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The use of unit values in estimating trade-related capital flight

The case of CEE countries with special focus on Russia

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Abstract

Methods measuring capital flight unfortunately yield a too wide band of estimates. A striking example is provided by estimates of capital flight from Russia. This study introduces unit-values analysis as a new and, hopefully, more robust tool in order to estimate trade-related capital flight. Trade-related capital flight prevails when capital account convertibility is strongly limited, as in the case of Russia. Unit values analysis aims at detecting the underpricing of exports and the overpricing of imports as the major flight channel. Using a multilateral translog price index we test for systematic deviations in EU export prices to Russia compared with exports to Bulgaria, the Czech Republic, Hungary, Poland and Romania. As benchmark we selected exports to France. We limit our calculations to six-digit and four-digit chapters in 70 – 89 of the Combined Nomenclature (manufactured goods). We find no systematic deviation in calculated prices and conclude that underpricing of EU exports to Russia (Russian imports from EU) does not play a dominant role for capital flight through manufactured goods. We extended the test to EU imports of oil and oil products (chapter 27) and found evidence for the underpricing of Russian deliveries, mainly in the chapter 2710 (petroleum oil, not crude).

JEL classification: C43, F30

Keywords : Unit values analysis, capital flight, transition economies.

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1. Introduction

Capital flight is unfortunately a too much differentiated concept, and the usual measurement concepts produce a too wide band of estimates (*Loungani and Mauro* 2000). Our study introduces unit-values analysis as a new tool in order to estimate one channel of flight, namely trade-related capital flight. Unit-value indexes are commonly used in the empirical literature to analyse many international trade issues, particularly price competitiveness. They were not yet applied for the detection of "pure" systematic pricing practices of firms. We analyse trade-related capital flight from Russia. The former state monopoly in trade was lifted in mid-1992, but major controls over the capital account remained. All experts agree that capital flight soared in the 1990s. With central control over capital flows, the underpricing of exports and the overpricing of imports becomes a major flight channel. Our study concentrates on fake invoices in imports of differentiated goods. While capital flight through the export of raw material, oil, gas and the import of some staple food (wheat) seems to be rather well documented, few light was shed on capital flight through the main part of imports -- differentiated goods. Some experts assume that capital flight through imports of highly diversified commodities was even higher than that through exports of raw materials (*Tikhomirov* 1997). The study is organised as follows: section two presents the history and channels of trade-related capital flight from Russia. We describe capital flight through differences between market and contract or transfer prices. Section three provides the essentials of the method for finding "pure" price differences from unit values. Section four tests for the importance and systematic of price deviations. We use multilateral *Törnquist* translog index numbers to construct import prices from EU exports of manufactured goods to Russia and compare them with prices of exports to other countries. Section five concludes.

2. Trade-related capital flight from Russia

The size of capital flight from Russia is estimated to have been enormous, especially in years prior to 1999 (between bn 14 and bn 36 US-Dollar in 1996 and 1997, *Tikhomirov* 1997, *Sheets* 1995). These estimates stood for about 11 to 27 percent of Russia’s gross foreign debt. The non-availability of foreign exchange for debt-serving institutions (mainly the central government) increased the financial fragility of the Russian economy and contributed to higher interest rates throughout the economy, putting an additional

financial burden on all companies. Capital flight was the reason for weak control over monetary aggregates, for less tax incomes, it increased the strain on the (social) expenditure side of the fiscal balances and, certainly, contributed to short-term deficit financing that led directly into the financial crisis in August 1998. In addition, some forms generate transaction costs reducing even potential profits on the level of those enterprises that transfer incomes abroad. The causes for capital flight in a period of systemic transformation are well known: in an early stage, the former nomenclature (or communist leadership) tried to transfer its earlier stolen assets abroad. Tax evasion is another motive, mainly for the emerging private sector. Political instability causes managers of big state-owned or even privatised companies to search for a safe haven instead of declaring profits, etc. etc.

The wide span of the estimates poses some methodological questions. We find two approaches in literature: the balance-of-payments analysis, and price comparisons. The bop analysis is based on flows in the capital account and on changes in the position of net errors and omissions. This method may overestimate capital flight for several reasons. One reason is linked to the general position of a country in the international economy. For a country like Russia exporting mainly raw material and energy, the structural surplus in trade needs to be coupled with capital exports. It is a tricky task to disentangle capital flight from normal capital export. A second cause of capital movements are normal portfolio diversification strategies of asset holders. When investors wish to correct their portfolio owing to factors such as a financial crisis in another region of the world, the outflow of capital is hardly to call capital flight. Compared with most Central and East European transition countries, where the current and capital accounts have been already liberalised, there were many controls on foreign exchange movements, particularly in the period under investigation (IMF, 2000). Hence, there are and there were yet only few occasions for non-trade related capital flight.[1] With severe controls, the main flight channel is through trade: artificially low export revenues and high import expenditures.

