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## Exchange rates and transition economies' export prices: Is there evidence for pricing-to-market behavior?

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# WIRTSCHAFTSTHEORETISCHE DISKUSSIONSBEITRÄGE

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Emilia Penkova

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## **EXCHANGE RATES AND TRANSITION ECONOMIES' EXPORT PRICES: IS THERE EVIDENCE FOR PRICING-TO-MARKET BEHAVIOUR?<sup>1</sup>**

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### **Abstract**

The paper tests for potential pricing-to-market for a wide range of export industries in selected transition economies, namely Poland, Hungary and Bulgaria, at the four-digit level over the period 1990-1998. Panel estimation is undertaken and a fixed-effects linear model is estimated. The empirical evidence reported here offers new evidence for transition economies that have not been investigated before. Given the industries sampled, more price discrimination across destination is observed in Bulgaria than in Poland and Hungary. There is no evidence showing pricing-to-market in relation to common industries across source countries.

JEL classification: C23, F14, P20.

Keywords: pricing-to-market, transition economies, panel data.

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## 1. Introduction

The period of exchange rate volatility in the early and mid-1980s and the coincident incorporation of imperfect competition into trade theory has led to a growing body empirical research, which supports the existence of pricing-to-market (henceforth PTM) behaviour. A partial list of recent studies includes inter alia Krugman (1987), Froot and Klemperer (1989), Knetter (1989, 1993, 1994), Marston (1990), Kasa (1992), Gagnon and Knetter (1995) and Gil-Pareja (2000).

The studies of PTM reveal an important feature of the competitive process in the traded goods market, more particularly, how the failure of traded goods prices to respond to exchange rate changes affects the international competitiveness of exporting firms. The empirical evidence on PTM is, however, mainly limited to advanced economies such as United States, Japan and Germany, prompted by the large trade imbalances among the three countries during the 1980s. Knetter (1989) and Marston (1990) present substantial industry-level evidence that Japanese and German exporters use destination-specific mark-up adjustment to stabilise local-currency prices of exports, although for Japan most of the evidence is based on pricing to the US. Knetter (1993) finds strong evidence of differences in PTM behaviour across a number of export industries for US, UK, Germany and Japan. Gagnon and Knetter (1995) also examine mark-up adjustment by Japanese, German and US exporters using panel data on disaggregated automobile exports and find that Japanese exporters offset approximately 70 percent of the effect of exchange rate changes on buyers' prices through mark-up adjustment. Also, Gil-Pareja (2000) tests for asymmetries in PTM behaviour for selected export industries in several EU member states<sup>2</sup>.

The aim of the current paper is to test for potential PTM behaviour for a wide range of export industries in transition economies, namely Poland, Hungary and Bulgaria, at four-digit level for the period 1990-1998. The empirical evidence reported here offers new evidence for transition economies that have not been investigated before and it also reveals important features of the relationship between exchange rates and export goods prices at a disaggregated level in the context of the trade competitiveness of transition economies in the EU.

The optimal response of a firm's export price to changes in currency values depends on a variety of factors. These factors operate through two channels, through the impact the exchange rates have on marginal cost, and through the impact exchange rates have on mark-ups of price over marginal cost. Krugman (1987) labelled the destination-specific adjustment of mark-ups in response to exchange rate changes as "pricing-to-market" (PTM). In other words, PTM occurs when sellers reduce mark-ups to buyers whose currencies have depreciated against the seller, thereby stabilising prices in the buyer's currency<sup>3</sup>. The notion of "pricing strategies" is, however, sensible only if firms operate in an imperfectly competitive environment, or export market segmentation is a necessary condition for the existence of price discrimination in general and PTM in particular<sup>4</sup>. Possible reasons why prices are not equalized across buyers in different markets could be: geographic factors, product heterogeneity, incomplete information, transportation costs and trade barriers, or this is a form of third degree price discrimination.

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<sup>2</sup> Belgium, France, Germany, Italy, the Netherlands, Spain and the United Kingdom.

<sup>3</sup> Knetter (1993) refers to it as local currency price stability.

<sup>4</sup> The reasons for segmentation are, however, not addressed in the theoretical models.

Furthermore, Knetter (1993) shows that in many cases destination-specific mark-up adjustment is very similar across destination markets and differs across industries. The current paper will, therefore, consider PTM from two different aspects, destination markets as well as common industries across source countries.

The selected period of the analysis covers the transformation process from a command towards a free market economy. A characteristic feature of the sample period were the tremendous variations in exchange rates, which ought to enable us to identify the extent of PTM relatively precisely (Table 1). The three countries experienced a common trend of real appreciation of their domestic currency. This process was, however, more stable in Poland and Hungary than in Bulgaria, which experienced the most volatile exchange rate changes, especially during 1997, when the banking system collapsed and a Currency Board was introduced as a result.

