PRICING TO MARKET BEHAVIOR OF UKRAINIAN EXPORTERS

by

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Abstract

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The mechanism of how exchange rate movements influence prices of exports and imports plays an underlying role in the adjustment of external balances. Studies on the relationship between exchange rate movements and prices of traded goods have been of great interest since the late 1980s, when the US current account deficit did not show an immediate and marked decline, though the value of US dollar had fallen significantly. For Ukraine this topic of research is of interest since results may reveal information about market environment in which Ukrainian export-oriented firms operate and help Ukrainian government make a decision on optimal exchange rate policy.

This thesis examines the relationship between exchange rate changes and Ukrainian exports prices. Using panel data and fixed effects model, I found that Ukrainian exporters completely pass-through exchange rate changes to prices in foreign market currency and there is no pricing to market, that is the phenomenon of price discrimination in international markets induced by exchange rate movements is absent.

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GLOSSARY

Integrated market: a market in which geography or nationality do not have systematic effects on transaction prices for otherwise identical products.

Geographically segmented market: a market in which location of the buyers and sellers influences the terms of the transaction in a substantial way (i.e., by more than the marginal cost of physically moving the good from one location to another).

Exchange rate pass-through: the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing countries.

Pricing to market: the phenomenon of exchange rate induced price discrimination in international markets.

Exchange rate: the number of units of the currency of a country that trade for one unit of another currency.

Exports: goods that are produced by the residents of a country but are sold to foreigners.

Chapter 1

INTRODUCTION

Policymakers are often concerned with the level of the current account, since an excessive imbalance in the current account – either a surplus or a deficit – may have undesirable long-run effects on national welfare. One of the instruments that policymakers may use in order to influence the current account is the exchange rate. Also, exchange rate is of great interest in microeconomic aspect, since it may influence demand for exports and profitability of exporting firms.

The question of the relationship between exchange rates and the trade balance has become of increasing interest since the late 1980s, when the US current account deficit did not show an immediate and marked decline despite the significant fall in the value of the US dollar.

The relationship between exchange rates and the current account depends on the price adjustment process. Trade volumes should depend on the relative prices of exports and imports, that is of real exchange rate: $q=EP^*/P$, where q – real exchange rate, E – nominal exchange rate, P – domestic price level, P^* - foreign price level. Simple, competitive models of international trade predict that when home currency depreciates (that is E rises), P^* remains fixed so that the domestic currency price of goods imported from abroad rises proportionally. The percentage by which import prices rise when the home currency depreciates by one percent is known as the degree of pass-through from the exchange rate to import prices. When domestic currency prices of imported goods rise proportionally to the exchange rate depreciation, the pass-through is said to be complete.

An incomplete pass-through of exchange rate changes into prices of goods imported from abroad may result from strategic pricing behavior of exporters, which will affect the adjustment of the exporting country's external balances as well. This incomplete pass-through is called 'pricing to market' or PTM. More precisely, PTM describes the phenomenon of markup adjustments in response to exchange rate changes. If, for example, the currency of the exporting country appreciates, this would cause the amount of exports to fall accordingly. But exporters may reduce the home currency price of exports to protect their market share, so that the export volume will not fall as much as predicted. If the currency of the exporting country depreciates, theory predicts that the volume of exports will rise immediately. Exporters may increase the home currency price of the goods sold abroad to capture additional markup (and importers in the foreign country now pay more). Consequently, the export volume will rise less than predicted. The reasons for strategic pricing behavior of exporters and the causes of incomplete and less than immediate adjustment of external balances will be discussed in more detail in the following chapters.

The main purpose of this thesis is to analyze the relationship between export prices and exchange rates across a variety of products and export markets. The main question is whether pricing to market behavior is an industry-specific or a country-specific phenomenon in the Ukrainian economy. This thesis paper will help to reveal whether Ukrainian exporters have market power or are competitive price-takers in international markets. It also helps provide a better understanding of exchange rate effects on the trade balance and the transmission of inflation across countries.

To examine the impact of exchange rates on export prices I use panel data on eighteen products exported to twelve countries for the years 1996-2000 (annual data).

The structure of the paper is as follows. Chapter 2 summarizes theoretical issues with respect to exchange rate fluctuations and export prices. It will also discuss some empirical works on pricing to market. In Chapter3 I describe data, econometric model and discuss results. Conclusions and suggestions for future research are presented in Chapter 4.

Chapter 2

THEORETICAL BACKGROUND

2.1. Development of the pricing to market theory.

With the elimination of the Bretton-Woods system a great deal of literature has tried to address theoretically and evaluate empirically the link between the highly variable currency prices and international trade (both quantities and prices).

The literature on the relationship between exchange rate changes and prices of tradable goods can be divided into to parts. First, studies on the law of one price (LOP). The second considers exchange rate pass-through (ERPT) and pricing to market (PTM) issues. Interest in such studies was sparked by the fact that the prices of many imports into the US have not fallen to the degree that one might expect given the strong dollar in 1980s. The question immediately arose: What are the effects of the declining dollar on inflation? (if prices did not fall after the dollar rose, they may not rise as dollar becomes weak).

Dornbusch (1985) applies models of industrial organization to explain price adjustments in terms of the degree of market concentration, the extent of product homogeneity and substitutability, and the relative market shares of domestic and foreign firms. The author described two extreme models that had been studied extensively in the literature to explain price determination for commodities and manufactures.

The first model assumes that the law of one price holds. The law of one price states that in a competitive market free of transportation costs and official barriers to trade (such as tariffs), identical goods sold in different countries must sell for the same price when their prices are expressed in terms of the

same currency. Let p_i, p_i^*, and e denote respectively the price of good i in the home country and currency, the foreign price in foreign currency, and the home currency price of foreign exchange. The law of one price than implies:

$$p_i = e*p_i^* \qquad (1)$$

In this form, the law of one price is introduced in the purchasing power parity (PPP) literature. PPP states that the relative national price levels are independent of the exchange rate since exchange rate movements are a reflection of national price trends.

The alternative model, which Dornbusch called "Keynesian", assumes that a country is fully specialized in the production of one good which is not a perfect substitute for foreign goods. Wages are fixed in national currencies. Letting P and P^* be the national GDP deflators, the relative price of domestic and foreign goods or the real exchange rate then is:

$$\lambda = P/e*P^* \qquad (2)$$

If the markup of prices over unit labour costs is constant then for given unit labor costs prices will be given. Hence, in this model exchange rate movements change relative prices one-for-one. But the assumption of constant markups is not justified when domestic and foreign firms have strategic interactions in pricing.

Next, Dornbusch analyses the problem of exchange rate pass-through in an oligopolistic market using the Cournot model. Dornbusch assumes that there is effective spatial separation between home market and foreign markets. Market demand is linear in the price of the commodity. There are n domestic and n^* foreign firms. Marginal costs (w for home and w^* for foreign firms in units of their local currencies) are assumed to be constant. $N = n + n^*$ is the

total number of firms. Then Dornbusch shows that elasticity of the equilibrium price with respect to the exchange rate (or pass-through) can be expressed as follows:

$$\Omega = \partial \ln(p)/\partial \ln(e) = (n^*/N)*(e*w^*/p)$$

Since both terms in the brackets are less than 1, it is clear that home currency appreciation will lower home market price less than proportionately, that is pass-through is incomplete. The first term in the expression for pass-through shows market structure, and the second is the inverse of markup. It should be noted here that markup is a decreasing function of the number of firms in the industry, so that if N increases, the term $(e*w^*/p)$ rises.

The degree of pass-through in this model depends on two things. First, pass-through rises if N (and thus the markup) is held constant, but the share of foreign firms increases. This is the effect that the location of firms has on pass-through. If the number of firms in the industry increases (but the market share of foreign firms n^*/N is constant), the markup falls and pass-through increases. This is the effect that the number of firms has on pass-through. This model does not consider whether markup can change due to strategic behavior of firms.

Knetter (1992) proposes a model of multi-market monopoly to follow up the relationship between exchange rate and prices. If a firm-monopolist produces goods for sale in separate destination markets, then the first order conditions for profit maximization imply that the firm equates the marginal revenue from sales in each market to the common marginal cost. Thus, the export price to each destination is a function of the common marginal cost and a destination-specific markup:

$$P_i = C*(\eta_i/\eta_i-1) \qquad (3)$$

where P_i is the export price, C is marginal cost, η is the absolute value of the elasticity of demand in the foreign market with respect to changes in price, i is a country subscript.

Knetter shows that a change in exchange rate vis-à-vis the currency of country i can affect the price charged to market i in two ways: by affecting either marginal cost (through changes in quantity or input prices) or the elasticity of import demand. Both effects determine pass-through, while PTM refers to the second effect only.