The channels of trade-related capital flight are in general (a) barter, (b) sham credits, (d) transfer pricing and (c) fake invoices. In case of *barter*, the domestic firm exchanges exported commodities directly into imported ones. The foreign partner pays an additional charge, which remains on a foreign bank account. In case of *sham credits*, the domestic firm grants a credit on exports. The credit is meant to default artificially, and the export yields an official loss. Both forms were typically in an early stage of Russian transition, when Russia's financial and banking system did not yet provide standard

[1] There was a certain field for capital account transactions over which the Central Bank of Russia had little control. In some cases, Russian residents acquired offshore banks typically in countries where supervision of banks is inadequate to set up correspondent accounts with a resident bank. These accounts served as a channel of capital flight (see *Loungani and Mauro*, 2000).

financial services for trade deals (*Tikhomirov* 1997). *Transfer pricing* prevails in international firms with co-operative relations in production. It is mainly a playground for a producer in, say the EU, establishing a production unit in Russia (or other CEE countries) in line with outsourcing strategies. The mother company delivers some intermediate good to the unit in Russia for outward processing charging intra-firm prices; and the use of inner prices rather aims at avoiding taxes in the EU. The bilateral operation can be easily enlarged for the multilateral case which includes units in several countries with the headquarter steering the commodity and payment flows according to net profit maximisation. Because Russian manufacturing firms very seldom establish this kind of co-operation with affiliated units abroad, we assume that false invoicing is the broadest channel of capital flight from Russia since the mid of the 1990s.

With *fake invoices*, domestically based companies sell (deliver) abroad for lower prices in international currency than they really charge customers (foreign units), or they buy abroad for higher prices than they really pay to their suppliers. False invoicing[2] could be the purpose of middleman firms established by domestic companies abroad. A company in a certain country A, say Russia, establishes a trading house in a second country B, say Germany. This establishment changes the hitherto direct and "normal" channel of trade. The 'middleman' buys from the German producer at the market price and re-sells it to the Russian mother firm at a higher price (see Figure 1). The trading house realises the profit, which will be taxed according to German tax law, but the net income of the Russian mother firm remains abroad (or can be re-patriated for financial investment purposes). If the middleman company is located in a third country C, say, Cyprus, the whole trade operation is called 'transit trade' of country C and indirect trade of countries A and B.

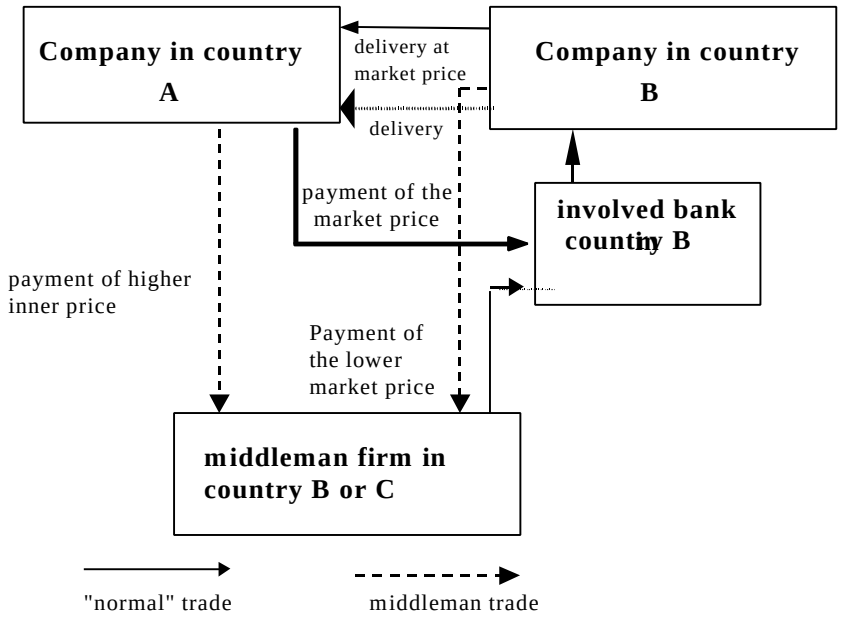
Trade related capital flight via middleman trade is not a phenomenon new for Russia. It was even a fact in closed economies with state monopoly in foreign trade. The increasing number of trading houses in east-west trade in the 1970s and 1980s also mirrors the organisation of capital flight from the centrally planned and closed economies often organised by members of the communist leadership. (Of course, traditional trading houses also served for solving counter trade (*Gabrisch* and *Stankovsky*, 1989)). The new private, privatised and even yet state-owned, but less-controlled Russian companies exploit under free trade conditions those channels state firms used for capital flight under the Soviet era. And the mushrooming trading houses in some smaller low-tax countries in Europe in the 1990s give evidence of a common

[2] *Tikhomirov* (1997) calls it ‘doubleinvoicing’ because the Russian exporter or importer closes two contracts with the foreign partner (or affiliate): The official invoice is the basis for reporting and taxation, the unofficial regulates the split of profits from the deal.

practice of capital flight in an east-west context when counter trade needs rather faded away.[3]

Figure 1:

The scheme of fake invoices and middleman trade



False invoicing practice increases not only macroeconomic burdens, but reduce also efficiency on the micro level. The purpose of the establishment of offshore trading houses is not to increase turnover (and production) but to enlarge a market exchange of goods and money by a non-market exchange. This raises costs for the entire economy: the company bears transaction and financing costs for the establishment and running of the trading house. Assume alternatively a legal tax relief the exporting or importing

[3] Counter trade in east-west trade was explained by the shortage of foreign exchange of the socialist firms. With convertibility this shortage disappeared, and the boom in trading houses followed different aims.

company could benefit from. Then, the net profit of the firm would be higher without running the trading house, and the welfare effect would be positive.