**Table 1: Real Exchange Rates (CPI based, 1989=100): US Dollar per Domestic Currency (Annual Average)**

Year	Polish Zloty	Hungarian Forints	Bulgarian Leva
1990	0.95	63.20	0.004
1991	1.06	74.80	0.018
1992	1.36	79.00	0.023
1993	1.81	91.90	0.028
1994	2.27	105.20	0.054
1995	2.42	125.70	0.067
1996	2.70	152.60	0.178
1997	3.28	186.80	1.674
1998	3.49	214.50	1.760

*Source: EBRD Transition Reports (1997,1999)*

Furthermore, Poland and Hungary are at the forefront of the group of advanced countries in terms of liberalisation of markets and trade, privatisation and financial sector reform. On many aspects they have set standards of excellence for other countries in transition. On the other hand, Bulgaria's economy during the period under observation was marked by stop-go stabilisation policies, a large inherited debt burden and a slow pace of structural reforms. The ad hoc economic policies delayed the transition from a plan led economy to a market system by nearly a decade, leading to the collapse of the banking system in 1996-1997. The selection of the countries, therefore, will give us an opportunity not only to test for PTM behaviour in a process of transition but also to estimate its extent in more and less advanced transition economies.

Evidence of PTM in economies in transition may reveal some useful information on industry strategies. For example, what is the adjustment pattern in the different industries: do they adjust quantities and/or prices? It also allows us to estimate whether behaviour in a given industry is different not only across destinations but also across exporting countries. For example, is the response of mark-ups to exchange rate changes different for Bulgarian and Polish agricultural

exports? Evidence on this point might provide some information about the importance of differences in labour and capital market as well as the economic institutions and objectives in determining industry behaviour.

The structure of the rest of the paper is as follows. Section 2 provides some stylised facts about trade and transition in the three selected economies. Section 3 offers a brief discussion of why PTM can occur in transition economies. Section 4 presents the theoretical framework. Section 5 introduces the empirical model. Section 6 describes the variables and the sources of data. Section 7 shows the estimation results. Section 8 offers some concluding remarks, and finally the Nomenclature Codes for the selected products are presented in the Data Appendix.

## 2. Stylised facts about trade and transition in Poland, Hungary and Bulgaria

Before the beginning of transition, centrally planned economies formed a closed trading bloc and trade was conducted mainly within the so called Council for Mutual Economic Assistance (CMEA)<sup>5</sup>. This was highly distorted trade, with little regard to either comparative advantage or transport costs. The collapse of CMEA in 1991 was thus a major disruption to all transition economies. The liberalisation of external trade in the early 1990s led to fast and sizeable change in the geographic composition of trade. Most of this adjustment consisted of a reallocation of trade flows away from the CMEA towards the European Union (Table 2)<sup>6</sup>.

**Table 2: EU-Oriented Exports in Comparative Perspective, 1989-1999**

	Average growth rate 1990-1995	Average growth rate 1996-1999
Bulgaria	21.9	1.9
Czech Republic	25.0	11.9
Hungary	15.5	17.3
Poland	19.4	4.9
Slovenia	37.4	0.9

*Source: Eurostat Database*

Two phases are distinguished in the above table. The first one covering the 1990-1995 period and the second phase beginning in 1996. During the first phase Bulgaria experienced a faster growth rate than Poland and Hungary which was due to two main reasons. First, Bulgaria under-traded with the EU more than Poland and Hungary. Its potential for redirection, due to a previously very high level of dependence on CMEA markets was therefore more substantial. Second, subsidies and depressed prices of exports artificially maintained exports in the 1994-1996 period. With the tightening of macroeconomic discipline, this source of export growth was no longer available during the second phase when the average annual growth rate of Bulgarian EU-oriented exports of 1.9 per cent exceeded only that of Slovenia. Both external (Kosovo conflict) and internal (the legacy of stalled reforms) factors appear to account for poor export performance. Poland also experienced a significant drop in export growth rate during the second phase. The macroeconomic stabilisation occupied the central position in its transition

<sup>5</sup> Only a very small share of trade was conducted with the rest of the world.

<sup>6</sup> Trade with the rest of the world also increased, but by much less.

strategy, and the exchange rate was held high and used as an anchor to help stabilise the economy and fight inflation rather than allowed to depreciate to stimulate exports.

The change in Bulgaria's geographic trade patterns was also more dramatic than in Poland and Hungary over the period under observation (Table 3, p.12). The largest exporting partner for both Poland and Hungary was Germany in 1991 and there was on average a stable increase of exports to this destination till 1998. However, this was not the case for Bulgaria. Although the relative share of exports to Russia was decreasing, it continued to be the main Bulgarian exporting partner till 1996 when eventually Italy became the largest exporting destination. Not only did geographical trade patterns change, but also the composition of trade changed to reflect more closely the specific resources and comparative advantages of the transition countries (Table 4, p.14). The figures confirm expectations: the three countries tend to specialise in exports of manufactured goods albeit with large variations within manufacturing. During the selected years there was not any significant change in the shares of the main Polish exporting sectors: manufactures and machinery and transport equipment. There was however a marked decrease in the share of Hungarian exports of food which accounted for 22 per cent in 1992, compared with 10.5 per cent in 1998. This fall could be due to the significant increase in the share of transport equipment and manufactured goods. Although there was also a decrease in the share of exports of Bulgarian food it was not that significant and in 1998 the food sector still played a significant role in Bulgarian exports.