All the models mentioned above are static in the sense that they do not take into account that the degree of pass-through is influenced by both the actual and expected duration of the exchange rate change. Krugman (1986) argues that the extent to which import prices fall is not independent of whether the home currency has just risen or has been high for a number of years, and is also sensitive to whether the current strength of the currency is regarded as permanent or is soon to be reversed. Krugman proposes a model that has intertemporal linkages in demand or supply.

From the supply side, PTM can result from temporary bottlenecks associated with changing export volume. In this case a firm bears high distribution costs (if there is increasing marginal costs of production, the effect will be even stronger). Suppose that an exporters currency depreciates relative to another country's currency. The exporter would leave the price of the good in the home currency unchanged and reduce the price in the importer's currency proportionately, stipulating that there is no problem with distribution costs. Alternatively, if a firm had high costs of increasing exports (increasing marginal costs), it would increase the price of the good in the importer's currency, so that demand falls to the present production capacity. After that, if exchange rate depreciation were expected to be permanent, the firm would

expand its exports gradually without high costs bearing until the export volume reaches the amount necessary for full pass-through. Alternatively, if the depreciation was temporary, the firm would not deem it valuable to expand production and distribution infrastructure.

However, as Knetter (1992) points out, the drawback of this approach is that it is difficult to explain PTM for permanent appreciations of the exporter's currency, since it is hard to justify constraints on decreasing shipments.

Another explanation of PTM proposed by Krugman in the same article is one attributing PTM to slow adjustment of demand. If there are lags in the effect of price on demand, then firms trade off low profits now for higher sales later. When the lags are long pricing will be dictated by long run cost rather than short run fluctuations. Like in the model discussed previously, the influence of exchange rate changes will have different effects on prices, depending how firms view this currency change: temporary or permanent.

2.2 Empirical studies of PTM.

Empirical studies of exchange rate pass-through were stimulated by large swings in the value of the dollar and the puzzling behavior of the US current account in the 1980s. Mann (1986) uses 4-digit industry US import prices and shows that foreign profit margins are adjusted to mitigate the impact of exchange rate changes on dollar prices of US imports. US exporters showed no tendency to adjust markups in response to exchange rate changes.

Knetter (1989) finds that US export prices are largely insensitive to exchange rate fluctuations, and that when price adjustment does occur it frequently amplifies the effect of exchange rate changes on local currency prices. For Germany more than half of the export markets rejected the implication of invariance of export prices to exchange rate changes that follow from the

constant elasticity hypothesis. Data showed price discrimination in most export destinations.

Lee (1995) is of great interest because it explores pricing to market in the context of a small country. First, he predicted that because an industry group in a small country is likely to have less market power outside its domestic market than a similar group of producers in a large country, it will price to market more than the group in the large country. At the same time, as an industry controls larger market share in an export market, pricing to market decreases. Second, if large-country exporters set the price in an export market, pricing to market will respond sensitively to the exchange rate of large third-party countries. Lee compared the obtained results for Korea with those for larger countries and showed that export market shares matter for pricing to market. The third-country effect on prices was found to be negligible.

Athukorala and Menon (1994) emphasizes the necessity of using methodology which captures the role of not only PTM behavior but also the cost impact of exchange rate fluctuations in explaining incomplete pass-through. This is important especially for import-dependent countries such as Japan, because exchange rate fluctuations have great impacts on input costs. The results suggest that incomplete pass-through is present in Japanese export behavior. The degree of pass-through tends to vary across industries, so studies on the relationships between exchange rates and prices must use more highly disaggregated data. The 2-digit industry classification disaggregation level used by Athukorala and Menon is insufficient to capture all peculiarities of strategic pricing behavior.

An earlier paper on exchange rate pass-through is Kreinin (1977). He uses a "natural experiment" approach to estimate the degree of pass-through that occurred following the currency realignments of 1971. Kreinin estimates pass-through to US import prices to be only 50%, to Germany 60%, Japan 70%,

Canada and Belgium 90% and Italy 100%. Kreinin interprets incomplete exchange rate pass-through as a reflection of either incomplete adjustment during the sample period or "largeness" of the importer in the sense of being able to influence the world price.

2.3. Theoretical model.

The simple model of perfect competition says that profit maximizing firm sets price equal marginal cost, or $P_i = C_i$, where P_i is the price of the i-th good. If the good is traded internationally, the price in the foreign currency, P_i^*, is simply $P_i^* = P_i/e$, where e is the domestic currency price of foreign exchange. This means that if the marginal cost is constant, pass-through, i.e. the elasticity of foreign currency price with respect to exchange rate ($dlnP^* / dlne$) is equal to one (in absolute value). This means that exchange rate changes are completely passed through to foreign currency price of the good.

In this study I use a model of profit maximizing firm that operates in imperfectly competitive international market and can use third degree price discrimination. Profits of the firm are given by:

$$\Pi_{it} = P_{it} * q_{it}(P_{it}/ e_{it}) - C_t(q_{it}(P_{it}/e_{it})) \qquad (4)$$

where Π_{it} is profit on market i (i = 1, …, N) at time t (t= 1, …, T)

P_{it} price on market i in exporter's currency

q_{it} quantity demanded by destination market i

e_{it} exchange rate measured in seller's currency per unit of buyer's currency

$C_t(.)$ cost function, which is constant across destination markets but may vary over time.

The first order condition for profit maximization implies that a firm equates marginal revenue from sales in each market to the common marginal cost. Alternatively, a firm sets price equal to the product of common for all destination markets marginal cost and markup, which varies with destination markets:

$$P_{it} = MC_t*(\varepsilon_{it}/(\varepsilon_{it} - 1)) \qquad (5)$$

where MC_t is common marginal cost

ε_{it} is the perception that the firm has about the value of the elasticity of demand with respect to the destination currency price in market i in period t ($\varepsilon_{it} = \varepsilon_{it}(P_{it}^{*})=\varepsilon_{it}(P_{it}/e_{it})$).

The system of equations given by (5) implies that the optimal export price to each destination in period t depends on two factors: the common marginal cost (MC_t) and the markup over marginal cost, which may contain both common and destination-specific components.

As Goldberg and Knetter (1997) noted, although the system of equations (5) is usually thought of as a first order condition for a monopolist, it is actually more general and ε_{it} can be considered as residual demand elasticities that exporters face in foreign markets.

Chapter 3

EMPIRICAL SECTION

3.1. Ukrainian context of markets and institutions.

The presence and degree of pricing to market (e.g., the situation when exchange rate pass-through to exports prices is incomplete) depends on whether markets are integrated or segmented. An integrated market is one in which national peculiarities and geographical location do not effect, systematically, transaction prices for otherwise identical products. Segmentation is a lack of integration. Segmentation means that an identical product can be traded at different prices in different markets depending on their location, and prices among markets differ by more than the costs of moving a product from one market to another (Goldberg et al 1997). Another factor that can influence the degree of pass-through is competitiveness of the market (possibility to exert market power).

This investigation of price discriminating behavior of Ukrainian exporters is based on a model of a profit maximizing domestic firm, which sells its product in different exports markets. The assumptions made are that this firm sells a homogeneous product and segmentation of export markets allows prices to differ in each market. Therefore, firms can take advantage of a profit maximizing strategy, setting prices according to each market's demand characteristics.

The framework is:

- multiple markets and multiple exchange rates;
- destination specific markups by price discriminating firm;
- used to test both market integration and market power;
- common marginal cost.

Since one of the major questions of my research is in which industries pass-through is incomplete, identifying the major Ukrainian exporting industries is necessary.

Table 1 shows total Ukrainian industrial production between years 1996 and 2000 (June). It shows that there was a steady increase of production, expressed at current prices, in almost all industries. In real terms, however, production of construction materials and fuel and of energy industries has shown continuous decline.

