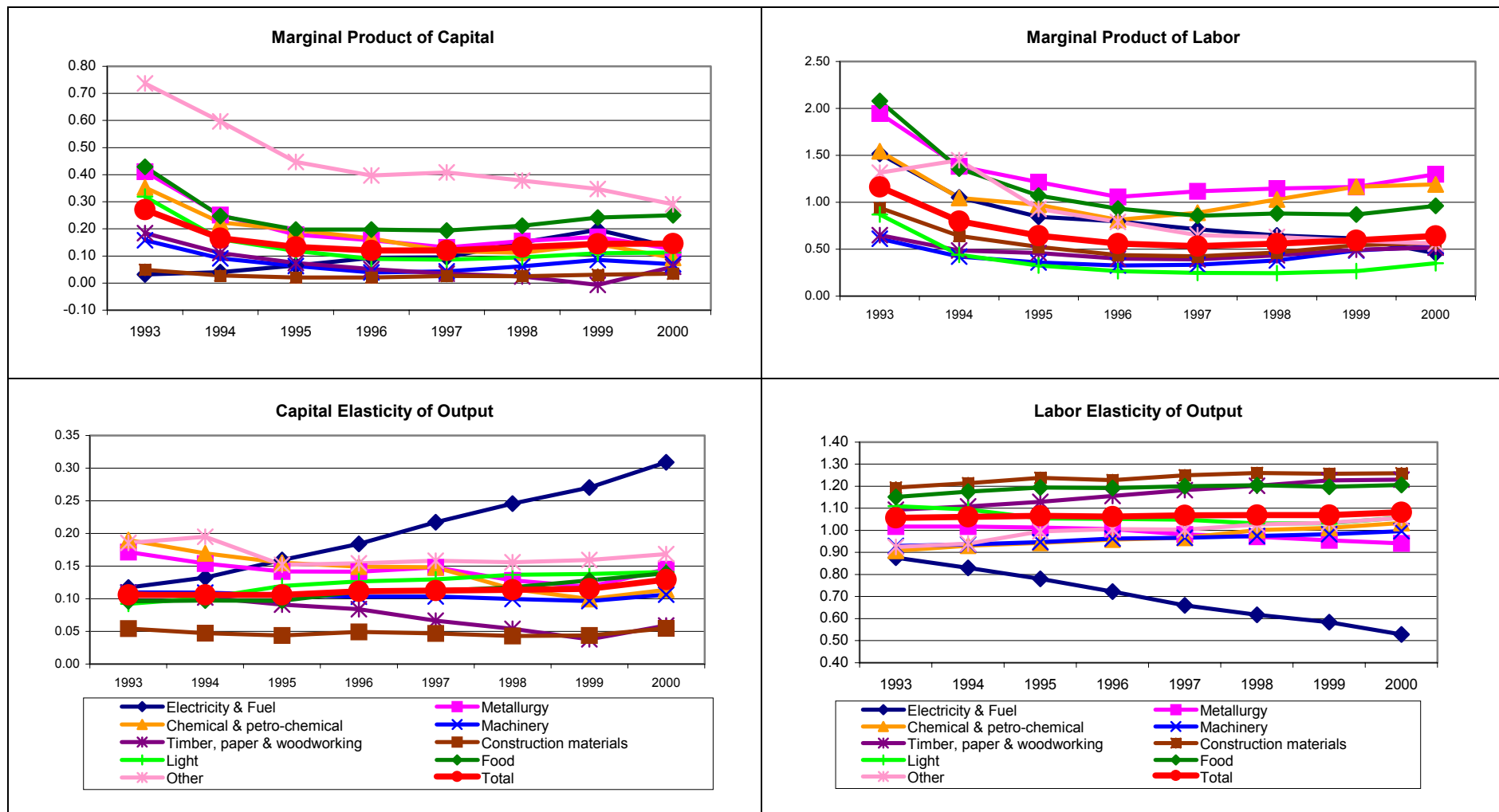
**1999**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9881	1	
TFP, ols	0.9694	0.993	1