The appropriate approach to measuring overwhelmingly trade-related capital flight would be the comparison between 'world market prices' and prices in invoices. When world prices are known, capital flight via false invoicing might be detected pretty soon by tax authorities. World market prices, however, are not always known, and capital flight might be underestimated. World market prices seem to be mostly known in the case of raw materials and other, more or less, homogeneous goods. In November 2000, the Russian Federal Ministry of Finance and the Federal Tax Police issued a report showing that oil companies sold to affiliate offshore trading companies at sub-market prices. The report said that the state was losing $ 9 bn a year (about 5 % of the gross domestic product) in tax receipts.[4] This example seems to demonstrate that political power of big oil companies may prevent tax authorities from punishment of those practices. In a similar way, capital flight through imports of homogenous commodities could be easily detected. *Tikhomirov* (1997) reported various Russian comparisons, published in newspapers, between the value of imports of wheat, maize, sunflower oil and white sugar at world prices and Russian contract prices. The difference was a US dollar 100 mn capital flight in 1994´. This huge difference could not be explained by freight costs.

Is a comparison between world and contract prices of an individual country a correct method? Some doubts arise. A first concern is indeed the cif/fob difference. A robust method should exclude such distortions. A second, more severe, concern is the term 'world price'. Even homogenous goods have different world prices: long-term contract prices of oil or gas differ from spot prices of the same quality. Table 1 provides an example about different world prices for 1994. We calculated from Eurostat unit values of exports and imports of wheat and maize. The first row reports the unit value of EU exports to Russia in two positions: wheat and meslin (chapter 10190), and maize or corn (chapter 1005). The second and the third rows report the unit values of EU imports in the identical positions from the USA and Canada. Which one is the correct world price? Let us assume that Russian middleman in the EU imported maize from the USA for 171 US dollar per ton and re-sold it to Russia for a 1,244 US dollar per ton, a huge capital flight had happened. If the middleman imported the maize from Canada for 1,618 US dollar, capital flight were from the EU to Russia. This examples shows that a method correcting for different 'world' prices is needed.

[4] See Goldman Sachs Economics: Daily news & views - new European markets, Middle East and AFRICA, London, November 30, 2000. (edition via e-mail).

Table 1:

Unit values in EU trade with wheat and maize in US dollars, 1994

Unit values in …..	Wheat and meslin (CN 100190)	Maize or corn (CN 1005)
EU exports to Russia	91.6	1,244
EU imports from the US	166.6	170.9
EU imports from Canada	179.6	1,618

Source: own calculation based on Eurostat data.

3. Analyzing "pure" price differences in international trade

A systematic way to estimate the importance of capital flight via trade in manufactures goods is a unit-values analysis. Starting point is the assumption that capital flight is mirrored in international price differences. International customs statistics, however, do not report prices of individual commodities but rather trade values and quantities. Nevertheless, they base on information companies provide on fob or cif term. EU statistics, for example, report exports at fob term, hence, transportation cost, tariffs of the country of destination etc. is not included in prices. The traditional tool for gaining information on price developments from trade statistics are unit values obtained by dividing the export or import value by a quantity indicator, mostly metric tons.[5] The main problem with unit-value indexes roots in aggregation. The higher the level of aggregation the larger the bias from changes in the mix of commodities and countries of supply or demand. In the further we will use the term *'commodity prices*' for all items at the 6-digit level of trade statistics. Some earlier studies used 5-digit levels (*Kravis* and *Lipsey* 1971). Most recently applied indexes are constructed at the 7-digit level. We use the EU trade statistics that offers 8- and 6-digit levels. At 8-digit levels, many items would drop out, and the loss of information is not smaller than when using 6-digit levels.

Industry-level prices are calculated at the next higher level of aggregation, hence at the 4-digit. We start with industry-level unit values. Neglecting the minor bias of aggregation at the 6-digit levels we will find the impact of almost pure commodity price differences at the industry-level price index. The theory of index numbers helps to construct these price indexes.

For the construction of the adequate price index for our application out of unit-values let us start with three simple statements:

(1) P_i is an industry-level vector of fixed prices p_i of a commodities vector X_i with i c= (1,....., M) commodities.

[5] We neglect the problems with this measure. For further discussion see *Greenaway*, *Hine*, and *Milner* 1994, p. 81.