Table 1. Gross industrial production in Ukraine, 1996- 2000 (January-June)

	1996	1997	1998	1999	2000 January -June
(In billions of hryvnia; at current prices)					
Total industry	73.3	75.1	82.9	107.5	65.5
Of which:					
Power generation	9.3	9.5	13.6	17.5	8.8
Fuels and energy*	8.8	8.3	9.6	12.0	7.0
Ferrous metallurgy	15.9	17.0	19.0	25.6	18.4
Non-ferrous metallurgy	1.1	1.1	1.3	2.3	1.8
Chemical and petrochemical	5.3	5.0	4.7	5.8	3.9
Machine building	11.0	11.9	12.5	15.1	8.3
Wood and paper**	1.6	1.5	1.4	2.3	1.5
Construction materials	2.4	2.4	2.7	3.3	1.5
Light industry	1.5	1.3	1.3	1.7	1.0
Food industry	11.9	12.7	12.4	16.3	9.9
(Share in total)					
Total industry	100.0	100.0	100.0	100.0	100.0
of which:					
Power generation	12.6	12.6	16.5	16.2	13.4
Fuels and energy	12.1	11.1	11.6	11.2	10.7
Ferrous metallurgy	21.6	22.7	22.9	23.8	28.1
Non-ferrous metallurgy	1.4	1.5	1.6	2.2	2.8
Chemical and petrochemical	7.3	6.6	5.7	5.4	5.9
Machine building	15.0	15.8	15.1	14.1	12.7
Wood and paper	2.2	2.0	1.7	2.2	2.3

Construction materials	3.3	3.3	3.2	3.1	2.2
Light industry	2.1	1.8	1.6	1.6	1.6
Food industry	16.3	16.9	14.9	15.1	15.1
(Real percent change)***					
Total industry	-5.1	-0.3	-1.0	4.0	10.8
of which:					
Power generation	-6.9	-2.6	-0.2	6.6	1.7
Fuels and energy	-6.7	6.2	-0.2	-0.8	-12.0
Ferrous metallurgy	11.9	8.1	-6.8	6.2	18.6
Non-ferrous metallurgy	8.0	9.4	13.1	13.7	20.9
Chemical and petrochemical	-4.6	-1.4	1.6	0.3	4.0
Machine building	-26.1	-0.2	-3.0	-2.1	9.1
Wood and paper	-18.6	-0.8	7.9	21.5	34.6
Construction materials	-34.2	-10.4	5.2	-1.9	-4.9
Light industry	-24.6	1.1	4.5	8.1	33.8
Food industry	-7.2	-10.3	-1.1	7.0	30.6

Sources: Ukrainian State Statistics Committee

* - Fuel and energy complex includes fuel and nuclear energy.

** - Data for 1996 and 1997 include forestry.

*** - Percentage change over corresponding period of the previous year.

Table 2 presents the commodity structure of Ukrainian exports. The main positions of Ukrainian exports are ferrous and non-ferrous metals, food items and raw materials, chemicals, machinery, fuel and energy products.

Table 2. Commodity structure of Ukrainian exports, 1996-2000 (I-II quarter)
(In millions of U.S. dollars)

	1996	1997	1998	1999	1999 percentage share	2000 (I-II q)
Total	15,547	15,418	13,699	12,463	100.0	7,026
Fuel and energy products	1,224	1,142	1,023	1,057	8.5	574
Machinery	2,061	1,970	1,786	1,388	11.1	706
Wood and wood products	191	209	238	313	2.5	188

Industrial products	614	643	672	593	4.8	320
Chemicals	2,198	2,015	1,735	1,384	11.1	874
Food items and raw materials	3,046	1,802	1,379	1,418	11.4	478
Ferrous and nonferrous metals	4,660	5,904	5,336	4,874	39.1	2,936
Other	1,554	1,733	1,530	1,436	11.5	950

Source: National Bank of Ukraine

Structure of Ukrainian exports by countries – trade partners of Ukraine is shown in Table 3.

Table 3. Directions of Ukrainian export trade, 1996-2000 (I-II quarters)

	1996	1997	1998	1999	1999 (percentage share)	2000 (I-II q)
Total	15,547	15,418	13,699	12,463	100.0	7,026
Countries of the former Soviet Union	8,841	6,841	5,273	4,092	32.8	1,550
Of which						
Russia	5,528	3,913	2,906	2,396	19.2	1,710
Belarus	733	858	548	346	2.8	118
Moldova	236	251	180	123	1.0	75
Uzbekistan	177	249	140	77	0.6	32
Turkmenistan	272	201	121	102	0.8	43
Lithuania	130	107	102	72	0.6	33
Kazakhstan	90	98	90	48	0.4	28
Latvia	78	87	78	9	0.1	53
Rest of World	6,706	8,577	8,426	8,371	67.2	4,476
Of which						
China	769	1,115	737	730	5.9	321
Turkey	411	668	696	673	5.4	408
Germany	419	580	639	560	4.5	335
USA	364	303	502	436	3.5	375
Poland	363	393	313	301	2.4	213
Hungary	374	364	263	278	2.2	162
Italy	345	419	550	459	3.7	257
Slovakia	232	282	245	199	1.6	98

Source: National Bank of Ukraine

3.2. Data description.

The price data used in this study are the export unit values calculated from State Statistics Committee of Ukraine data. The unit values (in hryvnia terms) are obtained by dividing the value of shipments (F.O.B. terms) by the quantity of shipments. The main difficulty in using the unit values as proxies for price is that unit values may change due to changes in the composition of some commodity bundle. I minimize this bias by using highly disaggregated data.

For this study several large export destinations are chosen. They are: Belarus, Russia, Austria, Bulgaria, Greece, Spain, Italy, Netherlands, Germany, Poland, Turkey, and USA. The choice is made so that currencies of export markets fluctuate in value against the Ukrainian currency. Data on large export destinations is used in order to increase the accuracy of measurement of unit values and to reduce the number of periods in which price is not observed due to a lack of shipments. The industries were selected to provide variation in terms of types of products. Table 4 shows the description of 18 products selected for investigating. This products were included in the sample because they have the highest export volumes among all exported products; another requirement for products is that they were exported in each of the years considered and to the maximum number of countries. The data are available on an annual basis.

Table 4. Nomenclature codes and product description.

	Nomenclature Code	Name of the Product
1	120600000	**Sunflower seeds**
2	120991000	**Vegetable seeds**
3	151211910	**sunflowerseed oil**
4	250830000	**Fireclay**
5	261400000	**Titanium ores and concentrates**
6	291712100	**Adipinic acid and salts**
7	320610100	**Pigments and preparations made on the base of titanium dioxide containing not less than 80% of titanium-dioxide**

8	440710910	**Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of crow**
9	440710930	**Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of pine**
10	440710990	**Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of other lumber**
11	440791310	**Dressed stacks, bars and friezes for covering made of oak**
12	440791900	**Oak lumber, other, not mentioned earlier**
13	720841000	**Iron and plain steel metal-roll not in rolls of the width more than 1250 mm and thickness not less than 4 mm**
14	720843000	**Iron and plain steel metal-roll not in rolls, other of the thickness not less than 4 mm and not more than 10 mm**
15	721711900	**Wire made of iron and plain steel, containing not less that 0.25 % of carbon without any covering with the maximum size of cross-section 0.8 mm and more**
16	721712900	**Wire made of iron and plain steel, containing not less that 0.25 % of carbon, galvanized, with the maximum size of cross-section 0.8 mm and more**
17	730439000	**Pipes, hollow sections, seamless, made of ferrous metals, other**
18	848210000	**Ball-bearing**

Monthly nominal exchange rate data are obtained from the International Monetary Fund, *International Financial Statistics*, monthly issues and yearly average exchange rates were calculated from them. Real exchange rates were constructed by dividing the nominal exchange rate by the consumer price index in the destination market. The consumer price indices are taken from *International Financial Statistics* CD.

3.3. Model specification and hypothesis statement.

For estimation of pass-through coefficients I use the following fixed-effects model of export prices across destinations for a particular product, which is obtained by log-linearizing equation (2) from paragraph 2.3:

$$p_{it} = \theta_t + \lambda_i + \beta_i*(e_{it}/CPI_{it}) + u_{it}\ , \qquad (3)$$

where i = 1, …, N indicates the country of destination

t = 1996, …, 2000 indicates time

p_{it} log of UAH export price to destination i in period t

e_{it}/CPI_{it} log of real exchange rate, calculated as bilateral exchange rate measured in seller's currency per unit of buyer's currency divided by consumer price index of destination country in period t .[1]

θ_t time dummies = $\left\{\begin{array}{l}1 \text{ for } 1996\\ 0 \text{ for } 1997\text{-}2000\end{array}\right\}$, …, $\left\{\begin{array}{l}0 \text{ for } 1996\text{-}1999\\ 1 \text{ for } 2000\end{array}\right\}$

λ_i destination dummies = $\left\{\begin{array}{l}1 \text{ for } 1996\\ 0 \text{ for } 1997\text{-}2000\end{array}\right\}$, …, $\left\{\begin{array}{l}0 \text{ for } 1996\text{-}1999\\ 1 \text{ for } 2000\end{array}\right\}$

u_{it} the error term, which is assumed to be independent and identically distributed with mean zero and variance σ_u^2.

The model specification allows to control for the effect of marginal cost changes on export prices without the need to measure marginal cost directly. Marginal cost is common across destinations but may vary over time in response to changes in quantity produced, technology or input prices.

[1] The nominal exchange rate is adjusted by CPI because the optimal export price should be neutral with respect to changes in the nominal exchange rate induced by inflation in destination market (Knetter 1993).