### 3. Pricing-to-market: why in transition economies?

In searching for reasons to justify potential PTM behaviour in transition economies we could outline the following possible scenarios. First, rather than passing on exchange rate changes into export prices firms try to hold onto their *market shares* by keeping prices stable in the importing country's currency. This is quite likely to occur as in the early years of transition, an appreciation of the real exchange rate was commonly observed and the Balassa-Samuelson (BS) effect is typically considered to provide an explanation for it<sup>7</sup>. Second, there are several arguments that may justify the preference for price stability, especially in the context of the ongoing reorientation of trade flows towards EU countries: the desire by an exporter to appear stable and respectable, the general uncertainty about competitors' reactions to price changes, and the direct cost of making frequent changes. Third, *capacity constraint* could also lead to PTM, for example, if sales are already constrained by marketing capacity, then exporters would pass-through a buyer's appreciation to the point where demand equals supply. Fourth, if exporters face *binding quantity* they would be expected to charge the market clearing price in the buyer's currency for the permitted quantity in each period. This implies that profit margins adjust fully to offset any depreciations of the exporter's currency.

### 4. Theoretical framework

The paper follows the model of price discrimination and the panel data empirical framework introduced by Knetter (1989). The use of disaggregated product categories allows us to assume that exchange rate changes are exogenous to the export industries and consequently the analysis

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<sup>7</sup>According to BS effect when productivity in the tradable sector relative to the non-tradable sector increases faster than abroad, the real exchange rate appreciates.

is partial equilibrium in nature. Consider a firm that produces goods for sale in  $n$  separate destination markets, indexed by  $i$ . The profits of the firm are given by:

$$\Pi(p_1, \dots, p_n) = \sum_{i=1}^n p_i q_i(e p_i) - C\left(\sum_{i=1}^n q_i(e p_i), w\right) \quad (1)$$

where  $p$  is the export price (i.e. price in the exporter's currency),  $e$  is the exchange rate per unit of exporter's currency deflated by the price level in the destination market,  $q$  is quantity demanded (a function of the export price relative to the price level in the destination market),  $w$  is an index of input prices in units of the exporter's currency, and  $C$  is the total cost function. The first order conditions for profit maximisation imply that the firm equates the marginal revenue from sales in each market to the common marginal cost. Alternatively, the export price to each destination is the product of the common marginal cost ( $c$ ) and a destination specific mark-up:

$$p_{it} = c_t \left( \frac{\varepsilon_{it}(e_{it} p_{it})}{\varepsilon_{it}(e_{it} p_{it}) - 1} \right) \quad i = 1, \dots, n \quad (2)$$

where  $\varepsilon_{it}$  is the absolute value of the elasticity of demand in the foreign market with respect to changes in price or this 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  $t$ . Equation (2) shows that the firm's optimal export price to each destination in period  $t$  depends on two factors: the common marginal cost and the mark-up of price over marginal cost, which may be common or destination-specific.

Although a theoretical model of monopolistic competition may not provide the best explanation of exports of transition economies at industry level, the theoretical framework here is based on it as it is the best way to reveal the main insights into PTM. More particularly, it illustrates very clearly how mark-up can vary with exchange rate changes. Furthermore, for given preferences, a variety of models of imperfect competition predict that more competitors will increase the tendency to observe stability in local currency prices. For example, Knetter (1992) shows that in the context of Dornbusch's (1987) model of exchange rate pass-through under Cournot oligopoly a great deal of PTM is observed when the exporting firms have a small share of the foreign market(s) and the market is not very competitive in the sense that mark-ups are large. In other words, PTM is greatest if the industry as a whole has a great deal of monopoly, but the exporting firms have a relatively small share of the foreign market and thus less influence over the equilibrium price. PTM is lowest when the industry as a whole is rather competitive, but exporting firms tend to dominate the industry, so that pass-through is nearly complete to all markets.



## 5. The Empirical model

The empirical framework adopted here follows the one introduced in greater detail in Knetter (1989,1993). The motivation comes from a simple model of price discrimination by a monopolist selling to several export destinations (equation 2). Price changes to any destination will consist of two components: (1) changes in marginal cost and (2) changes in the mark-up of price over marginal cost. As we assume that total costs of the firm are independent of the market of sale, therefore marginal cost is the same for all destination markets but can vary over time ( $c_t$ ) due to changes in quantity produced, technology, or input prices. Destination-specific adjustment of mark-ups occurs in response to changes in variables that are unique to each destination. Knetter (1993) argues that the most important destination-specific explanatory variable is the exchange rate between the exporter's currency and the currency of the destination market. He admits that other factors such as changes in income in the destination market may also play a role, however, he considers them of secondary importance. An interesting area for further research would be to investigate how the inclusion of demand and also quality factors could affect the estimated relationship. However, here we are concerned with exports of transition economies and the lack of disaggregated data on demand and quality factors lead us to follow Knetter (1993) and estimate the following equation<sup>8</sup>:

$$\Delta p_{it} = \theta + \alpha_i \Delta e_{it} + u_{it} \quad (3)$$

This is a fixed-effects linear model where  $\Delta$  is the first difference operator,  $p$  is the log of export price in units of the exporter's currency,  $e$  is the log of the bilateral exchange rate (expressed as units of the buyer's currency per unit of the exporter's currency adjusted by the Wholesale Price Index in the destination market),  $i$  and  $t$  index  $n$  destination markets and  $T$  time periods, respectively, and  $\theta_i$  and  $\alpha_i$  are parameters to be estimated. The intercept term is allowed to vary due to effects that are constant across industries but vary over time (the  $\theta$ 's). The primary underlying factor that accounts for such movements is marginal cost of the exporters. It is also possible that some common movement in prices is due to changes in the mark-up over marginal cost and is common to all destination markets. The time effects will be treated as fixed. The model allows for the slope coefficients to vary across destinations which is crucial for capturing PTM.