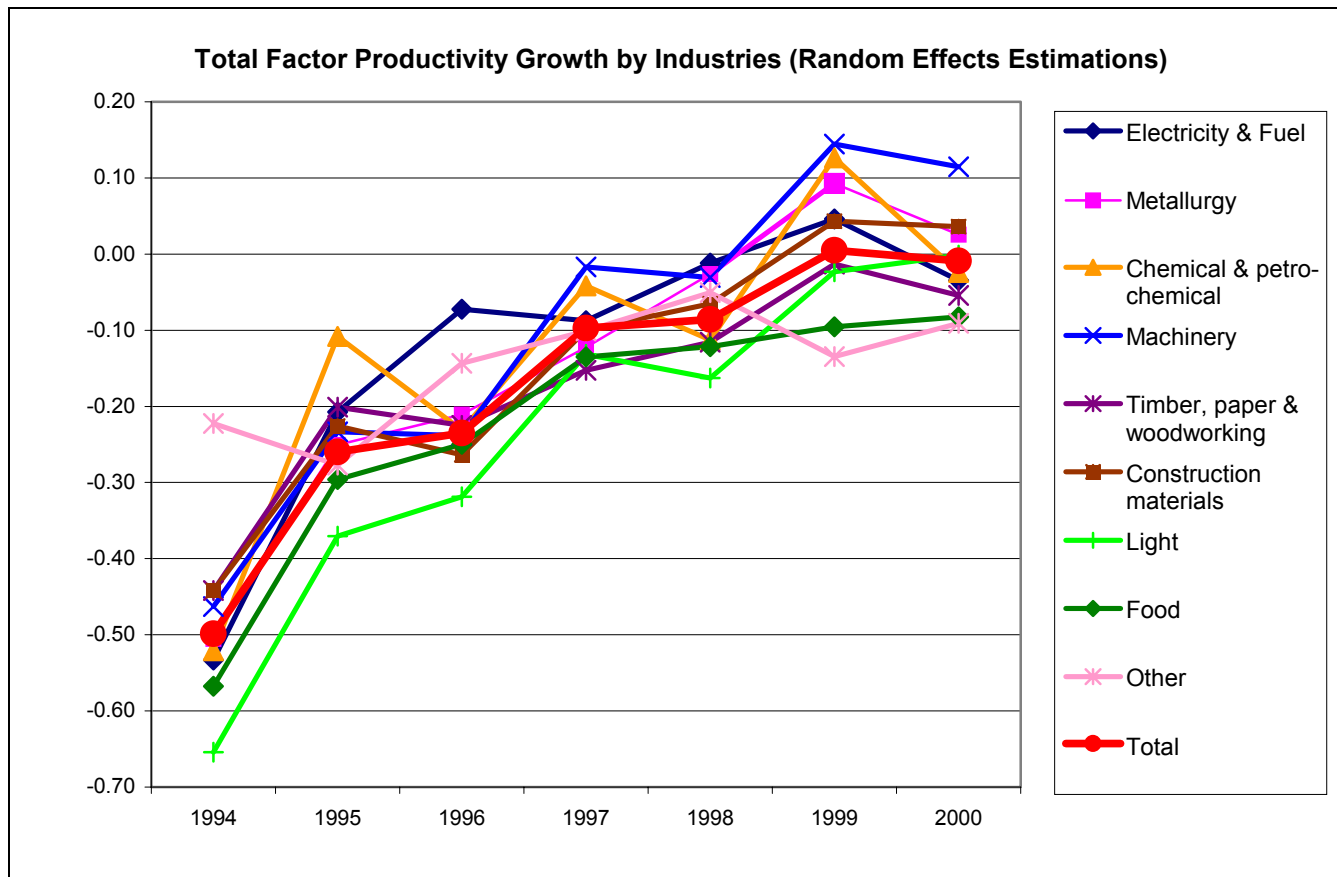
**2000**

	TFP, fe	TFP, re	TFP, ols
TFP, fe	1		
TFP, re	0.9911	1	
TFP, ols	0.9756	0.9939	1

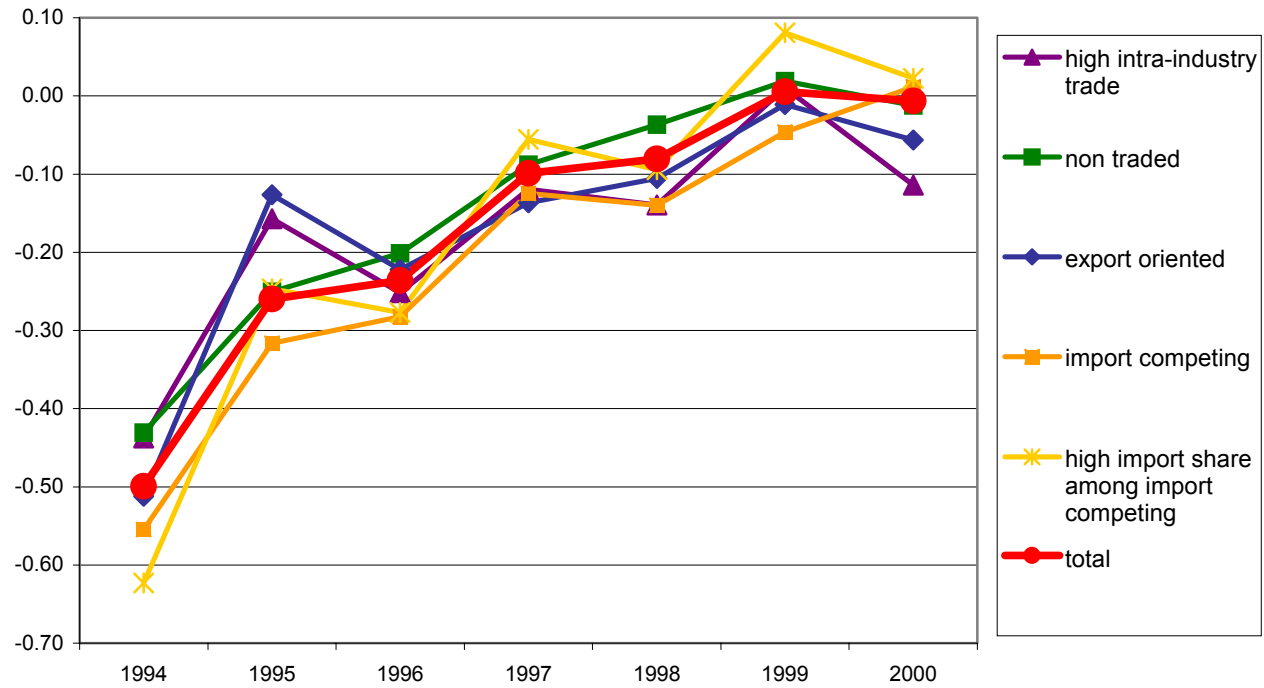
Figure 1. Marginal Products of Capital and Labor and Capital and Labor Elasticity of Output (Random Effects Estimations)