Therefore, the fixed time effect, introduced by including in the model the full set of time dummies (θ_t), can be interpreted as reflecting the marginal cost of exporting industry. Besides, the fixed time effect is likely to include some common changes in markup over marginal cost, which are common to all destination markets and are not resulted from country-specific price discrimination.

The fixed country effect (λ_i) accounts for the other component in the price, that is markup. This markup varies across destinations, that is destination specific dummy reflects demand conditions peculiar to different countries. Within the framework of the model used here, markup, captured by the destination-specific dummy, is constant in the sense that it does not change with changes in exchange rate.

Destination-specific effects captured by dummy variable λ are geography, trade policy and other institutional features of destinations that vary across countries but are constant over time. Knetter (1992) describes them as the factors, which determine the "competitiveness" of the destination market and thus its average level of markup over cost.

The crucial destination-specific explanatory variable, which is of the main interest in this work, is the exchange rate between the exporter's currency and the currency of the destination market. β is the coefficient, which accounts for PTM behavior. It shows how markup to a particular destination varies in response to fluctuations in the value of the exporter's currency against the buyer's.

The statistical interpretation of the β's is as follows. A value of β_i equal to zero implies that the markup to a particular destination is unresponsive to bilateral exchange rate fluctuations. Thus, pass-through from exchange rate

changes to the export price in the buyer's currency would be complete. Positive values of β_i imply that exporters tend to stabilize prices in the buyer's currency that means presence of PTM and variation in markups. For example, if $\beta_i = 0.5$, this means that in response to a 10 percent appreciation (depreciation) of his currency, the exporter would reduce (increase) his markup by 5 percent. Ceteris paribus assumption, the price paid in units of the buyer's currency would rise (fall) by only 5 percent. Negative values of β_i imply that destination-specific changes in markup amplify the effect of bilateral exchange rate changes on the price in units of the buyer's currency. This may be the case when demand in the foreign market becomes less elastic as price increases.

The economic interpretation of β's depends on the assumptions about market structure. No PTM can occur in a frictionless, competitive model of trade. Export market segmentation is a necessary condition for the existence of price discrimination in general and PTM in particular (Knetter 1992). Coefficient β shows how exporters in a given industry change home currency price according to exchange rate fluctuations. This response of exporters depends on price elasticity of demand in the destination market i. As it was noted earlier, P_{it} in the system of equations (5) shows profit maximizing export price, which depends on marginal cost and markup. Since marginal cost is constant across destinations, home currency price variations across destinations depend on markup changes, which in turn is a function of elasticity of demand in market i. Exporter will leave home currency price unchanged if elasticity of demand in the destination market does not respond to local price changes, that is when

(6)

$$\frac{\partial \varepsilon_{it}}{\partial (P_{it} / e_{it})} = 0$$

So, β_i equals zero when demand elasticity in market i is constant. This means that exchange rate changes are passed through completely to importer's prices:

(7)

$$\left|\frac{\partial(P_{it}/e_{it})}{P_{it}/e_{it}}\right| = \left|\frac{\partial P_{it}^*}{P_{it}^*}\right| = \left|\frac{\partial e_{it}}{e_{it}}\right|$$

If export demand becomes more price-elastic with increasing local prices, exporters may not let exchange rate changes pass-through completely to local prices:

(8)

$$\frac{\partial \varepsilon_{it}}{\partial(P_{it}/e_{it})} > 0 \Rightarrow \qquad \left|\frac{\partial(P_{it}/e_{it})}{P_{it}/e_{it}}\right| = \left|\frac{\partial P_{it}^*}{P_{it}^*}\right| < \left|\frac{\partial e_{it}}{e_{it}}\right|$$

Buyers of the exported product may still face the price increase as a result of the exporter's currency appreciation, but this price increase will be less than proportional to the relative exchange rate change. This suggests strategic behavior, which means that exporters cut profit margins (by reducing domestic currency price) during currency appreciation to protect market share (other reasons for PTM are mentioned in Chapter 2). Alternatively, if the elasticity of demand for the exported product becomes smaller with price increase, the exporter has the possibility to increase markup during currency appreciation. This suggests negative pricing to market.

While estimating equation (3), I test the null hypothesis $\beta_i = 0$ against the alternative $\beta_i \neq 0$. The model is estimated by Pooled Least Squares method using White Heteroskedasticity-Consistent Standard Errors and Covariance,

including fixed country effects. The same model is estimated for each of 18 products.

In this study I use annual data. The estimation results should be interpreted as long-run relationships, since the dynamics of price responses to be studied would need data of higher frequency. With annual data, the problem of measurement error is less serious. Since unit values are used in the study instead of prices, higher frequency data could be more easily influenced by changes in the composition of a given product category. Marston (1990) shows that using high frequency data makes estimates of pass-through spuriously biased downward in cases when exporters invoice in the importer's currency and the contract is signed in advance; exchange rate changes may also not be passed through in the short-run if they are thought to be temporary because of adjustment cost. Annual data allows estimating pass-through coefficients not biased by short-run price rigidity. In this study I use data on exports at the highest possible disaggregation level. This not only makes measurement error less severe, but also helps to cope with endogeneity problems. Although the exchange rate depends on price levels, at a disaggregated level, the exchange rate can arguably be treated as exogenous.

3.4. Discussion of results.

The results for 18 Ukrainian products are reported in Table 5. Since each product is exported to 7-12 different countries, 150 destination-product pairs are included in the sample and β coefficients are reported for each of the pairs. Standard errors for each coefficient are reported in brackets. According to Table 5, the estimated values of β are generally insignificantly different from zero, meaning that pass-through is complete for most of Ukrainian exports sold in most of the markets in the sample. Namely, the null hypothesis of complete pass-through is rejected by the data at the 10% level

only in 29 of the 150 country-product pairs analyzed. Only 9 out of the 29 coefficients are positive, that is show the tendency of Ukrainian exporters to smooth prices in importers' currencies.

When analyzing the table by rows, it should be pointed out that the only evidence of PTM in the data is for *Pipes and hollow sections* (nomenclature code is 730439000), where we have statistically significant positive β coefficients for 4 out of 8 destination countries. The coefficient varies from 0.253 for USA to 0.711 for Italy (the other two countries with significant positive coefficients are Germany and Poland). This means that Ukrainian exporters of the product pass-through from 74.7% to 28.9% of exchange rate changes to importers' currencies. Taking into account the fact that Ukrainian currency was continuously depreciating in the period 1996-2000 against the currencies of Italy, Poland, Germany and USA, we conclude that this depreciation was followed by increase in markups for exporters of the product under consideration.

When analyzing Table 5 by columns, the only regularity worth mentioning is that six out of fifteen β coefficients are statistically significant and negative for Bulgaria. The data suggest that Ukrainian exporters adjust hryvnia prices in a manner that amplifies the effect of exchange rate fluctuations on Bulgarian prices. This is optimizing behavior if exporters perceive demand schedules to be more convex than a constant elasticity demand schedule, that is demand becomes less price elastic when price changes.

Besides the exceptions mentioned above, according to the data in the sample, I conclude that Ukrainian exporters fully pass through exchange rate changes to local currency import prices.

Table 6 reports the estimates of country effects for each product, denoted by λ. F-tests, although not reported here, are statistically significant for every

product and tell that country effects should be included in the model. This implies that price of a product differs across countries, that, in turn, supports the hypothesis of market segmentation and noncompetitive behavior of Ukrainian exporters. Table 6 shows that 83 out of 150 country effects are significantly different from zero. This means that more than in a half of cases Ukrainian exporters set prices different from marginal cost (positive estimates of λ's mean that exporters sell at a profit, while negative λ's mean that exporters sell at a damping price, which is lower than marginal cost).

Table 5. Estimates of PTM coefficients β for Ukrainian exports.