We cannot determine with confidence the time-series properties of the variables because of the short-time dimensions of the data. However, if they are non-stationary, level regressions will be spurious. As can be seen from equation (2), the economic insights and the unit root results about the properties of the variables reported in previous research<sup>9</sup>, therefore, lead us to perform estimations in first differences.

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<sup>8</sup> We could assume that the demand for exports from transition economies is the same across destinations as they are all EU economies.

<sup>9</sup> Knetter (1993), Gagnon and Knetter (1995) and Gil-Pareja (2000).

## 6. Data

The data used in this study are based on the annual value and quantity of exports (proxied by arrivals in the EU country) to selected destination countries depending on the availability of data for a number of four-digit industries in the three source countries: Poland, Hungary and Bulgaria. The destination markets are as follows: for Poland–France, Germany, Italy, UK and Netherlands; for Hungary– France, Germany, Italy, UK and Austria; for Bulgaria–France, Germany, Italy, UK and Greece. The sample period is 1990 to 1998 and the data are obtained from Eurostat Database COMEXT. The exchange-rate series, used as an independent variable, is expressed in units of the buyer’s currency per unit of the exporter’s currency and is based on the annual average nominal exchange rate collected from the OECD Database, Datastream. The nominal rates are adjusted by dividing by the Wholesale Price Index in the destination market. The reason for this adjustment is that the optimal export price should be neutral with respect to changes in the nominal rate that correspond to inflation in the destination market. The Wholesale Price Indices are annual averages collected from the OECD Database, Datastream. Marginal costs and mark-ups are not observed directly<sup>10</sup>, but common movements in prices due to changes in marginal cost or common mark-up changes are accounted for by including a full set of time dummies in the model. Following Gil-Pareja (2000) we obtain forward exchange rates from the covered interest rate parity condition by using annual average interest rates for EU and transition economies from International Financial Statistics<sup>11</sup>. We use Treasury Bill rates, except for Austria and the Netherlands for which, due to data limitations, deposit rates are employed. The forward rates are adjusted by employing the Consumer Price Index in the destination market taken from International Financial Statistics. The specific industries selected and the data sources for the unit-value data are listed in Description of the Codes at Two-Digit Level (p.18). It should be noted that the criterion for selection of the destination countries and industries was the availability of data. This suggests that sampling is not random and as a result, caution should be taken in drawing inferences about other trading relationships.

## 7. Estimation and empirical results

PTM is a phenomenon about *divergence* between prices of goods sold to one particular market and to other market. For this purpose, panel estimation is undertaken and a fixed-effects linear model is estimated. By employing SUR technique we conduct the estimation at 4-digit level and report the results at 2-digit level.

The inference about PTM evidence depends entirely on the interpretation of the estimated coefficient of  $\alpha$  which is as follows: a value of zero means that the mark-up to a particular destination is unresponsive to fluctuations in the value of the exporter’s currency against the buyer’s, therefore, changes in currency values would be fully passed through to the buyer; negative values of  $\alpha$  imply that mark-up adjustment is associated with local currency price stability; positive values of  $\alpha$  correspond to the case in which destination-specific changes in mark-ups amplify the effect of destination-specific exchange rate changes on the price in units of the buyer’s currency. A necessary condition for PTM to occur is, therefore, a negative and

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<sup>10</sup> Knetter (1989) discusses the disadvantages of using available data to proxy for marginal costs.

<sup>11</sup> The rationale for this adjustment is that while WPI is a better deflator for goods in trade, CPI is more relevant for the portfolio holder.

significant coefficient of  $\alpha$ . Furthermore, we also need to test if this coefficient can be constrained across destinations or industries.

The empirical estimation follows several stages. First, for each source-country-industry pair, the regression equations for the different destinations are estimated jointly, imposing the cross-equation restrictions. Tables 5-7 (p.15-17) present the estimated values of  $\alpha$  when it is constrained to be the same across destinations. The F statistics indicate that the null hypothesis of identical values of  $\alpha$  across destinations (negative and significant) is rejected by the data at the 5-percent level in twenty one of the sixty five source-industry pairs. PTM appears to be an important phenomenon for four industries for Poland, four for Hungary and thirteen for Bulgaria. These are clothing, glass, aluminium and electrical machinery for Poland; organic chemicals, leather, footwear and vehicles for Hungary; and finally for Bulgaria: plants, vegetables, fertilizers, oils, plastics, rubber, leather, clothing, footwear, iron and steel, aluminium, electrical machinery and furniture. The negative values of  $\alpha$  imply that mark-up adjustment is associated with stabilisation of local currency prices. For example, a value of  $-0.5$  (Polish exports of clothing) means that in response to a 10 percent depreciation (appreciation) of the buyer's currency, the Polish exporters would reduce (increase) their mark-up by 5 percent relative to the mark-up charged to other destination markets. We receive positive values of  $\alpha$  for four industries: these are inorganic chemicals and clothing (not knitted) for Poland; vegetables for Hungary, and clothing (knitted) for Bulgaria. Positive values of  $\alpha$  imply that destination-specific mark-up adjustment amplifies the effect of exchange rate changes on the local currency price. This finding of "perverse" PTM is not necessarily implausible. Measurement error might bias  $\alpha$  upward. If market share matters and much of the movement in exchange rates is temporary then in the context of Froot and Klemperer (1989) model interest rate effects dominate cost effects and we may observe positive  $\alpha$ 's. It may also be due to heterogeneity either within the sector or within the market of consumers. For example, when an exchange rate movement causes an exporter to raise prices, he may lose sales to his most price-elastic consumers first, or, he may lose sales of products that face the highest price elasticity of demand<sup>12</sup>.