**Figure 2**  
**Total Factor Productivity Growth**



**Total Factor Productivity Growth by Trade Categories (Random Effects Estimations)**





**Figure 3 TFP, Real Output, Real Capital and Labor Cumulative Growth by Trade Categories since 1996**

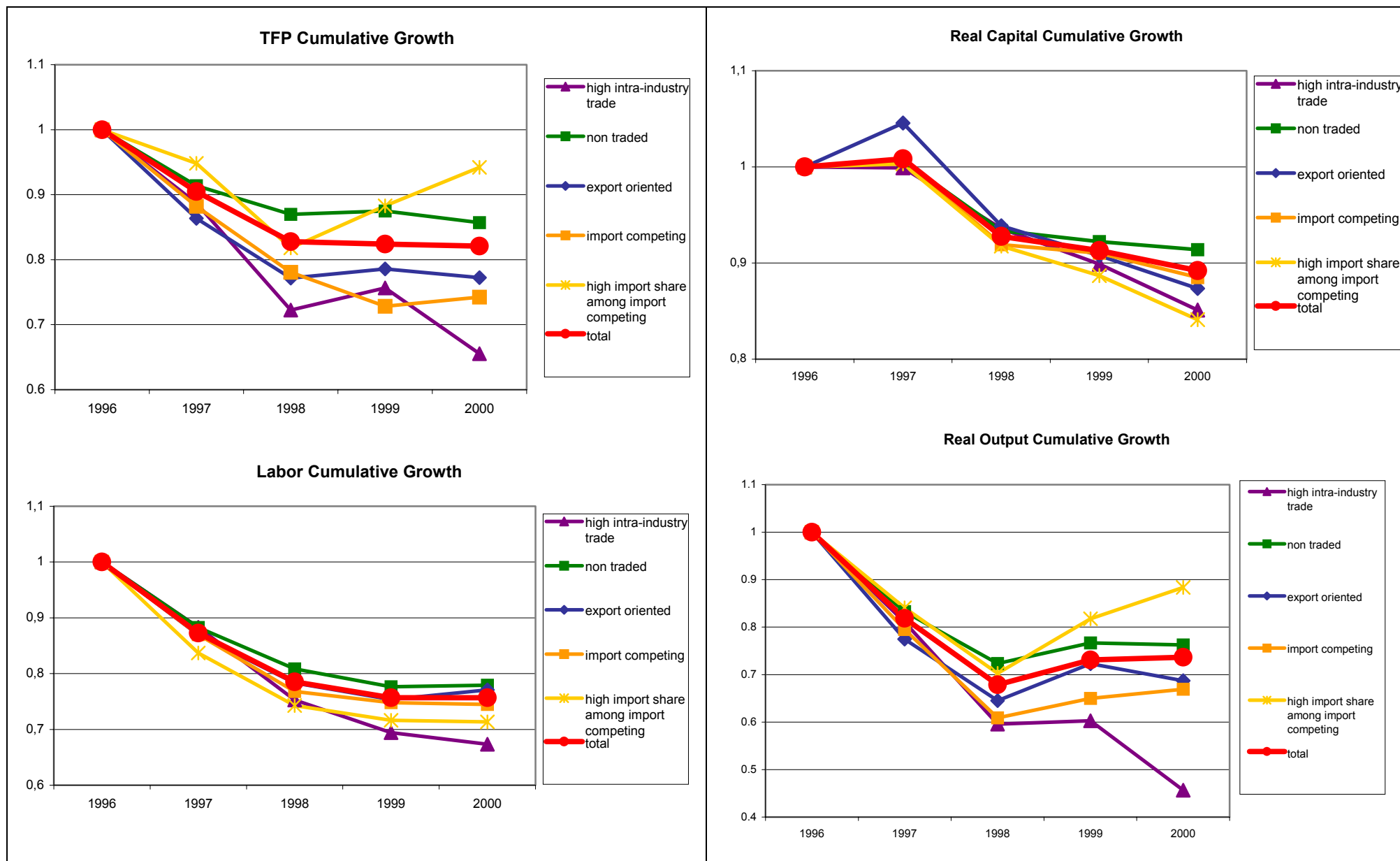






Table 5.1

## Ratios of import to output by firm

		1994	1995	1996	1997	1998	1999	2000
Electricity & Fuel	mean	0.003	0.065	0.062	0.055	0.064	0.061	0.064
	st. dev.	0.010	0.152	0.066	0.066	0.094	0.119	0.100
Metallurgy	mean	0.060	0.213	0.124	0.146	0.130	0.114	0.109
	st. dev.	0.177	0.276	0.200	0.209	0.218	0.223	0.193
Chemical & petro-chemical	mean	0.043	0.263	0.222	0.240	0.235	0.177	0.182
	st. dev.	0.071	0.212	0.189	0.192	0.183	0.169	0.171
Machinery	mean	0.070	0.257	0.221	0.261	0.269	0.271	0.255
	st. dev.	0.148	0.223	0.202	0.226	0.229	0.244	0.222
Timber, paper & woodworking	mean	0.002	0.072	0.066	0.075	0.056	0.050	0.071
	st. dev.	0.016	0.121	0.114	0.135	0.098	0.093	0.116
Construction materials	mean	0.003	0.048	0.023	0.020	0.019	0.012	0.015
	st. dev.	0.025	0.126	0.069	0.072	0.062	0.057	0.062
Light	mean	0.008	0.348	0.319	0.353	0.282	0.290	0.303
	st. dev.	0.029	0.087	0.144	0.170	0.148	0.127	0.150
Food	mean	0.045	0.325	0.163	0.182	0.174	0.137	0.106
	st. dev.	0.068	0.197	0.156	0.153	0.162	0.166	0.127
Other	mean	0.081	0.529	0.416	0.451	0.451	0.378	0.406
	st. dev.	0.112	0.083	0.241	0.245	0.237	0.206	0.244
Total	mean	0.034	0.228	0.187	0.210	0.200	0.181	0.187
	st. dev.	0.083	0.211	0.200	0.216	0.211	0.204	0.209

Table 5.2

## Share of foreign-owned firms production in the total production by industries

		1994	1995	1996	1997	1998	1999	2000
Electricity & Fuel	mean	0.018	0.016	0.017	0.018	0.042	0.040	0.052
	st. dev.	0.032	0.028	0.029	0.033	0.061	0.054	0.076
Metallurgy	mean	0.018	0.020	0.022	0.018	0.082	0.096	0.330
	st. dev.	0.021	0.022	0.026	0.022	0.083	0.140	0.322
Chemical & petro-chemical	mean	0.023	0.035	0.032	0.034	0.152	0.194	0.206
	st. dev.	0.033	0.056	0.053	0.052	0.165	0.227	0.165
Machinery	mean	0.036	0.042	0.064	0.073	0.097	0.142	0.180
	st. dev.	0.065	0.068	0.119	0.140	0.138	0.199	0.207
Timber, paper & woodworking	mean	0.185	0.171	0.213	0.181	0.244	0.161	0.189
	st. dev.	0.285	0.237	0.317	0.226	0.256	0.170	0.203
Construction materials	mean	0.015	0.025	0.024	0.041	0.048	0.111	0.173
	st. dev.	0.018	0.031	0.037	0.061	0.074	0.152	0.223
Light	mean	0.036	0.025	0.035	0.045	0.046	0.055	0.050
	st. dev.	0.076	0.060	0.090	0.100	0.092	0.101	0.102
Food	mean	0.067	0.080	0.086	0.124	0.149	0.200	0.276
	st. dev.	0.093	0.118	0.146	0.177	0.245	0.244	0.270
Other	mean	0.058	0.062	0.164	0.159	0.142	0.183	0.166
	st. dev.	0.127	0.123	0.300	0.296	0.205	0.280	0.252
Total	mean	0.044	0.048	0.068	0.076	0.107	0.140	0.182
	st. dev.	0.094	0.091	0.149	0.151	0.160	0.197	0.217