COUNTRY / PRODUCT	Belarus	Russia	Austria	Bulgaria	Greece	Spain	Italy	Netherlands	Germany	Poland	Turkey	USA
120600000	**-0,102***	0,048			0,168	0,204	0,283	0,293	0,118	0,211	-0,016	
120991000	0,180	0,789				-0,585	-0,651	-0,814	-0,433	-0,698		
151211910	-0,023	-0,086	0,360	-0,007				0,082	0,490	-0,272	-0,047	0,050
250830000	-0,004	-0,155		-0,039	-0,262	-0,052	-0,248			0,171	-0,010	
261400000	-0,048	**-0,315***		0,000				0,086		0,701	-0,014	**0,785***
291712100		-0,014	0,040			-0,032	0,020	0,042	0,021	0,044	0,010	
320610100	0,017	0,107	-0,165	**-0,070***		-0,155	-0,181	-0,273	-0,217	-0,651	0,023	0,039
440710910		**-0,546***	0,234	**-0,049***	0,798		0,124		-0,349	0,529		
440710930		0,164	-0,041	-0,060	0,368		**-1,336***	-0,381	-0,318	0,430	-0,005	-0,612
440710990		**0,729***	-0,395	**-0,129***	0,237	0,197	**-0,716***	-0,205	0,248	**-0,766***	0,040	
440791310		0,111	-0,536	-0,013	**-1,226***	-0,055	-0,592	0,594	-0,467	-0,689		
440791900		0,204	-0,030	**-0,065***	-0,244	-0,376	**-0,560***	**-0,530***	-0,090	-0,317	-0,125	
720841000	-0,001	**0,188***		**-0,023***					**-0,209***	**-0,700***	0,036	0,100
720843000	-0,017	-0,050		0,009			**0,177***		-0,008	-0,058	-0,021	
721711900	-0,019	0,014	0,535	0,000	0,236		0,067		0,247	-0,059	0,033	
721712900	-0,067	0,092		0,024	-0,775		-0,379		0,102	0,603		
730439000	**-0,030***	-0,055		0,011			**0,711***		**0,312***	**0,541***	**-0,149***	**0,253***
848210000	**0,049***	0,081		**-0,037***		**-0,241***	-0,242			0,148	**-0,086***	

The * denotes that the coefficient is significant at 10% level.

Table 6. Estimates of λ coefficients for Ukrainian exports.

COUNTRY / PRODUCT	Belarus	Russia	Austria	Bulgaria	Greece	Spain	Italy	Netherlands	Germany	Poland	Turkey	USA
120600000	**-2.060***	-0.335			-0.102	-0.110	0.908	**-1.027***	**-0.986***	**-0.654***	-1.116	
120991000	**3.882***	3.331				-1.944	-3.867	**0.896***	0.513	0.476		
151211910	-0.075	0.087	**0.695***	**0.177***				0.033	0.136	-0.063	-0.477	0.106
250830000	**-3.366***	**-3.580***		**-2.485***	-4.596	-3.514	-4.858			**-2.900***	**-3.439***	
261400000	-1.016	**-1.643***		**0.245***				0.031		0.303	-0.223	**-2.307***
291712100		**0.628***	**0.668***			0.479	0.759	**0.562***	**0.580***	**0.605***	**0.720***	
320610100	**1.098***	**1.071***	0.584	**0.589***		0.250	-0.306	**0.982***	**0.969***	0.550	**1.173***	**0.716***
440710910		**-1.375***	-0.387	**-0.843***	3.016		-0.083		-0.490	**-0.820***		
440710930		-0.105	**-1.457***	**-1.160***	0.658		**-9.233***	**-0.600***	**-0.899***	**-0.900***	-1.284	0.515
440710990		**0.841***	**-1.515***	**-1.099***	0.250	-0.251	**-5.820***	**-1.143***	**-1.256***	**-1.671***	-0.570	
440791310		**0.713***	**-1.582***	**-0.664***	**-6.463***	-0.783	-4.360	**-0.387***	**-0.543***	**-1.149***		
440791900		-0.207	**-0.805***	**-1.295***	-1.752	**-2.375***	**-4.061***	**-0.442***	**-0.651***	**-1.119***	**-2.829***	
720841000	-0.352	0.004		**-0.603***					**-0.405***	**-0.916***	-0.217	**-0.400***
720843000	**-0.820***	**-0.627***		**-0.640***			0.608		**-0.491***	**-0.705***	**-1.091***	
721711900	**-0.593***	**-0.379***	0.339	**-0.466***	0.566		-0.107		**-0.425***	-0.379	-0.070	
721712900	-0.763	0.032		**-0.202***	-3.787		-2.577		-0.184	0.186		
730439000	-0.313	-0.074		**-0.161***			**4.358***		**-0.257***	0.213	**-2.252***	**-0.371***
848210000	**2.861***	**2.379***		**1.844***		0.834	0.466			**1.952***	0.713	

The * denotes that the coefficient is significant at 10% level.

Chapter 4

CONCLUSIONS.

In this thesis I used a fixed effect panel data model to estimate pass-through coefficients of 18 eight-digit export products that are exported to twelve countries. Using annual data for the period 1996-2000, I obtained the result, which shows that Ukrainian export prices are rather insensitive to exchange rate fluctuations. There are several explanations to this result. First, if there were no segmentation in export markets, Ukrainian exporters would be unable to vary markups among destination countries, so that if there were changes in markups, associated with exchange rate fluctuations, the effect would be the same for each country for any chosen product. This also suggests that the law of one price holds for exported products. Ukrainian exporters would also be unable to vary markups in the case of perfectly competitive markets, that is in the case where markups equal to zero. But empirical results show that country effects in most cases are statistically significant, which means that markups are different from zero and export markets are segmented. Another case when pass-through is complete is when a large exporting country may exert market power and refuse to absorb any of the impact of exchange rate changes. Very likely, it is not the case for Ukraine, since with its relatively low GDP level it can only be treated as a small country. In the case of Ukraine, the absence of PTM behavior of exporters can be explained by the perception that Ukrainian exporters have about the elasticity of demand schedules in export markets. Complete exchange rate pass-through to local import prices is consistent with optimizing behavior of Ukrainian exporters only if demand in export markets is of constant elasticity.

The fact that Ukrainian exporters completely pass through exchange rate changes to foreign prices has the following policy implications. First of all, absence of pricing to market means that foreign currency prices fluctuate

proportionally with exchange rate fluctuations, which causes quantities demanded to fluctuate, leading to more volatile production. So, exchange rate may be used for stimulating export demand and export-oriented industries; besides, with the help of exchange rate the government can influence current account. Also, on the basis of this thesis new firms, which are planning to enter the industries in the sample, may infer about the elasticity of demand in international markets and environment in which they are supposed to operate.

In a small open economy, the flexible exchange rate implies the existence of an additional transmission channel for monetary policy apart from the standard aggregate demand channel. When exchange rate changes in response to monetary shocks, import prices are affected too. Exchange rate changes typically affect the relative price between domestic and foreign goods, thereby influencing aggregate demand. Aggregate demand, in turn, affects inflation through the aggregate supply (or Phillips curve) relation (Adolfson, 2001). This relationship is present, however, only under complete exchange rate pass-through or no pricing to market. When exchange rate pass-through is incomplete, movements in exchange rates do not affect prices faced by consumers and exchange rate adjustment cannot be used as a transmission channel for monetary policy. Devereux and Engel (2001) argue that flexible exchange rate regime is optimal for the economy with complete exchange rate pass-through. The same conclusion is made by Friedman (1953) and Feldstein (1992).

This thesis, however, does not allow giving recommendations to NBU on the issue of exchange rate regime. To make it possible the research on exchange rate pass-through to Ukrainian import prices is needed. The analysis of exchange rate induced export and import price adjustment in complex has to be done to advice on the optimal exchange rate regime.

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APPENDIX. ECONOMETRIC OUTPUT.

Product Code 120600000 - Sunflower seeds

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:41
Sample: 1996 2000
Included observations: 5
Total panel observations 45
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	0.146648	0.143598	1.021241	0.3131
Y98?	0.365015	0.065505	5.572357	0.0000
Y99?	0.767711	0.106642	7.198976	0.0000
Y00?	0.731230	0.127113	5.752609	0.0000
EBEL?	-0.102342	0.049489	-2.067966	0.0450
ERUS?	0.048068	0.325689	0.147588	0.8834
EGRE?	0.168343	0.351066	0.479520	0.6341
ESPA?	0.203826	0.273227	0.745997	0.4599
EITA?	0.283144	0.256235	1.105016	0.2756
ENIT?	0.292579	0.256578	1.140310	0.2608
EGER?	0.118385	0.263946	0.448518	0.6561
EPOL?	0.210900	0.483731	0.435987	0.6651
ETUR?	-0.015872	0.048464	-0.327489	0.7450
Fixed Effects				
_BEL--C	-0.402121			
_RUS--C	-0.402121			
_GRE--C	-0.402121			
_SPA--C	-0.402121			
_ITA--C	-0.402121			
_NIT--C	-0.402121			
_GER--C	-0.402121			
_POL--C	-0.402121			
_TUR--C	-0.402121			

R-squared	0.855463	Mean dependent var	3.70E-18
Adjusted R-squared	0.723495	S.D. dependent var	0.412391
S.E. of regression	0.216851	Sum squared resid	1.081557
F-statistic	11.34409	Durbin-Watson stat	2.716739
Prob(F-statistic)	0.000001		