Second, a pooled estimate for common industries has been estimated and tested to see if it is the same across source countries (the results are presented in Table 8, p.17). Although the F-tests reveal that the null hypothesis that export price adjustment behaviour is identical across source countries within a given industry can be rejected at 5 percent level for all of the industries considered, the value of  $\alpha$  is not significant for any of these industries. The table reports the estimated value of  $\alpha$  for each source country individually as well as the estimate obtained by pooling the data for all source countries and estimating a new common value of  $\alpha$ . They show that the point estimates of the response of price to exchange rate changes are different in most cases.

All these stages were repeated by using forward instead of spot exchange rates to test if the optimal pricing behaviour in transition economies is determined by the forward market<sup>13</sup>. The results were, however, quite disappointing. Hardly any of the estimated coefficients were significant if correctly signed at all. This may be due to the fact that during the period of early

<sup>12</sup> In the case of "normal" PTM the price elasticity of demand increases with the price charged.

<sup>13</sup> The forward exchange rates were obtained from the covered interest parity condition.

transition forward markets were either non existent or they were used solely for speculation and not for hedging trade flows.

In summary, the observed price discrimination across export destinations rather than common industries across source countries can be explained by the fact that the biggest change to the geographical composition of trade flows happened early in transition and has changed little since then. The stronger evidence of PTM for Bulgaria across destinations can be rationalised in the following ways: first, due to the perceived uncertainty of the national currencies, export prices were mainly preset in foreign currency which means that an unanticipated depreciation or appreciation will change price margins even in the absence of PTM, and second, due to unfavourable geographic and economic conditions, the exporting firms have a small share of the EU markets and they have little control over prices at which they sell and therefore exchange rate changes may not have significant impacts on export prices. In searching for reasons to justify the lack of empirical evidence for Polish and Hungarian exporters to price-to-market we should note that there was no change in their main exporting partner over the observed period, or they started the transition with well established positions in the German market and over time there was a stable increase of exports to this destination (Table 3, p.12). This may suggest that in contrast to the Bulgarian exporters, due to more favourable geographic and economic conditions, Polish and Hungarian exporters exhibit a different pattern of adjustment. Due to the lack of data on quality and product varieties, we could however only speculate about the different industry strategies. Turning to the industries for which PTM is observed we need to emphasise again that the specific industries are not randomly selected, or we estimate and report only these industries for which there is available data and in this context we could assume that these are the main exporting industries over the period of investigation<sup>14</sup>.

The different level of pass-through of exchange rate changes into profit margin exhibited by common industries across source countries could be explained by the fact that trade at industry level was at different stages for the observed transition economies from the beginning of the transition process, and moreover the sectoral composition of trade has been changing more gradually and this process is likely to continue for many years to come.

## 8. Conclusions

The current empirical analysis reveals new insights into the concept of PTM by expanding the countries for which it can be applied. In particular, comparisons across destination countries and industries in relation to PTM by producers from transition economies have not been undertaken before. The paper has documented that export price differentials across destinations exist and are sensitive to exchange-rate changes for certain number of highly disaggregated industries for transition economies. Furthermore, with this paper we shed some light on the ambiguity in the relationship between “market power” and PTM. The previous research has been focused mainly on the big advanced economies, such as USA, Germany and Japan, searching for evidence of PTM resulting from “market power”, as we would expect to have substantial PTM when the exporting firm has a great deal of monopoly power. The same result can, however, be observed when exporting firms have relatively small share of the foreign

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<sup>14</sup> As the data are at a disaggregated level and the lack of the data on all 4-digit level industries prevent us from estimating the relative share of the industries for which we find evidence of PTM.

market and thus less influence over the equilibrium price, which is obviously the case for Bulgaria.

PTM is an important strategy for transition economies in the context of the ongoing reorientation of trade flows towards EU countries and trade competitiveness in the EMU. This suggests that future research should attempt to include more transition economies and analyse the effect of exchange rate changes not only on their export but also their import prices. Furthermore, the empirical analysis can be extended in several different ways. First, a distinction between temporary and permanent exchange rate changes could lead to some interesting results<sup>15</sup>. Second, tests for PTM between export and domestic markets could reveal more evidence of PTM. Third, the issue of structural breaks deserves attention when export prices in transition economies are modelled. This will, however, require a shift of the empirical analysis, or hysteresis in prices should be investigated. Fourth, an appropriate dynamic specification of export prices and exchange rates could provide some more information not only about short but also long-run PTM. Moreover, PTM can occur due to hysteresis in trade volumes. For example, in the presence of hysteresis in export quantity adjustment through entry or exit, a firm with a longer planning horizon could price-to-market and give more emphasis to market share. Also, non-parametric methods could be employed to address non-linearities between exchange rates and price changes, or PTM could be due to a second degree segmentation as well. Finally, a test for asymmetries – whether there is symmetric PTM behaviour during periods of depreciations and appreciations - could also reveal some interesting features of transition economies.