**Table 6.1. Complexity index**

	mean	st. dev.
Electricity & Fuel	0.726	0.155
Metallurgy	0.796	0.107
Chemical & petro-chemical	0.843	0.053
Machinery	0.831	0.127
Timber, paper & woodworking	0.822	0.074
Construction materials	0.848	0.059
Light	0.739	0.107
Food	0.717	0.197
Other	0.804	0.149
Total	0.803	0.133

**Table 6.2. Regional Market Shares**

	1994	1995	1996	1997	1998	1999	2000
Electricity & Fuel	0.38	0.30	0.33	0.29	0.32	0.30	0.41
Metallurgy	0.66	0.65	0.61	0.59	0.61	0.61	0.71
Chemical & petro-chemical	0.67	0.69	0.70	0.72	0.71	0.68	0.79
Machinery	0.48	0.44	0.46	0.46	0.44	0.44	0.50
Timber, paper & woodworking	0.14	0.14	0.14	0.15	0.16	0.17	0.28
Construction materials	0.19	0.20	0.23	0.23	0.23	0.24	0.31
Light	0.21	0.20	0.22	0.23	0.22	0.21	0.29
Food	0.16	0.16	0.17	0.17	0.18	0.18	0.22
Other	0.26	0.26	0.18	0.19	0.19	0.17	0.18
Total	0.24	0.23	0.24	0.25	0.25	0.25	0.31

**Table 6.3. Herfindalh Index**

	1994	1995	1996	1997	1998	1999	2000
Electricity & Fuel	0.049	0.058	0.059	0.054	0.061	0.070	0.134
Metallurgy	0.170	0.173	0.169	0.155	0.162	0.156	0.209
Chemical & petro-chemical	0.143	0.131	0.156	0.170	0.181	0.138	0.201
Machinery	0.066	0.065	0.071	0.074	0.068	0.069	0.089
Timber, paper & woodworking	0.013	0.015	0.015	0.019	0.024	0.026	0.044
Construction materials	0.016	0.015	0.018	0.017	0.019	0.021	0.031
Light	0.020	0.023	0.025	0.025	0.030	0.030	0.042
Food	0.014	0.015	0.018	0.020	0.024	0.028	0.038
Other	0.029	0.025	0.029	0.031	0.027	0.039	0.048
Total	0.028	0.030	0.033	0.036	0.038	0.040	0.056

**Table 6.4. Standard Deviation of PPI**

	1994	1995	1996	1997	1998	1999	2000
Electricity & Fuel	0.081	0.114	0.033	0.014	0.023	0.035	0.032
Metallurgy	0.103	0.081	0.016	0.014	0.055	0.038	0.023
Chemical & petro-chemical	0.072	0.080	0.016	0.017	0.040	0.035	0.016
Machinery	0.058	0.082	0.019	0.022	0.029	0.036	0.023
Timber, paper & woodworking	0.050	0.058	0.015	0.007	0.038	0.031	0.014
Construction materials	0.049	0.084	0.018	0.006	0.012	0.013	0.012
Light	0.054	0.043	0.011	0.010	0.043	0.031	0.017
Food	0.079	0.086	0.018	0.012	0.060	0.036	0.027
Other	0.040	0.051	0.012	0.007	0.039	0.045	0.021
Total	0.062	0.073	0.016	0.012	0.041	0.033	0.021

**Table 7.1**  
**TFP Growth Regressions. All Industries**

Variables	1994-2000			1994-1998			1999-2000		
	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>
LnL	-0.364	-0.002	0.002	-0.401	-0.006	-0.006	-0.553	0.016	0.014
	[47.90]**	[1.08]	[1.23]	[34.57]**	[2.97]**	[3.19]**	[17.33]**	[5.09]**	[4.54]**
capital/output ratio	-0.012	-0.007	-0.006	-0.013	-0.008	-0.007	-0.020	-0.007	-0.006
	[54.03]**	[43.22]**	[24.45]**	[44.84]**	[40.54]**	[21.88]**	[30.40]**	[28.09]**	[15.46]**
national Herfindalh index	0.141	0.317	0.257	0.049	0.428	0.412	-1.091	0.334	0.302
	[1.66]	[8.15]**	[7.08]**	[0.35]	[9.54]**	[8.53]**	[5.53]**	[5.93]**	[5.72]**
lagged market share	-0.653	-0.037	-0.007	-0.844	-0.051	-0.035	-1.994	-0.018	-0.002
	[28.35]**	[4.61]**	[1.03]	[27.13]**	[6.03]**	[4.28]**	[19.90]**	[1.35]	[0.18]
standard deviation of PPI	0.002	0.001	0.001	-0.684	-1.688	-1.865	0.002	0.001	0.001
	[6.47]**	[3.50]**	[3.09]**	[9.44]**	[31.96]**	[36.05]**	[5.33]**	[4.25]**	[4.48]**
import shares by firms	0.388	0.195	0.156	0.008	0.085	0.088	-0.225	0.118	0.134
	[17.00]**	[15.39]**	[13.81]**	[0.27]	[5.72]**	[6.24]**	[1.98]*	[5.78]**	[6.84]**
imported inputs	0.267	0.200	0.135	0.198	0.247	0.179	0.011	-0.087	-0.093
	[14.99]**	[14.98]**	[10.22]**	[5.73]**	[12.15]**	[8.77]**	[0.34]	[5.15]**	[5.47]**
share of FDI	0.253	0.137	0.097	0.322	0.077	0.034	0.314	0.046	0.043
	[6.89]**	[5.59]**	[4.36]**	[4.63]**	[2.10]*	[0.96]	[3.28]**	[1.54]	[1.57]
share of FDI among suppliers	-0.174	0.204	0.365	-0.199	0.787	0.927	0.456	-0.343	-0.363
	[3.14]**	[5.09]**	[10.38]**	[2.21]*	[11.90]**	[15.41]**	[2.60]**	[6.39]**	[7.65]**
share of FDI among consumers	0.857	0.993	0.919	0.487	0.806	0.771	-0.240	0.060	0.065
	[19.30]**	[30.67]**	[30.28]**	[5.25]**	[14.31]**	[14.21]**	[2.19]*	[1.47]	[1.61]
real exchange rate	0.158	0.333	0.410	-10.957	-3.328	-2.868	1.158	0.114	0.109
	[1.24]	[3.61]**	[4.75]**	[21.42]**	[19.26]**	[18.25]**	[0.71]	[0.66]	[0.68]
constant	1.667	-0.384	-0.388	2.774	-0.046	-0.056	3.295	-0.044	-0.031
	[39.49]**	[31.95]**	[36.50]**	[39.87]**	[2.65]**	[3.53]**	[12.59]**	[1.55]	[1.15]
Observations	77969	77964	77966	56040	56021	56023	21929	21943	21943
Number of firms	21323	21322		19368	19371		13521	13522	
R-squared	0.14		0.08	0.15		0.09	0.15		0.04