Product Code 120991000 - Vegetable seeds

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:45
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	0.098951	0.424369	0.233172	0.8172
Y98?	1.017095	0.308594	3.295896	0.0025
Y99?	1.204738	0.543817	2.215335	0.0342
Y00?	1.713487	0.715519	2.394747	0.0229
EBEL?	0.180451	0.153054	1.179000	0.2474
ERUS?	0.789307	1.005336	0.785117	0.4383
ESPA?	-0.584934	1.213679	-0.481951	0.6332
EITA?	-0.650716	1.157534	-0.562157	0.5781
ENIT?	-0.813962	1.237829	-0.657573	0.5157
EGER?	-0.433039	1.134992	-0.381535	0.7054
EPOL?	-0.697592	1.957078	-0.356446	0.7239
Fixed Effects				
_BEL--C	-0.806854			
_RUS--C	-0.806854			
_SPA--C	-0.806854			
_ITA--C	-0.806854			
_NIT--C	-0.806854			
_GER--C	-0.806854			
_POL--C	-0.806854			

R-squared	0.408864	Mean dependent var	8.57E-11
Adjusted R-squared	-0.182272	S.D. dependent var	0.716417
S.E. of regression	0.778977	Sum squared resid	10.31569
F-statistic	1.175820	Durbin-Watson stat	3.096177
Prob(F-statistic)	0.369571		

Product Code 151211910 - sunflowerseed oil

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:47
Sample: 1996 2000
Included observations: 5
Total panel observations 45
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.104493	0.063385	-1.648539	0.1069
Y98?	0.214193	0.085925	2.492779	0.0168
Y99?	0.550702	0.084341	6.529473	0.0000
Y00?	0.421811	0.085571	4.929384	0.0000
EBEL?	-0.022544	0.011376	-1.981691	0.0542
ERUS?	-0.085876	0.051729	-1.660116	0.1045
EAUS?	0.360159	0.200242	1.798621	0.0794
EBUL?	-0.007328	0.013319	-0.550206	0.5852
ENIT?	0.082316	0.132283	0.622269	0.5372
EGER?	0.489733	0.375941	1.302685	0.2000
EPOL?	-0.272095	0.174082	-1.563030	0.1257
ETUR?	-0.047091	0.025147	-1.872623	0.0683
EUSA?	0.050429	0.096436	0.522924	0.6038
Fixed Effects				
_BEL--C	-0.216443			
_RUS--C	-0.216443			
_AUS--C	-0.216443			
_BUL--C	-0.216443			
_NIT--C	-0.216443			
_GER--C	-0.216443			
_POL--C	-0.216443			
_TUR--C	-0.216443			
_USA--C	-0.216443			

R-squared	0.887024	Mean dependent var	-2.22E-11
Adjusted R-squared	0.783873	S.D. dependent var	0.323795
S.E. of regression	0.150531	Sum squared resid	0.521168
F-statistic	15.04866	Durbin-Watson stat	3.179886
Prob(F-statistic)	0.000000		

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:48
Sample: 1996 2000
Included observations: 5
Total panel observations 40
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.051991	0.102256	-0.508439	0.6142
Y98?	0.225635	0.144214	1.564589	0.1264
Y99?	1.021708	0.485466	2.104591	0.0424
Y00?	0.967535	0.439543	2.201227	0.0342
EBEL?	-0.003829	0.080678	-0.047461	0.9624
ERUS?	-0.155146	0.283889	-0.546503	0.5881
EBUL?	-0.039260	0.059539	-0.659404	0.5138
EGRE?	-0.261568	0.782649	-0.334209	0.7402
ESPA?	-0.052341	0.707688	-0.073961	0.9415
EITA?	-0.247666	0.682457	-0.362903	0.7188
EPOL?	0.170597	0.992188	0.171940	0.8644
ETUR?	-0.009770	0.139110	-0.070233	0.9444
Fixed Effects				
_BEL--C	-0.432577			
_RUS--C	-0.432577			
_BUL--C	-0.432577			
_GRE--C	-0.432577			
_SPA--C	-0.432577			
_ITA--C	-0.432577			
_POL--C	-0.432577			
_TUR--C	-0.432577			

R-squared	0.754612	Mean dependent var	-2.50E-11
Adjusted R-squared	0.521492	S.D. dependent var	0.555660
S.E. of regression	0.384374	Sum squared resid	2.954864
F-statistic	5.591220	Durbin-Watson stat	3.287500
Prob(F-statistic)	0.000451		

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:49
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	0.062747	0.150708	0.416348	0.6800
Y98?	-0.061407	0.146248	-0.419885	0.6775
Y99?	0.288670	0.167244	1.726041	0.0943
Y00?	0.367773	0.194986	1.886149	0.0687
EBEL?	-0.047851	0.092792	-0.515677	0.6097
ERUS?	-0.314765	0.104451	-3.013512	0.0051
EBUL?	0.000455	0.026762	0.017001	0.9865
ENIT?	0.085848	0.306146	0.280415	0.7810
EPOL?	0.700591	0.735216	0.952905	0.3480
ETUR?	-0.013892	0.095282	-0.145795	0.8850
EUSA?	0.784618	0.231624	3.387470	0.0019
Fixed Effects				
_BEL--C	-0.131557			
_RUS--C	-0.131557			
_BUL--C	-0.131557			
_NIT--C	-0.131557			
_POL--C	-0.131557			
_TUR--C	-0.131557			
_USA--C	-0.131557			

R-squared	0.711707	Mean dependent var	-2.86E-11
Adjusted R-squared	0.423415	S.D. dependent var	0.359266
S.E. of regression	0.272802	Sum squared resid	1.265155
F-statistic	4.196788	Durbin-Watson stat	2.436447
Prob(F-statistic)	0.004680		

Product Code 291712100 - Adipinic acid and salts

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:50
Sample: 1996 2000
Included observations: 5
Total panel observations 40
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	0.009332	0.020760	0.449520	0.6558
Y98?	0.280733	0.019695	14.25429	0.0000
Y99?	0.691078	0.042943	16.09281	0.0000
Y00?	1.015635	0.049346	20.58207	0.0000
ERUS?	-0.014368	0.031474	-0.456500	0.6508
EAUS?	0.040241	0.086019	0.467813	0.6427
ESPA?	-0.031735	0.082733	-0.383582	0.7035
EITA?	0.020001	0.075294	0.265638	0.7920
ENIT?	0.041643	0.075333	0.552780	0.5838
EGER?	0.021218	0.072190	0.293912	0.7705
EPOL?	0.043615	0.120086	0.363200	0.7186
ETUR?	0.009634	0.015567	0.618881	0.5399
Fixed Effects				
_RUS--C	-0.399356			
_AUS--C	-0.399356			
_SPA--C	-0.399356			
_ITA--C	-0.399356			
_NIT--C	-0.399356			
_GER--C	-0.399356			
_POL--C	-0.399356			
_TUR--C	-0.399356			

R-squared	0.996058	Mean dependent var	5.00E-11
Adjusted R-squared	0.992314	S.D. dependent var	0.408016
S.E. of regression	0.035771	Sum squared resid	0.025591
F-statistic	459.4703	Durbin-Watson stat	3.133859
Prob(F-statistic)	0.000000		

Product Code 320610100 - Pigments and preparations made on the base of titanium dioxide containing not less than 80% of titanium-dioxide

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:51
Sample: 1996 2000
Included observations: 5
Total panel observations 55
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.059287	0.041246	-1.437414	0.1567
Y98?	0.197198	0.068157	2.893284	0.0056
Y99?	0.787716	0.127193	6.193056	0.0000
Y00?	1.102934	0.140198	7.866989	0.0000
EBEL?	0.016709	0.022934	0.728534	0.4696
ERUS?	0.106831	0.074644	1.431202	0.1585
EAUS?	-0.165267	0.192903	-0.856738	0.3956
EBUL?	-0.070480	0.016791	-4.197487	0.0001
ESPA?	-0.155068	0.178245	-0.869972	0.3884
EITA?	-0.181115	0.173578	-1.043421	0.3017
ENIT?	-0.273155	0.191819	-1.424023	0.1605
EGER?	-0.216666	0.165382	-1.310088	0.1960
EPOL?	-0.651462	0.398730	-1.633842	0.1085
ETUR?	0.022507	0.043434	0.518184	0.6066
EUSA?	0.038886	0.157241	0.247300	0.8057
Fixed Effects				
_BEL--C	-0.405712			
_RUS--C	-0.405712			
_AUS--C	-0.405712			
_BUL--C	-0.405712			
_SPA--C	-0.405712			
_ITA--C	-0.405712			
_NIT--C	-0.405712			
_GER--C	-0.405712			
_POL--C	-0.405712			
_TUR--C	-0.405712			
_USA--C	-0.405712			