(2) The price index of the industry level, $P(P_i)$ depends on the vector of fixed commodity prices, the quantitative vector and a quality vector A_i. Then we can write

$$P(P_i) = \frac{\sum_{i=1}^{M} p_i x_i}{A_i \sum_{i=1}^{M} x_i} \qquad (1)$$

The nominator represents the industry-level value, the denominator the quality index of the quantitative bundle of commodities. If we define the unit-value at the industry-level as

$$R(P_i) = \sum_{i=1}^{M} p_i x_i \,/\, \sum_{i=1}^{M} x_i \qquad (2)$$

we obtain from (1)

$$P(P_i) = R(p_i) / A_i \qquad (3)$$

(1) Then, in the bilateral case comprising two observation points in time or two economic agents I and II, the price index at the industry level $P^*(P_i)$ can be defined as

$$P^*(P_i) = \frac{P^I(P_i)}{P^{II}(P_i)} = \frac{R^I(P_i)/A_i^I}{R^{II}(P_i)/A_i^{II}} \qquad (4)$$

According to the economic theory of index numbers (for an overview see *Diewert* 1991) unit values do not automatically equal the arithmetic or geometric mean of price differences $P(P_i)$ of a number M of commodities. Only if there were no difference in the quality vectors (A_i) in both observations we may assume that the industry-level prices are tantamount to the unit values.

After re-arrangement and taking the logs we obtain from (4) for the bilateral case

$$\left[lnR^{I}(P_i) - lnR^{II}(P_i) \right] = \left[lnA_i^{I} - lnA_i^{II} \right] + lnP^*(P_i) \qquad (5)$$

with $P^*(P_i)$ being the price difference at the industry level. The unit value then is the construct from the two component vectors of quality and price.

The crucialaspect in our study is the price index. Our considerations follow now the usual path in literature. Here, the theory of index numbers is microeconomically founded. Assume a given utility u of a so-called aggregator function F(x) with

$x \equiv (x_1, ..., x_N)$ quantities and fixed prices. Then consumers and producers minimize their expenditure. Doing this, the composition of the aggregator function as well as the price index of the commodity bundle is determined by the form of the aggregator function and the given utility u:

$$C(u, p_i) \equiv min_x \{ p_i x_i : F(x) \geq u \} = uC(1, p) \equiv uc(p) \qquad (6)$$

with *C* as expenditure function dependent on given *u* and *p* and being linearly homogeneous. Then, total expenditures are a product of the given utility level and the minimum costs for the production of one unit of this utility, *c(p)*. Though this has not very much to do with reality, the approach allows for the development of price indices (including unit values), that fulfill various mathematical requirements. Index numbers with the best results are so-called 'superlative' index numbers, for example the *Fisher index*, the *Törnquist* index and the *Walsh i*ndex. They are all geometric indexes. These indexes imply that each unit cost function belongs to an aggregator function F ('exact' indexes) and fulfills the product-test equality: The product of the price and the quantity index equals the value ratio of both observations I and II. All superlative index numbers can be used alternatively in empirical analysis. They approach to each other to less than 0.2 % in time serious analysis and to about 2 % in cross section analysis (*Diewert* 1991).

In some recent studies the *Törnquist*-index has been used. In the bilateral case, the *Törnquist*-index is a share-weighted geometric mean:

$$P_T = \prod_{i=1}^{M} \left(\frac{p_i^I}{p_i^{II}} \right)^{S_i} \qquad (7)$$

The translog index is

$$\ln P_T = 1/2 \sum_{i=1}^{M} (S_i^I + S_i^{II})(\ln p_i^I - \ln p_i^{II}) \qquad (8)$$

S reports the share of the value of all individual quantities of *i* in the total value traded in observation cases I and II: $\frac{p_i^I x_i^I}{\sum_{i=1}^{N} p_i^I x_i^I}$. A change in the price index at the industry level then is determined exclusively (with given value shares) by a change in the prices of individual commodities.

The problem with the bilateral price index is transitivity: results obtained heavily depend on the order in which observations are chosen for comparison. The bias is of minor importance in time-series application because of its natural ordering. The problem may, however, become significant for data containing both time-series and cross-sectional elements as in our study. A multilateral translog index is used to solve the problem: observations of individual commodities are weighted by average indexes

containing information on all observations *N* of a given sample and, thus, the multilateral index is derived by taking the difference in two bilateral comparisons:

$$ln\,P^*(P_i) = \frac{1}{2}\sum_{i=1}^{M}\left(S_i^I + \overline{S_i}\right)\left(ln\,p_i^I - \overline{ln\,p_i}\right) - \frac{1}{2}\sum_{i=1}^{M}\left(S_i^{II} + \overline{S_i}\right)\left(ln\,p_i^{II} - \overline{ln\,p_i}\right) \quad (9)$$

with

$$\overline{S_i} \equiv \frac{1}{N}\sum_{i=1}^{N} S_i^I \quad \text{and}$$

$$\overline{ln\,p_i} \equiv \frac{1}{N}\sum_{i=1}^{N} ln\,p_i^I \ .$$

By viewing $\overline{S_i}$ and $\overline{ln\,p_i}$ as the cost shares and logarithmic prices each bilateral comparison is between an observation of interest I and the hypothetical base observation II. The average index $\overline{S_i}$ includes all observations *N* of the single commodity *i* in the panel.[6] *Aw* and *Roberts* (1988) used the Törnquist index for decomposing the increase of aggregate import prices into changes of quality and changes of the unit values in exports into the USA during 1994-1982 according to equation (5). (See a similar approach on Spain by Martines-*Zarzoso* and *Suarez Burguet* 2000).