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level

**Table 7.2**  
**TFP Growth Regressions. Import Competing Industries**

Variables	1994-2000			1994-1998			1999-2000		
	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>
LnL	-0.349	-0.009	-0.004	-0.372	-0.011	-0.010	-0.541	0.013	0.011
	[30.57]**	[2.84]**	[1.29]	[21.24]**	[3.38]**	[3.13]**	[10.63]**	[2.40]*	[1.98]*
capital/output ratio	-0.012	-0.008	-0.007	-0.014	-0.009	-0.009	-0.019	-0.007	-0.006
	[35.36]**	[30.67]**	[17.41]**	[28.74]**	[29.84]**	[15.75]**	[19.63]**	[18.09]**	[10.31]**
national Herfindalh index	-0.143	0.280	0.258	-0.228	0.469	0.467	-1.321	0.394	0.361
	[1.03]	[4.80]**	[4.65]**	[1.08]	[6.68]**	[6.23]**	[4.20]**	[4.52]**	[4.59]**
lagged market share	-0.651	0.025	0.043	-0.855	0.014	0.019	-2.281	0.015	0.030
	[19.18]**	[2.29]*	[4.31]**	[18.40]**	[1.17]	[1.64]	[14.36]**	[0.81]	[1.63]
standard deviation of PPI	0.002	0.001	0.000	-0.824	-1.566	-1.661	0.002	0.001	0.001
	[5.70]**	[2.36]*	[2.10]*	[6.47]**	[19.25]**	[21.65]**	[4.54]**	[3.75]**	[4.09]**
import shares by firms	0.546	0.375	0.328	0.152	0.183	0.183	-0.246	0.079	0.083
	[17.02]**	[20.22]**	[18.60]**	[3.37]**	[8.15]**	[8.30]**	[1.75]	[2.41]*	[2.69]**
imported inputs	0.138	0.232	0.218	0.098	0.363	0.304	-0.107	-0.051	-0.044
	[5.98]**	[12.84]**	[12.11]**	[2.02]*	[12.22]**	[10.34]**	[2.53]*	[2.20]*	[2.01]*
share of FDI	0.123	0.112	0.116	0.195	0.081	0.082	0.154	-0.057	-0.070
	[2.20]*	[3.20]**	[3.68]**	[2.05]*	[1.65]	[1.82]	[0.93]	[1.24]	[1.72]
share of FDI among suppliers	0.178	0.872	0.930	0.445	1.811	1.772	0.180	-0.395	-0.440
	[1.62]	[10.60]**	[11.92]**	[2.32]*	[13.70]**	[13.31]**	[0.68]	[3.39]**	[4.07]**
share of FDI among consumers	1.308	0.994	0.931	0.960	0.780	0.808	0.372	0.189	0.133
	[17.44]**	[16.57]**	[15.41]**	[4.77]**	[6.27]**	[6.10]**	[2.10]*	[2.51]*	[1.86]
real exchange rate	-0.329	-0.069	0.069	-9.982	-2.116	-1.990	-2.136	-0.520	-0.590
	[1.52]	[0.47]	[0.49]	[9.90]**	[7.38]**	[7.53]**	[0.78]	[1.80]	[2.23]*
constant	1.555	-0.479	-0.498	2.510	-0.264	-0.256	3.874	0.024	0.058
	[23.73]**	[25.05]**	[27.91]**	[21.33]**	[8.91]**	[8.82]**	[8.97]**	[0.50]	[1.26]
Observations	34636	34650	34657	25128	25125	25130	9508	9525	9527
Number of firms	9360	9365		8598	8602		5852	5855	
R-squared	0.17		0.11	0.16		0.10	0.16		0.04