R-squared	0.973544	Mean dependent var	3.64E-11
Adjusted R-squared	0.950737	S.D. dependent var	0.431270
S.E. of regression	0.095722	Sum squared resid	0.265719
F-statistic	76.22477	Durbin-Watson stat	2.562399
Prob(F-statistic)	0.000000		

Product Code 440710910 - Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of crow

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:51
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.130496	0.134318	-0.971545	0.3388
Y98?	0.198306	0.172406	1.150224	0.2588
Y99?	0.751709	0.120713	6.227253	0.0000
Y00?	0.935143	0.121528	7.694876	0.0000
ERUS?	-0.546368	0.104756	-5.215631	0.0000
EAUS?	0.234218	0.150496	1.556309	0.1298
EBUL?	-0.049055	0.022688	-2.162161	0.0384
EGRE?	0.797515	0.658558	1.211002	0.2350
EITA?	0.123506	0.265810	0.464641	0.6454
EGER?	-0.349423	0.317862	-1.099289	0.2801
EPOL?	0.529079	0.574381	0.921128	0.3641
Fixed Effects				
_RUS--C	-0.350932			
_AUS--C	-0.350932			
_BUL--C	-0.350932			
_GRE--C	-0.350932			
_ITA--C	-0.350932			
_GER--C	-0.350932			
_POL--C	-0.350932			

R-squared	0.889603	Mean dependent var	2.86E-11
Adjusted R-squared	0.779206	S.D. dependent var	0.589845
S.E. of regression	0.277161	Sum squared resid	1.305907
F-statistic	13.69896	Durbin-Watson stat	2.957760
Prob(F-statistic)	0.000003		

Product Code 440710930 - Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of pine

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:52
Sample: 1996 2000
Included observations: 5
Total panel observations 50
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.002176	0.210907	-0.010317	0.9918
Y98?	0.116749	0.154165	0.757295	0.4527
Y99?	0.409769	0.177410	2.309724	0.0254
Y00?	0.619272	0.182258	3.397773	0.0014
ERUS?	0.163708	0.507236	0.322744	0.7484
EAUS?	-0.040967	0.398474	-0.102811	0.9186
EBUL?	-0.059518	0.042742	-1.392515	0.1705
EGRE?	0.367995	0.533731	0.689477	0.4940
EITA?	-1.335895	0.293563	-4.550616	0.0000
ENIT?	-0.380994	0.347022	-1.097896	0.2780
EGER?	-0.318182	0.326753	-0.973769	0.3353
EPOL?	0.430267	0.497162	0.865446	0.3913
ETUR?	-0.005347	0.066519	-0.080390	0.9363
EUSA?	-0.612194	0.603187	-1.014933	0.3154
Fixed Effects				
_RUS--C	-0.228723			
_AUS--C	-0.228723			
_BUL--C	-0.228723			
_GRE--C	-0.228723			
_ITA--C	-0.002141			
_NIT--C	-0.228723			
_GER--C	-0.228723			
_POL--C	-0.228723			
_TUR--C	-0.228723			
_USA--C	-0.228723			

R-squared	0.422054	Mean dependent var	0.022658
Adjusted R-squared	-0.089206	S.D. dependent var	0.372524
S.E. of regression	0.388785	Sum squared resid	3.929993
F-statistic	1.460532	Durbin-Watson stat	2.740722
Prob(F-statistic)	0.198726		

Product Code 440710990 - Lumber sawed and split, dressed, polished and nonpolished of softwood, other, made of other lumber

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:53
Sample: 1996 2000
Included observations: 5
Total panel observations 50
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.028699	0.097034	-0.295764	0.7687
Y98?	0.189537	0.075889	2.497549	0.0161
Y99?	0.843749	0.074486	11.32760	0.0000
Y00?	1.161370	0.071966	16.13778	0.0000
ERUS?	0.729217	0.159332	4.576698	0.0000
EAUS?	-0.394810	0.341243	-1.156977	0.2533
EBUL?	-0.128825	0.014385	-8.955324	0.0000
EGRE?	0.237330	0.139528	1.700949	0.0957
SPA?	0.197484	0.168197	1.174118	0.2464
EITA?	-0.715661	0.187550	-3.815842	0.0004
ENIT?	-0.204525	0.115611	-1.769082	0.0835
EGER?	0.247715	0.198721	1.246547	0.2189
EPOL?	-0.765781	0.219727	-3.485148	0.0011
ETUR?	0.039636	0.030802	1.286819	0.2046
Fixed Effects				
_RUS--C	-0.433191			
_AUS--C	-0.433191			
_BUL--C	-0.433191			
_GRE--C	-0.433191			
_SPA--C	-0.433191			
_ITA--C	-0.433191			
_NIT--C	-0.433191			
_GER--C	-0.433191			
_POL--C	-0.433191			
_TUR--C	-0.433191			

R-squared	0.924898	Mean dependent var	-4.00E-11
Adjusted R-squared	0.858462	S.D. dependent var	0.476086
S.E. of regression	0.179111	Sum squared resid	0.834098
F-statistic	24.63046	Durbin-Watson stat	3.598415
Prob(F-statistic)	0.000000		

Product Code 440791310 - Dressed stacks, bars and friezes for covering made of oak

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:54
Sample: 1996 2000
Included observations: 5
Total panel observations 45
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.200428	0.075612	-2.650738	0.0114
Y98?	0.264508	0.079111	3.343517	0.0018
Y99?	1.395494	0.159238	8.763558	0.0000
Y00?	1.398061	0.158100	8.842868	0.0000
ERUS?	0.111066	0.141300	0.786034	0.4364
EAUS?	-0.536433	0.280936	-1.909451	0.0632
EBUL?	-0.013025	0.023790	-0.547502	0.5870
EGRE?	-1.226360	0.460278	-2.664392	0.0110
ESPA?	-0.054970	0.229527	-0.239494	0.8119
EITA?	-0.591747	0.351219	-1.684837	0.0996
ENIT?	0.594192	0.531725	1.117481	0.2703
EGER?	-0.466971	0.258387	-1.807251	0.0781
EPOL?	-0.689006	0.505278	-1.363617	0.1801
Fixed Effects				
_RUS--C	-0.571527			
_AUS--C	-0.571527			
_BUL--C	-0.571527			
_GRE--C	-0.571527			
_SPA--C	-0.571527			
_ITA--C	-0.571527			
_NIT--C	-0.571527			
_GER--C	-0.571527			
_POL--C	-0.571527			

R-squared	0.939613	Mean dependent var	8.89E-11
Adjusted R-squared	0.884477	S.D. dependent var	0.638922
S.E. of regression	0.217161	Sum squared resid	1.084654
F-statistic	29.82312	Durbin-Watson stat	2.733858
Prob(F-statistic)	0.000000		

Product Code 440791900 - Oak lumber, other, not mentioned earlier

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:55
Sample: 1996 2000
Included observations: 5
Total panel observations 50
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.053668	0.118616	-0.452455	0.6531
Y98?	0.195628	0.073839	2.649375	0.0110
Y99?	0.847982	0.088259	9.607890	0.0000
Y00?	1.201281	0.115415	10.40834	0.0000
ERUS?	0.204489	0.282191	0.724649	0.4723
EAUS?	-0.030300	0.183058	-0.165523	0.8693
EBUL?	-0.065185	0.017815	-3.658897	0.0007
EGRE?	-0.243782	0.283888	-0.858725	0.3949
ESPA?	-0.375807	0.197519	-1.902633	0.0634
EITA?	-0.560377	0.173906	-3.222295	0.0023
ENIT?	-0.530202	0.232664	-2.278831	0.0274
EGER?	-0.090463	0.202869	-0.445919	0.6577
EPOL?	-0.316688	0.400332	-0.791064	0.4330
ETUR?	-0.124888	0.080525	-1.550914	0.1278
Fixed Effects				
_RUS--C	-0.438244			
_AUS--C	-0.438244			
_BUL--C	-0.438244			
_GRE--C	-0.438244			
_SPA--C	-0.438244			
_ITA--C	-0.438244			
_NIT--C	-0.438244			
_GER--C	-0.438244			
_POL--C	-0.438244			
_TUR--C	-0.438244			

R-squared	0.902398	Mean dependent var	-6.00E-11
Adjusted R-squared	0.816057	S.D. dependent var	0.483872
S.E. of regression	0.207526	Sum squared resid	1.119742
F-statistic	18.49131	Durbin-Watson stat	2.815067
Prob(F-statistic)	0.000000		

Product Code 720841000 - Iron and plain steel metal-roll not in rolls of the width more than 1250 mm and thickness not less than 4 mm