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<sup>15</sup> No attempt is made to distinguish between temporary and permanent exchange rate changes for estimation purposes. There is no widely accepted method by which to make such distinctions.

**Table 3: Structure of Exports by Trading Partners****Poland**

Year	Exporting Partner 1	Percentage of Total Exports	Exporting Partner 2	Percentage of Total Exports	Exporting Partner 3	Percentage of Total Exports	Exporting Partner 4	Percentage of Total Exports	Exporting Partner 5	Percentage of Total Exports
1991	Germany	25.2	Russia	5.4	Italy	4.8	Netherlands	4.7	Hungary	4.5
1992	Germany	34.9	Netherlands	5.2	Russia	4.9	Italy	4.6	Hungary	4.5
1993	Germany	36.3	Netherlands	5.9	Italy	5.2	Russia	4.6	Hungary	4.5
1994	Germany	35.7	Netherlands	5.9	Russia	5.4	Italy	4.9	UK	4.6
1995	Germany	38.3	Russia	5.6	Netherlands	5.6	Italy	4.9	UK	4.0
1996	Germany	34.4	Russia	6.8	Italy	5.3	Netherlands	4.8	France	4.4
1997	Germany	32.9	Russia	8.4	Italy	5.9	Netherlands	4.7	Ukraine	4.7
1998	Germany	36.3	Italy	5.9	Russia	5.7	Netherlands	4.8	France	4.7

**Hungary**

Year	Exporting Partner 1	Percentage of Total Exports	Exporting Partner 2	Percentage of Total Exports	Exporting Partner 3	Percentage of Total Exports	Exporting Partner 4	Percentage of Total Exports	Exporting Partner 5	Percentage of Total Exports
1991	Germany	25.4	Russia	15.3	Austria	7.9	Italy	7.1	US	3.5
1992	Germany	26.1	Russia	15.9	Austria	9.0	Italy	7.9	US	3.7
1993	Germany	26.6	Russia	15.3	Austria	10.1	Italy	8.0	US	4.2
1994	Germany	28.2	Austria	10.9	Italy	8.5	Russia	7.5	UK	4.3
1995	Germany	28.6	Austria	10.1	Italy	8.5	Russia	6.4	France	4.0
1996	Germany	33.7	Austria	10.9	Italy	7.0	Russia	4.9	UK	3.9
1997	Germany	37.3	Austria	11.5	Italy	6.2	Russia	5.1	France	3.8
1998	Germany	36.6	Austria	10.6	Italy	5.8	Netherlands	4.7	US	4.5

**Bulgaria**

Year	Exporting Partner 1	Percentage of Total Exports	Exporting Partner 2	Percentage of Total Exports	Exporting Partner 3	Percentage of Total Exports	Exporting Partner 4	Percentage of Total Exports	Exporting Partner 5	Percentage of Total Exports
1991	Russia	15.6	Germany	5.4	Greece	5.1	Italy	5.0	Macedonia	4.9
1992	Russia	15.0	Germany	6.0	Greece	5.5	Italy	5.3	Macedonia	5.0
1993	Russia	13.6	Germany	6.6	Greece	6.2	Macedonia	6.1	Italy	5.9
1994	Russia	13.5	Macedonia	10.3	Germany	8.9	Greece	7.8	Italy	7.6
1995	Russia	10.0	Germany	8.6	Italy	8.1	Macedonia	8.1	Greece	6.9
1996	Italy	10.1	Russia	9.8	Germany	9.0	Turkey	7.9	Greece	7.1
1997	Italy	11.7	Germany	9.5	Turkey	9.0	Greece	8.2	Russia	8.0
1998	Italy	12.7	Germany	10.5	Greece	8.8	Turkey	8.0	Russia	5.5

*Source: Eurostat Database*

**Table 4: Structure of Exports by SITC (% of total , current prices)****1992**

Country	Food and live animals, beverages and tobacco	Crude materials, inedible	Mineral fuels and lubricants	Animal and vegetable oils	Chemicals and related products	Manufactured goods classified chiefly by material	Machinery and transport equipment	Miscellaneous manufactured articles
Poland	13.4	8.5	10.7	0.1	8.6	27.1	19.2	11.7
Hungary	21.8	5.5	3.4	1.0	10.8	16.0	20.8	20.4
Bulgaria	17.0	5.4	8.1	0.6	15.0	24.9	17.1	9.2

**1994**

Country	Food and live animals, beverages and tobacco	Crude materials, inedible	Mineral fuels and lubricants	Animal and vegetable oils	Chemicals and related products	Manufactured goods classified chiefly by material	Machinery and transport equipment	Miscellaneous manufactured articles
Poland	11.5	4.7	9.1	0.1	6.7	27.6	19.8	20.5
Hungary	18.5	5.2	4.0	0.9	11.2	16.7	25.6	17.9
Bulgaria	19.8	5.7	8.2	0.6	14.8	27.3	13.3	10.5

**1998**

Country	Food and live animals, beverages and tobacco	Crude materials, inedible	Mineral fuels and lubricants	Animal and vegetable oils	Chemicals and related products	Manufactured goods classified chiefly by material	Machinery and transport equipment	Miscellaneous manufactured articles
Poland	10.4	2.9	5.5	0.1	6.7	25.2	28.4	20.8
Hungary	10.5	2.3	1.9	0.6	7.1	12.4	52.0	13.2
Bulgaria	14.2	5.9	6.3	0.6	14.3	29.1	13.1	16.5