This multilateral translog price index is used to measure the price of EU exports by country of destination. Equation (9) contains observable data from EU customs statistics and will further on serve for the empirical investigation of systematic price deviations in exports to Russia (Russian imports from the EU). The term 'systematic' includes some comparison with EU exports to other countries.

A pure price index would represent cost differences according to equation (6). Deviations between trade of a given country with various other countries are to explain by other determinants, that is price policy of companies in an environment of imperfect competition. The cost determinant can be excluded in our research because we use export data of the European Union implicitly assuming a certain production function for the entire Union (the same 'average' productivity, factor endowment). Since we cannot exclude industry specific effects we have to use some tests to determine the likelihood of fake invoicing practices.

6 If I and II are countries, *N* reports the number of years; if I and II are years, *N* reports the number of countries considered)

4. Testing and results

4.1 Data and method

We use data from Eurostat Combined Nomenclature chapters 7 and 8. Chapters 70 throughout 81 include glass, pearls and base metals and articles thereof. Chapters 82 throughout 89 are products of machinery industries (Annex Table A). We consider exports of the EU to Russia, Bulgaria, the Czech Republic, Hungary, Poland, and Romania. We calculate relative prices taking France as the EU benchmark. We believe that capital flight in the EU to France via transfer pricing or sham invoicing is not a significant practice of firms. Cif/fob differences do not distort our analysis since we use only export data.

One important feature of both sets of industries is that the EU run trade deficits in chapters 70-81 with the countries considered, but surpluses in chapters 82-89 (Annex Table B). These industry specifics (possibly due to factor endowment differences) could have some influence over the channel of capital flight. Though we test EU exports for overpricing, capital flight might also occur via EU imports (underpricing).

Exports were taken at the 6-digit level (commodity level). The six-digit level was aggregated to the 4-digit level (industry-level). The entire sample contains 1,630 items which stand for about 61 % of all EU exports to Russia of chapters 3 to 8. Unit values were calculated from values and quantities for years 1996, 1997, 1998 and on average of these years. We assume capital flight to be particularly pronounced in this period. Price indexes on the industry level (4-digit) for Russia were related to indexes for France and compared with differentials of other transition countries (Poland, Czech Republic, Hungary, Bulgaria and Romania).

A problem typical for this kind of data generation is the lack of either quantitative or value entries in exports of some items at the 6-digit level. In these cases, data have to be imputed in order to avoid bias. We decided for the following imputation procedure:

- If one entry were missing, the average of the remaining two was taken.
- If two entries were missing, the reported one was taken for the remaining two.
- If all three entries in value or quantity were missing, the item was deleted from calculation.

Constructing $\overline{S_i}$ and $\overline{ln\, p_i}$ from 6-digit-level data we added all observable S_i^I and $ln\, p_i^I$ and divided the sum by the number N of the observations. The maximum number of observations was 7 (7 countries x 1 average of three years). In case of some countries and years, the total number of observations may be lower since there were no data to

calculate unit values or shares. We deleted all items for which the number of observations was less than six.

4.2 Results

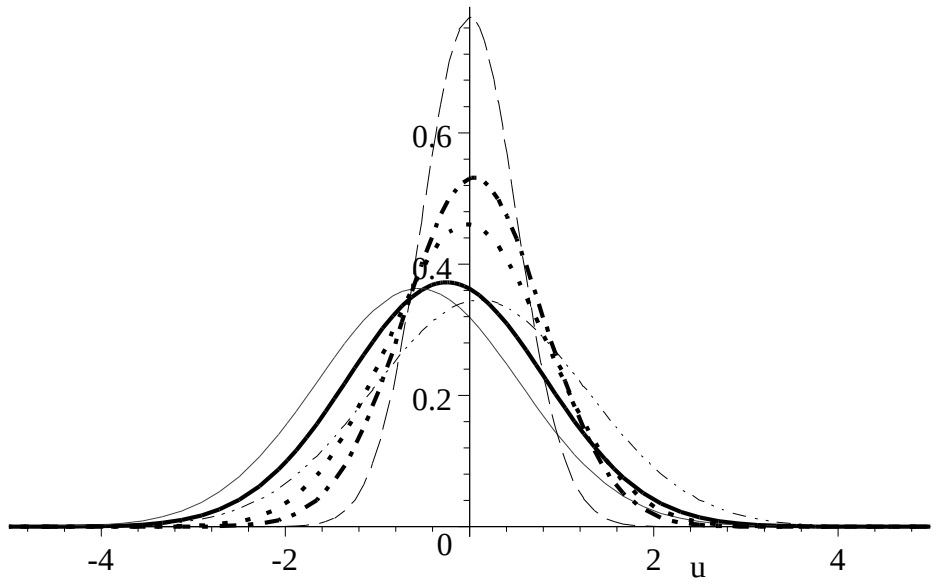
The first step was to calculate mean values, standard deviations and the coefficient of variation of the entire panel and of two panels 70-81 and 82-89 (Table 2).