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level

**Table 7.3**  
**TFP Growth Regressions. Export Oriented Industries**

Variables	1994-2000			1994-1998			1999-2000		
	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>
LnL	-0.305	0.004	0.007	-0.487	-0.018	-0.017	-0.573	0.039	0.037
	[8.64]**	[0.59]	[1.12]	[8.10]**	[2.35]*	[2.35]*	[4.37]**	[3.27]**	[3.61]**
capital/output ratio	-0.010	-0.007	-0.006	-0.012	-0.007	-0.007	-0.024	-0.005	-0.004
	[10.73]**	[10.84]**	[6.69]**	[10.28]**	[10.21]**	[5.94]**	[7.27]**	[4.86]**	[2.57]*
national Herfindalh index	-0.779	-0.032	-0.080	0.422	0.052	0.030	-1.006	0.418	0.395
	[1.66]	[0.19]	[0.58]	[0.54]	[0.26]	[0.18]	[0.83]	[1.69]	[1.72]
lagged market share	-0.649	-0.099	-0.068	-0.694	-0.059	-0.053	-1.125	-0.100	-0.083
	[7.77]**	[3.35]**	[2.79]**	[6.26]**	[1.92]	[1.87]	[2.90]**	[2.05]*	[1.95]
standard deviation of PPI	-1.367	-1.749	-1.790	-0.360	-1.274	-1.276	-2.217	-3.300	-3.394
	[4.97]**	[7.40]**	[7.91]**	[1.02]	[5.05]**	[5.36]**	[1.13]	[4.16]**	[4.78]**
import shares by firms	0.671	0.137	0.086	0.451	0.048	0.047	0.144	0.032	0.030
	[3.78]**	[1.95]	[1.48]	[2.11]*	[0.67]	[0.66]	[0.22]	[0.26]	[0.29]
imported inputs	0.245	0.330	0.340	1.569	1.409	1.341	-0.124	-0.392	-0.385
	[2.61]**	[4.49]**	[4.40]**	[6.33]**	[9.87]**	[9.84]**	[0.48]	[3.82]**	[4.09]**
share of FDI	0.027	-0.402	-0.429	-0.176	-0.544	-0.595	0.898	0.532	0.459
	[0.19]	[3.81]**	[4.46]**	[0.70]	[3.34]**	[3.91]**	[3.05]**	[3.35]**	[3.59]**
share of FDI among suppliers	-0.464	-0.025	0.175	-1.941	-0.777	-0.507	0.280	-1.315	-1.231
	[1.41]	[0.11]	[0.79]	[3.66]**	[2.04]*	[1.28]	[0.31]	[3.46]**	[3.62]**
share of FDI among consumers	1.536	1.940	1.869	0.917	2.779	2.822	-0.093	-1.469	-1.346
	[5.03]**	[8.33]**	[8.43]**	[1.68]	[7.78]**	[8.19]**	[0.09]	[3.42]**	[3.71]**
real exchange rate	-0.379	-0.003	0.062	-8.551	-2.084	-2.036	25.826	0.177	0.249
	[0.60]	[0.01]	[0.16]	[3.37]**	[2.97]**	[2.94]**	[2.91]**	[0.25]	[0.35]
constant	1.903	-0.188	-0.218	3.426	-0.052	-0.067	1.108	0.211	0.188
	[8.58]**	[3.65]**	[4.76]**	[8.62]**	[0.72]	[0.92]	[0.79]	[1.42]	[1.31]
Observations	4076	4076	4077	2897	2896	2897	1179	1180	1180
Number of firms	1308	1309		1076	1077		801	801	
R-squared	0.12		0.10	0.17		0.12	0.22		0.08

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level

**Table 7.4**  
**TFP Growth Regressions. Non Traded Industries**

Variables	1994-2000			1994-1998			1999-2000		
	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>	<i>TFP, fe</i>	<i>TFP, re</i>	<i>TFP, ols</i>
LnL	-0.368	0.004	0.007	-0.397	0.000	0.000	-0.553	0.012	0.010
	[33.94]**	[1.29]	[3.16]**	[24.33]**	[0.09]	[0.16]	[12.82]**	[2.72]**	[2.26]**
capital/output ratio	-0.011	-0.006	-0.006	-0.013	-0.007	-0.006	-0.021	-0.007	-0.006
	[37.83]**	[29.66]**	[15.40]**	[31.03]**	[26.54]**	[13.66]**	[21.36]**	[19.77]**	[10.05]**
national Herfindalh index	0.048	0.354	0.344	0.624	0.535	0.495	-1.051	0.344	0.316
	[0.35]	[5.42]**	[5.06]**	[2.31]**	[6.91]**	[5.12]**	[3.18]**	[3.63]**	[3.42]**
lagged market share	-0.671	-0.061	-0.030	-0.914	-0.106	-0.080	-1.830	-0.033	-0.012
	[18.66]**	[4.85]**	[2.61]**	[18.79]**	[7.86]**	[5.87]**	[12.72]**	[1.57]	[0.60]
standard deviation of PPI	-1.267	-1.678	-1.835	-0.488	-1.287	-1.445	-0.677	-1.965	-2.119
	[15.55]**	[23.34]**	[22.05]**	[4.94]**	[16.17]**	[15.76]**	[2.56]**	[12.31]**	[9.85]**
import shares by firms	-0.026	0.115	0.138	-0.371	0.110	0.140	-0.142	0.203	0.221
	[0.71]	[5.75]**	[8.03]**	[8.42]**	[4.84]**	[6.66]**	[0.50]	[5.54]**	[6.05]**
imported inputs	0.760	0.376	0.259	0.549	0.376	0.313	0.284	-0.093	-0.119
	[18.47]**	[13.45]**	[9.33]**	[7.51]**	[10.26]**	[8.43]**	[3.52]**	[2.32]**	[2.81]**
share of FDI	0.369	0.149	0.117	1.146	0.296	0.211	0.113	0.183	0.226
	[5.78]**	[3.01]**	[2.24]**	[7.45]**	[3.07]**	[1.61]	[0.66]	[3.11]**	[4.28]**
share of FDI among suppliers	-0.416	-0.094	0.038	-0.352	0.419	0.571	1.316	-0.598	-0.619
	[6.53]**	[1.93]	[0.83]	[3.43]**	[5.27]**	[7.86]**	[4.99]**	[7.48]**	[7.85]**
share of FDI among consumers	0.214	0.537	0.526	0.200	0.589	0.572	-0.880	-0.175	-0.154
	[3.85]**	[13.14]**	[13.11]**	[1.92]	[8.74]**	[7.94]**	[6.25]**	[3.31]**	[2.87]**
real exchange rate	1.086	0.956	0.799	-10.019	-3.340	-2.821	2.896	0.585	0.578
	[6.72]**	[7.98]**	[7.10]**	[15.56]**	[14.82]**	[13.67]**	[1.34]	[2.58]**	[2.77]**
constant	1.649	-0.310	-0.297	2.597	-0.043	-0.064	2.703	0.043	0.057
	[28.91]**	[18.54]**	[20.04]**	[28.28]**	[1.83]	[2.96]**	[7.80]**	[1.10]	[1.49]
Observations	36832	36813	36804	26247	26232	26228	10585	10581	10576
Number of firms	10048	10041		9126	9123		6479	6478	
R-squared	0.13		0.09	0.14		0.09	0.16		0.06