*Source: Eurostat Database*



**Table 5 : Polish Exports - Constrained Estimates of  $\alpha$  from equation 3**

<b>Product Code and Description</b>	<b><math>\alpha</math></b>	<b>F Statistic</b>
01 Live animals	-0.4319(0.5198)	4.3220
06 Live trees and other plants	-0.8807(0.8168)	1.4332
25 Salt, sulphur, earths and stone, plastering material, lime and cement	-0.6191(0.4607)	7.7611
28 Inorganic chemicals: organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	0.0884(0.2036)	2.2359*
31 Fertilizers	-0.3072(0.5738)	1.8631
39 Plastics and plastic products	-0.1173(0.4156)	4.1487
41 Hydres and skins (other than furskins) and leather	-0.4326(0.5667)	2.2024
44 Wood and articles of wood, wood charcoal	-0.2884(0.2004)	9.8508
48 Paper and paperboard, articles of paper pulp, paper or paperboard	-0.2884(0.2004)	1.0599
61 Articles of apparel and clothing accessories, knitted or crocheted	-0.4454(0.0148)	7.3197*
62 Articles of apparel and clothing accessories, not knitted or crocheted	0.2121(0.1674)	6.8646*
63 Other made up textile articles, sets, worn clothing and worn textile articles, rags	-0.0266(0.3262)	2.6019
64 Footwear, gaiters and the like, parts of such articles	-0.7118(0.3393)	2.5557
70 Glass and glassware	-0.9375(0.4011)	5.4635*
76 Aluminium and articles thereof	-1.0043(0.2561)	4.9615*
82 Tools, implements, cutlery, spoons and forks, of base metal, parts thereof of base metal	-0.2344(0.3232)	5.4316
84 Nuclear reactors, boilers, machinery and mechanical appliances, parts thereof	-0.1164(0.3474)	1.8788
85 Electrical machinery and equipment and parts thereof	-0.7541(0.3474)	2.7894*

*Note:* Standard errors are given in parentheses.

\* Constraint rejected at 5-per cent level for significant  $\alpha$ .

**Table 6: Hungarian Exports - Constrained Estimates of  $\alpha$  from equation 3**

<b>Product Code and Description</b>	<b><math>\alpha</math></b>	<b>F statistic</b>
01 Live animals	-0.0263(0.2015)	1.7996
02 Meat and edible meat offal	-0.2975(0.3648)	2.4834
06 Live trees and other plants	-0.7539(0.2605)	1.2462
10 Cereals	-0.0266(0.4929)	1.4904
14 Vegetable plaiting materials, vegetable products	0.3750(0.3683)	1.6963
15 Animal or vegetable fats and oils and their cleavage products	-0.2015(0.5743)	5.2528
16 Preparations of meat, fish or crustaceans	-0.3889(0.3776)	1.1454
20 Preparations of vegetables, fruit, nuts or other parts of plants	-0.2720(0.7337)	2.3347
29 Organic chemicals	-1.0210(0.5255)	4.6241*
39 Plastics and plastic products	-0.1199(0.3094)	1.5071
42 Articles of leather	-1.7143(0.2836)	4.2626*
44 Wood and articles of wood	-0.6466(0.5624)	7.0814
46 Wickerwork and basketwork	-0.2491(0.7741)	4.2648
49 Books, newspapers, pictures and other products of the printing industry	-0.2865(0.0796)	2.5780
52 Cotton	-0.3245(0.4517)	2.8983
55 Man-made staple fibres	-0.8963(0.7284)	2.7834
60 Knitted or crocheted fabrics	-0.1871(0.3392)	3.9660
62 Articles of apparel and clothing accessories, not knitted or crocheted	-0.4424(0.7091)	4.2055
64 Footwear	-0.9836(0.2781)	4.5056*
70 Glass and glassware	-0.1887(0.5236)	3.0165
76 Aluminium and articles thereof	-0.3934(0.4056)	3.9460
83 Miscellaneous articles of base metal	-0.2432(0.3175)	2.4211
84 Nuclear reactors	-0.4656(0.4165)	2.2452
87 Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	-1.1991(0.0919)	3.0102*
94 Furniture	-0.0855(0.1676)	2.6076

Note: Standard errors are given in parentheses.

\* Constraint rejected at 5-per cent level for significant  $\alpha$ .