Table 2:

Descriptive statistics of lnP*

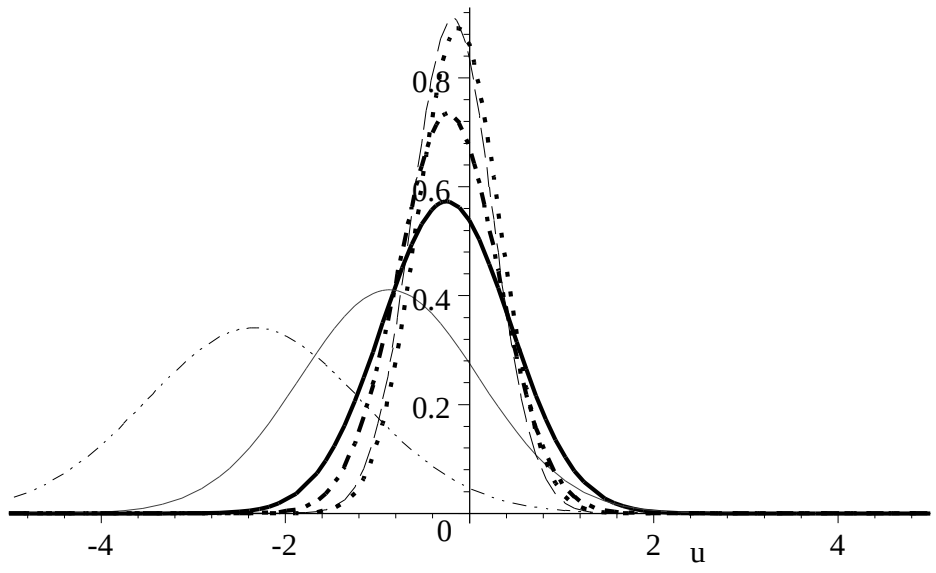
CN Chapters 71 throughout 89						
	Russia	Poland	Czech Republic	Hungary	Bulgaria	Romania
Mean	-1.438	-0.116	-0.085	-0.129	-0.755	-0.173
Standard deviation	1.660	0.475	0.636	0.640	1.029	0.858
Coefficient of variation:	2.756	0.226	0.404	0.410	1.060	0.736
70 throughout 81						
Mean	0.108	0.001	-0.024	0.045	-0.559	-0.041
Standard deviation	1.155	0.514	0.867	0.751	1.099	1.071
Coefficient of variation:	1.334	0.264	0.752	0.564	1.208	1.148
82 throughout 89						
Mean	-2.343	-0.185	-0.120	-0.232	-0.870	-0.250
Standard deviation	1.171	0.438	0.448	0.542	0.971	0.696
Coefficient of variation:	1.370	0.192	0.200	0.294	0.944	0.485

Graph 1: Distribution of lnP* around the mean value in chapters 70-81



Legende: Russia (dot dot dash) - - — — Poland (dash) – – – – Czech Republic (dots) - - - -
Hungary (dot dash) - - - - Bulgaria (solid - thin) ——— Romania (solid – medium) - - - -

Graph 2: Distribution of lnP* around the mean value in chapters 82-89



Legende: Russia (dot dot dash) - - — — Poland (dash) – – – – – 1Czech Republic (dots) - - - -Hungary
(dot dash) - - - - Bulgaria (solid - thin) ——— Romania (solid – medium) - - - -

At first inspection we observe values that represent higher prices in EU exports to Russia in chapters 70-81, but lower prices in exports in chapters 82-89. Since the latter represent more sophisticated and differentiated goods, the result is somewhat surprising. Capital flight from Russia in less and to Russia in more sophisticated goods? We compared the results with values obtained from EU exports to Bulgaria, the Czech Republic, Hungary, Poland and Romania. With the exception of exports to Bulgaria, prices in export of chapters 70-81 to Poland, the Czech Republic, Hungary and Romania are more or less the same as prices in exports to France. In machinery and equipment exports, most exports to the other countries yielded a lower price than exports to France, like in the case of exports to Russia. The first conclusion then reads that false invoicing seems to be a strategy in Russian imports of less sophisticated goods, but not of machinery and transport equipment.

The next step was to test for the comparability of the mean values by double T-test (Table 3). Since most $H_o < |1.96|$ in the panel 70-81 for Russia, we cannot reject the null hypothesis. Price differences between the countries in these chapters are not systematic (except to Bulgaria and cannot be compared. The picture changes for the panel consisting of chapters 82-89. In exports of machinery and transport equipment the test reveals the comparability of mean values, though EU export prices are lower than prices in EU exports to France.