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:55
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.152279	0.062844	-2.423131	0.0214
Y98?	0.217938	0.052133	4.180431	0.0002
Y99?	0.535471	0.053921	9.930648	0.0000
Y00?	0.770817	0.046791	16.47364	0.0000
EBEL?	-0.000520	0.021242	-0.024501	0.9806
ERUS?	0.187762	0.059588	3.151030	0.0036
EBUL?	-0.022920	0.010250	-2.236107	0.0327
EGER?	-0.208859	0.087540	-2.385852	0.0233
EPOL?	-0.699939	0.141364	-4.951330	0.0000
ETUR?	0.035624	0.032870	1.083772	0.2868
EUSA?	0.100479	0.111874	0.898136	0.3760
Fixed Effects				
_BEL--C	-0.274389			
_RUS--C	-0.274389			
_BUL--C	-0.274389			
_GER--C	-0.274389			
_POL--C	-0.274389			
_TUR--C	-0.274389			
_USA--C	-0.274389			

R-squared	0.950187	Mean dependent var	3.17E-18
Adjusted R-squared	0.900374	S.D. dependent var	0.319963
S.E. of regression	0.100992	Sum squared resid	0.173389
F-statistic	32.42757	Durbin-Watson stat	2.794467
Prob(F-statistic)	0.000000		

Product Code 720843000 - Iron and plain steel metal-roll not in rolls, other of the thickness not less than 4 mm and not more than 10 mm

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:56
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.002787	0.039252	-0.071015	0.9438
Y98?	0.226585	0.056042	4.043123	0.0003
Y99?	0.345164	0.040188	8.588830	0.0000
Y00?	0.713715	0.046957	15.19942	0.0000
EBEL?	-0.016586	0.016467	-1.007202	0.3216
ERUS?	-0.050051	0.029713	-1.684456	0.1021
EBUL?	0.008806	0.006881	1.279707	0.2101
EITA?	0.177447	0.068774	2.580148	0.0148
EGER?	-0.007777	0.067073	-0.115942	0.9084
EPOL?	-0.058371	0.449308	-0.129912	0.8975
ETUR?	-0.020778	0.015977	-1.300449	0.2030
Fixed Effects				
_BEL--C	-0.256535			
_RUS--C	-0.256535			
_BUL--C	-0.256535			
_ITA--C	-0.256535			
_GER--C	-0.256535			
_POL--C	-0.256535			
_TUR--C	-0.256535			

R-squared	0.956996	Mean dependent var	-2.86E-11
Adjusted R-squared	0.913992	S.D. dependent var	0.295484
S.E. of regression	0.086657	Sum squared resid	0.127661
F-statistic	37.83113	Durbin-Watson stat	3.282082
Prob(F-statistic)	0.000000		

Product Code 721711900 - Wire made of iron and plain steel, containing not less that 0.25 % of carbon without any covering with the maximum size of cross-section 0.8 mm and more

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:57
Sample: 1996 2000
Included observations: 5
Total panel observations 45
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.001279	0.079145	-0.016163	0.9872
Y98?	0.102880	0.088310	1.164988	0.2508
Y99?	0.357689	0.112427	3.181523	0.0028
Y00?	0.683383	0.127912	5.342608	0.0000
EBEL?	-0.018926	0.020392	-0.928115	0.3588
ERUS?	0.013919	0.068400	0.203490	0.8398
EAUS?	0.535331	0.357315	1.498204	0.1417
EBUL?	-0.000450	0.024588	-0.018284	0.9855
EGRE?	0.235535	0.190474	1.236578	0.2233
EITA?	0.066553	0.201087	0.330968	0.7424
EGER?	0.246779	0.167594	1.472478	0.1485
EPOL?	-0.059098	0.395918	-0.149269	0.8821
ETUR?	0.032631	0.043133	0.756504	0.4537
Fixed Effects				
_BEL--C	-0.228534			
_RUS--C	-0.228534			
_AUS--C	-0.228534			
_BUL--C	-0.228534			
_GRE--C	-0.228534			
_ITA--C	-0.228534			
_GER--C	-0.228534			
_POL--C	-0.228534			
_TUR--C	-0.228534			

R-squared	0.892486	Mean dependent var	2.22E-11
Adjusted R-squared	0.794321	S.D. dependent var	0.325312
S.E. of regression	0.147535	Sum squared resid	0.500631
F-statistic	15.91049	Durbin-Watson stat	3.359265
Prob(F-statistic)	0.000000		

Product Code 721712900 - Wire made of iron and plain steel, containing not less that 0.25 % of carbon, galvanized, with the maximum size of cross-section 0.8 mm and more

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:57
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	0.026947	0.163799	0.164512	0.8704
Y98?	0.044118	0.157464	0.280181	0.7812
Y99?	0.552838	0.184861	2.990552	0.0054
Y00?	0.850765	0.191526	4.442032	0.0001
EBEL?	-0.066959	0.039716	-1.685960	0.1018
ERUS?	0.092118	0.106916	0.861593	0.3955
EBUL?	0.024285	0.035448	0.685093	0.4984
EGRE?	-0.774976	0.439816	-1.762049	0.0879
EITA?	-0.378909	0.416910	-0.908849	0.3704
EGER?	0.101594	0.231307	0.439215	0.6636
EPOL?	0.602978	0.347116	1.737107	0.0923
Fixed Effects				
_BEL--C	-0.294934			
_RUS--C	-0.294934			
_BUL--C	-0.294934			
_GRE--C	-0.294934			
_ITA--C	-0.294934			
_GER--C	-0.294934			
_POL--C	-0.294934			

R-squared	0.833649	Mean dependent var	-5.71E-11
Adjusted R-squared	0.667298	S.D. dependent var	0.387702
S.E. of regression	0.223627	Sum squared resid	0.850157
F-statistic	8.519369	Durbin-Watson stat	2.615432
Prob(F-statistic)	0.000075		

Product Code 730439000 - Pipes, hollow sections, seamless, made of ferrous metals, other

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:58
Sample: 1996 2000
Included observations: 5
Total panel observations 40
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.040821	0.035449	-1.151570	0.2571
Y98?	0.126746	0.052961	2.393180	0.0220
Y99?	0.325013	0.066450	4.891101	0.0000
Y00?	0.498632	0.079070	6.306239	0.0000
EBEL?	-0.030400	0.015359	-1.979330	0.0555
ERUS?	-0.055052	0.056888	-0.967719	0.3396
EBUL?	0.010936	0.008940	1.223169	0.2292
EITA?	0.710890	0.170309	4.174117	0.0002
EGER?	0.312374	0.102855	3.037026	0.0044
EPOL?	0.540748	0.180523	2.995454	0.0049
ETUR?	-0.148701	0.021181	-7.020475	0.0000
EUSA?	0.252973	0.078835	3.208877	0.0028
Fixed Effects				
_BEL--C	-0.181914			
_RUS--C	-0.181914			
_BUL--C	-0.181914			
_ITA--C	-0.181914			
_GER--C	-0.181914			
_POL--C	-0.181914			
_TUR--C	-0.181914			
_USA--C	-0.181914			

R-squared	0.964325	Mean dependent var	-7.50E-11
Adjusted R-squared	0.930433	S.D. dependent var	0.319653
S.E. of regression	0.084310	Sum squared resid	0.142163
F-statistic	49.14677	Durbin-Watson stat	2.683739
Prob(F-statistic)	0.000000		

Product Code 84821000 - Ball-bearing

Dependent Variable: P?
Method: Pooled Least Squares
Date: 05/27/02 Time: 15:59
Sample: 1996 2000
Included observations: 5
Total panel observations 35
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y97?	-0.049534	0.038351	-1.291616	0.2060
Y98?	0.211726	0.066168	3.199823	0.0032
Y99?	0.365087	0.066368	5.500980	0.0000
Y00?	0.577364	0.067177	8.594654	0.0000
EBEL?	0.049463	0.014092	3.509999	0.0014
ERUS?	0.081484	0.049234	1.655030	0.1080
EBUL?	-0.037112	0.009671	-3.837459	0.0006
ESPA?	-0.241061	0.106996	-2.252983	0.0315
EITA?	-0.241996	0.153295	-1.578631	0.1246
EPOL?	0.147661	0.148764	0.992580	0.3286
ETUR?	-0.085833	0.025862	-3.318896	0.0023
Fixed Effects				
_BEL--C	-0.220929			
_RUS--C	-0.220929			
_BUL--C	-0.220929			
_SPA--C	-0.220929			
_ITA--C	-0.220929			
_POL--C	-0.220929			
_TUR--C	-0.220929			

R-squared	0.922786	Mean dependent var	-2.86E-11
Adjusted R-squared	0.845572	S.D. dependent var	0.234714
S.E. of regression	0.092236	Sum squared resid	0.144628
F-statistic	20.31676	Durbin-Watson stat	3.303298
Prob(F-statistic)	0.000000		