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level

**Table 8.1. Complexity and competition. All industries**

	1994-2000				1994-1998				1999-2000			
	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols
LnL	0.011	0.007	-0.006	-0.002	-0.044	-0.041	-0.009	-0.009	0.041	0.037	0.013	0.011
	[1.11]	[0.80]	[2.93]**	[1.41]	[4.04]**	[4.05]**	[4.30]**	[4.75]**	[2.46]*	[2.11]*	[4.09]**	[3.49]**
capital/output ratio	-0.015	-0.015	-0.007	-0.007	-0.022	-0.023	-0.008	-0.008	-0.013	-0.013	-0.007	-0.006
	[17.30]**	[10.30]**	[44.87]**	[25.81]**	[16.49]**	[10.06]**	[41.55]**	[22.39]**	[11.78]**	[6.74]**	[29.43]**	[16.31]**
national Herfindalh index	0.240	0.175	0.245	0.180	0.377	0.351	0.389	0.366	0.221	0.185	0.239	0.202
	[6.12]**	[4.80]**	[6.28]**	[4.98]**	[8.30]**	[7.25]**	[8.63]**	[7.61]**	[3.90]**	[3.52]**	[4.23]**	[3.84]**
lagged market share	-0.077	-0.031	-0.050	-0.022	-0.029	-0.042	-0.059	-0.044	-0.184	-0.140	-0.037	-0.023
	[1.67]	[0.80]	[6.26]**	[3.12]**	[0.58]	[0.93]	[6.97]**	[5.40]**	[2.62]**	[1.99]*	[2.87]**	[1.76]
standard deviation of PPI	0.001	0.001	0.001	0.001	-1.622	-1.772	-1.615	-1.764	0.001	0.001	0.001	0.001
	[4.22]**	[4.29]**	[3.82]**	[3.76]**	[30.45]**	[33.95]**	[30.32]**	[33.80]**	[4.75]**	[5.68]**	[4.35]**	[5.14]**
import shares by firms	0.055	-0.092	-0.007	-0.140	0.158	0.191	0.097	0.123	-0.438	-0.366	-0.500	-0.422
	[0.79]	[1.48]	[0.11]	[2.29]*	[2.00]*	[2.58]**	[1.25]	[1.70]	[3.89]**	[3.17]**	[4.48]**	[3.67]**
imported inputs	0.221	0.168	0.220	0.166	0.290	0.232	0.272	0.212	-0.067	-0.071	-0.066	-0.070
	[16.45]**	[12.51]**	[16.44]**	[12.40]**	[14.00]**	[11.18]**	[13.23]**	[10.29]**	[3.96]**	[4.14]**	[3.94]**	[4.11]**
share of FDI	0.440	0.732	0.238	0.545	1.371	1.274	0.925	0.789	1.548	1.355	1.440	1.254
	[2.65]**	[4.34]**	[1.45]	[3.29]**	[4.26]**	[4.24]**	[2.92]**	[2.66]**	[7.04]**	[5.92]**	[6.58]**	[5.57]**
share of FDI among suppliers	0.235	0.398	0.240	0.404	0.729	0.853	0.747	0.876	-0.242	-0.265	-0.245	-0.268
	[5.73]**	[10.84]**	[5.86]**	[11.03]**	[10.77]**	[13.65]**	[11.04]**	[14.02]**	[4.25]**	[5.02]**	[4.34]**	[5.14]**
share of FDI among consumers	0.997	0.927	0.998	0.926	0.821	0.789	0.808	0.773	0.076	0.097	0.081	0.102
	[30.84]**	[30.48]**	[30.86]**	[30.45]**	[14.59]**	[14.53]**	[14.35]**	[14.25]**	[1.87]	[2.37]**	[2.00]*	[2.49]*
complexity index	0.305	0.271	0.217	0.233	-0.090	-0.053	0.170	0.190	0.489	0.482	0.363	0.360
	[4.56]**	[4.51]**	[12.54]**	[16.98]**	[1.25]	[0.77]	[9.35]**	[12.30]**	[4.45]**	[4.03]**	[10.65]**	[11.89]**
complexity index multiplied by LnL	-0.022	-0.012			0.046	0.042			-0.036	-0.034		
	[1.69]	[1.06]			[3.29]**	[3.15]**			[1.68]	[1.50]		
complexity index multiplied by lagged market share	0.035	0.012			-0.038	-0.003			0.189	0.152		
	[0.61]	[0.26]			[0.62]	[0.05]			[2.15]*	[1.74]		
complexity index multiplied by capital/output ratio	0.010	0.011			0.017	0.018			0.008	0.008		
	[9.33]**	[5.88]**			[10.63]**	[6.73]**			[5.52]**	[3.37]**		
complexity index multiplied by import shares	0.160	0.288	0.237	0.349	-0.119	-0.161	-0.031	-0.063	0.677	0.604	0.751	0.671
	[1.85]	[3.71]**	[2.78]**	[4.58]**	[1.22]	[1.73]	[0.32]	[0.69]	[4.83]**	[4.26]**	[5.42]**	[4.77]**
complexity index multiplied by share of FDI	-0.425	-0.852	-0.187	-0.633	-1.610	-1.559	-1.095	-0.998	-1.893	-1.662	-1.770	-1.548
	[2.13]*	[4.22]**	[0.95]	[3.19]**	[4.13]**	[4.28]**	[2.85]**	[2.77]**	[7.12]**	[6.06]**	[6.69]**	[5.75]**
real exchange rate	0.285	0.324	0.279	0.322	-3.397	-2.953	-3.402	-2.951	0.047	0.033	0.053	0.040
	[3.08]**	[3.72]**	[3.01]**	[3.70]**	[19.67]**	[18.78]**	[19.68]**	[18.76]**	[0.27]	[0.21]	[0.31]	[0.25]
constant	-0.585	-0.556	-0.516	-0.525	0.040	0.004	-0.152	-0.175	-0.394	-0.377	-0.295	-0.282
	[11.41]**	[12.24]**	[30.28]**	[37.26]**	[0.72]	[0.07]	[7.14]**	[9.45]**	[4.58]**	[4.08]**	[8.16]**	[8.60]**
Observations	77964	77966	77964	77966	56021	56023	56021	56023	21943	21943	21943	21943
Number of firms	21322		21322		19371		19371		13522		13522	
R-squared		0.08		0.08		0.09		0.09		0.06		0.05