How could we explain these results?

A first possible explanation is that price differences reflect a pricing-to-markets strategy of firms in machinery and transport equipment. This strategy considers differences in the countries' purchasing power. When the GDP per capita of the Czech Republic is higher than in Bulgaria, EU exporters might charge a higher price for the same good. Indeed, among the other CEE countries, relative prices (measured in terms of France) in exports to Bulgaria are the lowest compared with Poland, the Czech Republic or Romania. Russia's purchasing power is lower than that of EU and other candidate countries (but relatively close to that of Bulgaria).[7]

[7] The WIIW calculated the GDP per capita in purchasing power parity of Russia for 1996-1998 at about 30 % of the EU average. For the other counties considered we find: about 38 % (Poland), about 60 % (Czech Republic), 48 % (Hungary), and 24 % (Bulgaria) (*Pöschl et al*., 2002).

Table 3:

Results of double t-tests of mean values

CN chapters 70 throughout 89						
	Russia	Poland	Czech Republic	Hungary	Bulgaria	Romania
Russia						
Poland	-12.501					
Czech Republic	-12.434	-0.652				
Hungary	-12.013	0.265	0.808			
Bulgaria	-5.708	9.205	9.054	8.435		
Romania	-11.061	0.934	1.343	0.659	-7.104	
70 throughout 81						
	Russia	Poland	Czech Republic	Hungary	Bulgaria	Romania
Russia						
Poland	0.834					
Czech Republic	0.902	0.245				
Hungary	0.451	-0.477	-0.594			
Bulgaria	4.142	4.573	3.787	4.495		
Romania	0.932	0.348	0.121	0.648	-3.346	
82 throughout 89						
	Russia	Poland	Czech Republic	Hungary	Bulgaria	Romania
Russia						
Poland	-22.439					
Czech Republic	-23.052	-1.347				
Hungary	-21.272	0.861	2.053			
Bulgaria	-12.587	8.351	9.109	7.459		
Romania	-19.977	1.019	2.032	0.269	-6.745	

A second explanation effect is transfer pricing being evident in trade with candidate countries but not with Russia. EU direct investment are higher in EU candidate countries than in Russia (measured per capita), and they concentrate more on machinery and transport equipment than in Russia. It is more plausible to assume intra-firm trade with candidate countries than with Russia. Hence, transfer pricing might have played a significant role in this trade, but not in trade with Russia.

The third proposal reads simply that capital flight from Russia in chapters 70-81 could occur mainly via EU imports and not exports (remember the trade balances of both panels).

4.3 Further testing

Last but not least, the method applied yields plausible results only when it detects chapters with capital flight indication. We extended our tests to two 4-digit industries where other sources report or assume the major part of Russian capital flight through exports (underpricing): crude oil (chapter 27090000) and non-sophisticated crude oil products (chapter 2710). In both of them, the EU runs large deficits in trade with Russia (Table C). Crude oil imports of the EU are reported at the 6-digit level. Chapter 2710, however, consists of 48 different products. The benchmark country are imports of the EU from Norway in both cases. For constructing the multilateral price index we selected as further countries: Algeria, Lybia, Nigeria, Saudi-Arabia, and Syria. We applied the same procedure for calculating the price indices, but distinct to our former calculations we deleted all items where the number of observations was less than three (relevant for chapter 2710 only).[8]

In both cases, prices of EU imports from Russia are below prices in imports from Norway. Measured by the deviation from the mean value, Russian prices are the lowest, particularly in industry 2710. While EUROSTAT does not provide various natural qualities of crude oil imports (content of sulphur, for example), the modest price deviations in crude oil imports of the EU might yet explain quality differences. Results for chapter 2710 seem to be more explainable: price deviations are more pronounced. Capital flight through underpricing by Russian exporters might be an actual strategy, not easily to detect by tax authorities.

Table 4:

LnP* in chapters 2709 and 2710; imports of the EU

	Russia	Lybia	Algeria	Saudi-Arabia	Nigeria	Syria	Mean
2709	-0.059	-0.017	0.025	-0.079	0.019	-0.054	-0.027
2710	-0.254	-0.149	-0.172	-0.156	-0.217	-0.219	-0.195
	Deviation from mean value						
2709	-0.031	0.010	0.052	-0.051	0.047	-0.026	0.000
2710	-0.060	0.045	0.023	0.038	-0.022	-0.025	0.000

5. Conclusions

We applied a new method in analyzing trade-related capital flight. Pure price differences were calculated by the help of a multilateral Törnquist price index. We concentrated the analysis on 1.630 items in EU exports in CN chapters 7 and 8 to Russia. Bulgaria. the Czech Republic. Hungary. Poland and Romania and used EU intra-exports to France as

[8] For crude oil, now aggregation was possible, hence, equation (9) applies only without summation.

benchmark. Mean values were analysed by the double T-test. We found no evidence of capital flight by the overpricing of exports to Russia. We conclude. that capital flight from Russia via false invoicing of Russian imports is of minor importance. We found rather some evidence for transfer pricing in EU exports to the candidate countries considered here in comparison with Russia. We found further some evidence of underpricing of EU imports of crude oil and non-sophisticated oil products.