**Table 7 : Bulgarian Exports - Constrained Estimates of  $\alpha$  from equation 3**

<b>Product Code and Description</b>	<b><math>\alpha</math></b>	<b>F statistic</b>
01 Live animals	-0.9337(0.1016)	4.9809
06 Live trees and other plants	-1.7241(0.2456)	4.7833*
20 Preparations of vegetables, fruit, nuts or other parts of plants	-0.8374(0.1028)	3.4545*
31 Fertilizers	-1.0358(0.1572)	4.5983*
33 Essential oils and resinoids, perfumery, cosmetic or toilet preparations	-0.8647(0.0593)	5.7780*
39 Plastics and plastic products	-0.8286(0.0494)	3.8280*
40 Rubber and articles thereof	-0.8167(0.0853)	3.8598*
42 Articles of leather	-1.1108(0.1359)	3.9605*
44 Wood and articles of wood	-0.0925(0.0779)	4.8457
51 Wool	-0.8376(0.2786)	1.4371
61 Articles of apparel and clothing accessories, knitted or crocheted	0.2046(0.1217)	1.0265
62 Articles of apparel and clothing accessories, not knitted or crocheted	-0.9767(0.1298)	4.2315*
64 Footwear, gaiters and the like, parts of such articles	-1.0102(0.0869)	2.8831*
72 Iron and steel	-0.9252(0.0373)	3.6301*
74 Copper and articles thereof	-0.1059(0.2246)	2.5834
76 Aluminium and articles thereof	-0.9007(0.1681)	5.6525*
84 Nuclear reactors, boilers, machinery and mechanical appliances, parts thereof	-0.9562(0.0534)	1.3389
87 Electrical machinery and equipment and parts thereof	-0.9863(0.0729)	3.5434*
94 Furniture	-0.9617(0.0901)	3.3047*

Note: Standard errors are given in parentheses.

\* Constraint rejected at 5-per cent level for significant  $\alpha$ .

**Table 8: Source Country Comparisons of Constrained Estimates of  $\alpha$  for Common Industries**

<b>Product Code</b>	<b>Poland</b>	<b>Hungary</b>	<b>Bulgaria</b>	<b>Pooled Estimate</b>	<b>F Statistic</b>
01	-0.4319 (0.5198)	-0.0263 (0.2015)	-0.9337 (0.1016)	-0.5771 (0.4367)	4.3690
06	-0.8807 (0.8168)	-0.7539 (0.2605)	-1.7241 (0.2456)	-0.9897 (0.8675)	3.7980
39	-0.1173 (0.4156)	-0.1199 (0.3094)	-0.8286 (0.0494)	-0.4027 (0.4713)	4.5218
44	-0.2884 (0.2004)	-0.6466 (0.5624)	-0.0925 (0.0779)	-0.3017 (0.2567)	5.6234
62	-0.2121 (0.1674)	-0.4424 (0.7091)	-0.2046 (0.1217)	-0.3237 (0.2423)	2.9876
64	-0.7118 (0.3393)	-0.9836 (0.2781)	-1.0102 (0.0869)	-0.8764 (0.7986)	3.4678
76	-1.0043 (0.2561)	-0.3934 (0.4056)	-0.9007 (0.1681)	-0.7913 (0.6987)	4.3219

Note: Standard errors are given in parentheses.

\* Constraint rejected at 5-per cent level for a significant  $\alpha$ .

### Description of the Codes at Two-Digit Level (Combined Nomenclature, Eurostat Database)

<b>01</b>	Live animals
<b>02</b>	Meat and edible meat offal
<b>06</b>	Live trees and other plants, bulbs, roots and the like, cut flowers and ornamental foliage
<b>10</b>	Cereals
<b>14</b>	Vegetable plaiting materials, vegetable products not elsewhere specified or included
<b>15</b>	Animal or vegetable fats and oils and their cleavage products, prepared edible fats, animal or vegetable waxes
<b>16</b>	Preparations of meat, fish or crustaceans, molluscs or other aquatic invertebrates
<b>20</b>	Preparations of vegetables, fruit, nuts or other parts of plants
<b>25</b>	Salt, sulphur, earths and stone, plastering material, lime and cement
<b>28</b>	Inorganic chemicals: organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes
<b>29</b>	Organic chemicals
<b>31</b>	Fertilizers
<b>33</b>	Essential oils and perfumery, cosmetic or toilet preparations
<b>39</b>	Plastics and plastic products
<b>40</b>	Rubber and articles thereof
<b>41</b>	Hydes and skins (other than fur skin) and leather
<b>42</b>	Articles of leather, harness, travel goods, handbags and similar containers, articles of animal gut (other than silk-worm gut)
<b>44</b>	Wood and articles of wood, wood charcoal.
<b>46</b>	Wickerwork and basketwork
<b>48</b>	Paper and paperboard, articles of paper pulp, paper or paperboard
<b>49</b>	Books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
<b>51</b>	Wool, fine and coarse animal hair, yarn and fabrics of horsehair
<b>52</b>	Cotton
<b>55</b>	Man-made staple fibres
<b>60</b>	Knitted or crocheted fabrics
<b>61</b>	Articles of apparel and clothing accessories, knitted or crocheted
<b>62</b>	Articles of apparel and clothing accessories, not knitted or crocheted
<b>63</b>	Other made up textile articles, sets, worn clothing and worn textile articles, rags
<b>64</b>	Footwear, gaiters and the like, parts of such articles
<b>70</b>	Glass and glassware
<b>72</b>	Iron and steel
<b>74</b>	Copper and articles thereof
<b>76</b>	Aluminium and articles thereof
<b>82</b>	Tools, implements, cutlery, spoons and forks, of base metal, parts thereof of base metal
<b>83</b>	Miscellaneous articles of base metal
<b>84</b>	Nuclear reactors, boilers, machinery and mechanical appliances, parts thereof
<b>85</b>	Electrical machinery and equipment and parts thereof, sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
<b>87</b>	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
<b>94</b>	Furniture, medical and surgical furniture, bedding, mattresses, mattress supports, cushions and similar stuffed furnishings, lamps and lighting fittings, not elsewhere specified, illuminated signs, illuminated name-plates and the like, prefabricated buildings

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