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level

**Table 8.2. Complexity and competition. Import competing industries only**

	1994-2000				1994-1998				1999-2000			
	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols	TFP, re	TFP, ols
LnL	0.028	0.035	-0.010	-0.006	-0.029	-0.018	-0.011	-0.010	0.075	0.074	0.012	0.009
	[2.20]**	[2.95]**	[3.20]**	[1.95]	[2.09]*	[1.36]	[3.11]**	[2.97]**	[3.23]**	[2.90]**	[2.20]*	[1.70]
capital/output ratio	-0.016	-0.016	-0.008	-0.007	-0.022	-0.023	-0.009	-0.009	-0.014	-0.013	-0.007	-0.006
	[15.35]**	[10.08]**	[31.00]**	[17.87]**	[13.80]**	[8.55]**	[29.63]**	[15.69]**	[10.42]**	[6.89]**	[18.88]**	[10.96]**
national Herfindalh index	0.183	0.142	0.193	0.149	0.471	0.442	0.505	0.478	0.143	0.102	0.154	0.114
	[3.07]**	[2.54]*	[3.26]**	[2.69]**	[6.60]**	[5.74]**	[7.12]**	[6.24]**	[1.62]	[1.31]	[1.76]	[1.45]
lagged market share	-0.056	-0.028	0.014	0.028	-0.082	-0.106	0.020	0.022	-0.114	-0.093	-0.022	-0.008
	[1.06]	[0.64]	[1.23]	[2.78]**	[1.42]	[2.05]*	[1.68]	[1.85]	[1.32]	[1.10]	[1.18]	[0.45]
standard deviation of PPI	0.001	0.001	0.001	0.001	-1.769	-1.811	-1.730	-1.771	0.001	0.001	0.001	0.001
	[3.16]**	[3.10]**	[2.85]**	[2.72]**	[20.44]**	[21.60]**	[20.13]**	[21.33]**	[3.98]**	[4.96]**	[3.85]**	[4.77]**
import shares by firms	0.434	0.288	0.349	0.222	0.152	0.140	0.040	0.018	-0.120	-0.119	-0.134	-0.131
	[4.82]**	[3.41]**	[3.93]**	[2.65]**	[1.39]	[1.35]	[0.38]	[0.17]	[0.77]	[0.73]	[0.86]	[0.80]
imported inputs	0.229	0.213	0.234	0.219	0.395	0.340	0.377	0.322	-0.114	-0.108	-0.105	-0.098
	[12.52]**	[11.39]**	[12.92]**	[11.85]**	[13.06]**	[11.27]**	[12.57]**	[10.81]**	[4.74]**	[4.61]**	[4.46]**	[4.27]**
share of FDI	-0.517	-0.056	-0.749	-0.265	-2.331	-1.978	-2.692	-2.341	2.316	2.039	2.184	1.904
	[2.35]*	[0.25]	[3.43]**	[1.18]	[4.34]**	[3.24]**	[5.02]**	[3.69]**	[7.33]**	[6.10]**	[6.93]**	[5.73]**
share of FDI among suppliers	1.059	1.133	1.020	1.090	2.013	1.961	1.979	1.929	-0.082	-0.103	-0.128	-0.156
	[12.57]**	[14.57]**	[12.14]**	[14.01]**	[14.90]**	[14.27]**	[14.64]**	[14.00]**	[0.68]	[0.96]	[1.08]	[1.47]
share of FDI among consumers	0.968	0.908	0.990	0.929	0.633	0.681	0.676	0.723	0.264	0.233	0.290	0.257
	[16.15]**	[15.19]**	[16.52]**	[15.51]**	[4.93]**	[4.98]**	[5.27]**	[5.27]**	[3.51]**	[3.17]**	[3.85]**	[3.53]**
complexity index	0.352	0.415	0.115	0.165	-0.331	-0.213	-0.157	-0.107	1.065	1.042	0.701	0.662
	[3.96]**	[4.99]**	[4.41]**	[7.09]**	[3.39]**	[2.25]*	[5.39]**	[3.91]**	[6.36]**	[5.56]**	[10.37]**	[9.50]**
complexity index multiplied by LnL	-0.052	-0.054			0.025	0.011			-0.084	-0.086		
	[3.05]**	[3.49]**			[1.37]	[0.61]			[2.77]**	[2.62]**		
complexity index multiplied by lagged market share	0.091	0.074			0.131	0.164			0.122	0.112		
	[1.37]	[1.32]			[1.80]	[2.48]*			[1.11]	[1.07]		
complexity index multiplied by capital/output ratio	0.011	0.011			0.016	0.017			0.009	0.010		
	[8.14]**	[5.46]**			[8.27]**	[5.36]**			[5.32]**	[3.62]**		
complexity index multiplied by import shares	-0.082	0.029	0.022	0.108	0.045	0.053	0.192	0.212	0.190	0.203	0.208	0.219
	[0.74]	[0.28]	[0.20]	[1.07]	[0.34]	[0.43]	[1.49]	[1.73]	[0.98]	[1.03]	[1.08]	[1.10]
complexity index multiplied by share of FDI	0.650	0.073	0.936	0.331	2.876	2.428	3.301	2.860	-3.012	-2.691	-2.856	-2.530
	[2.53]*	[0.28]	[3.67]**	[1.27]	[4.56]**	[3.43]**	[5.25]**	[3.89]**	[8.05]**	[6.85]**	[7.65]**	[6.48]**
real exchange rate	-0.096	-0.022	-0.089	-0.009	-1.935	-1.916	-1.960	-1.926	-0.571	-0.649	-0.510	-0.586
	[0.64]	[0.15]	[0.60]	[0.06]	[6.72]**	[7.18]**	[6.80]**	[7.21]**	[2.01]*	[2.49]*	[1.79]	[2.25]*
constant	-0.723	-0.773	-0.548	-0.589	-0.035	-0.103	-0.161	-0.182	-0.747	-0.699	-0.477	-0.418
	[10.73]**	[12.53]**	[21.19]**	[25.66]**	[0.46]	[1.43]	[4.57]**	[5.42]**	[5.65]**	[4.75]**	[7.00]**	[6.13]**
Observations	34650	34657	34650	34657	25125	25130	25125	25130	9525	9527	9525	9527
Number of firms	9365		9365		8602		8602		5855		5855	
R-squared		0.11		0.11		0.11		0.11		0.07		0.06

Absolute value of t-statistics in brackets; \* significant at 5% level; \*\* significant at 1% level