References

Aw. B.Y. and M.J. Roberts. 1988. Price and quality comparisons for U.S. footwear imports: An application of multilateral index numbers. in Feenstra. R.C. (ed.). Empirical Methods for International Trade. MIT Press. Cambridge. MA. 257-75.

Diewert. W.E. 1991. Index numbers. in Eatwell J.. M. Murray und P. Newman (ed). The New Palgrave. A dictionary of Economics. Volume 2. E to J. 767-80.

Eurostat. COMEX-Intra and Extra EU-Trade on CD-ROM. 2001.

Gabrisch. H. and J. Stankovsky. 1989. 'Special Forms of East-West Trade. Part I. Countertrade.' Transl. Soviet & Eastern European Foreign Trade. Spring 1989.

Greenaway. D.. R. Hine. and C. Milner. 1994. 'Country-specific factors and the pattern of horizontal and vertical intra-industry trade in the UK'. Weltwirtschaftliches Archiv. Vol. 130. No. 1. 77-100.

IMF (International Monetary Fund). 2000. *Annual Report on Exchange Arrangements and Exchange Restrictions 2000*. Washington D.C. August 2000.

Kravis. I. B and R. E. Lipsey. 1971. 'Price Competitiveness in World Trade′ Studies in International Economic Relations. No. 6. University Microfilms.

Loungani. Prakash and Paolo Mauro. 2000. ‘Capital Flight from Russia’ International Economic Policy Review 2 (2000). 141-156; http://www.imf.org/external/pubs/ft/iepr/2000/vol.2.

Martines-Zarzoso. I. and C. Suarez Burguet. 2000. 'Measurement of Exports Prices and Changes in Product Quality' in International Advances in Economic Reseach. vol 6. no 4.

Pöschl. Joesef et.al. 2002. ‘Transition Countries Face Up to Global Stagnation: Is it Catching?’. *Research Reports* No.. 283. Vienna: The Vienna Institute for Comparative Economic Studies. February 2002.

Sheets. N. 1995. Capital Flight from the Countries in Transition. International Finance Discussion Paper. No. 514. International Finance Cooperation. Washington D.C.

Tikhomirov. V. 1997. Capital flight from Post-Soviet Russia. Europe-Asia Studies. Vol. 49. No. 4. 591-615.

Annex

Table A:

CN-Chapters analysed (2-digit overview)

70 GLASS AND GLASSWARE
71 NATURAL OR CULTURED PEARLS. PRECIOUS OR SEMI-PRECIOUS STONES. PRECIOUS METALS. METALS CLAD WITH PRECIOUS METAL. AND ARTICLES THEREOF; IMITATION JEWELLERY; COIN
72 IRON AND STEEL
73 ARTICLES OF IRON OR STEEL
74 COPPER AND ARTICLES THEREOF
75 NICKEL AND ARTICLES THEREOF
76 ALUMINIUM AND ARTICLES THEREOF
78 LEAD AND ARTICLES THEREOF
79 ZINC AND ARTICLES THEREOF
80 TIN AND ARTICLES THEREOF
81 OTHER BASE METALS; CERMETS; ARTICLES THEREOF
82 TOOLS. IMPLEMENTS. CUTLERY. SPOONS AND FORKS. OF BASE METAL; PARTS THEREOF OF BASE METAL
83 MISCELLANEOUS ARTICLES OF BASE METAL
84 NUCLEAR REACTORS. BOILERS. MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF
85 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
86 RAILWAY OR TRAMWAY LOCOMOTIVES. ROLLING-STOCK AND PARTS THEREOF; RAILWAY OR TRAMWAY TRACK FIXTURES AND FITTINGS AND PARTS THEREOF; MECHANICAL. INCLUDING ELECTRO-MECHANICAL. TRAFFIC SIGNALLING EQUIPMENT OF ALL KINDS
87 VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING-STOCK. AND PARTS AND ACCESSORIES THEREOF
88 AIRCRAFT. SPACECRAFT. AND PARTS THEREOF
89 SHIPS. BOATS AND FLOATING STRUCTURES

Table B:

EU balance of trade with France and selected CEE countries in chapters 70-89. 1997
- in 1.000 ECU -

CN chapter	Russia	France	Poland	Czech Rep.	Hungary	Bulgaria
70	103289	135340	61383	-166420	26466	-6925
71	-993809	271227	-81815	12896	9088	-588
72	-1086989	-272667	-73276	-155753	-23939	-267649
73	506879	968602	-48243	-222713	94157	10635
74	-1604352	81125	-502719	25385	29384	-106149
75	-729387	72274	5526	12645	7139	-1992
76	-1295131	443563	169437	21330	-212418	26861
78	-10255	-1046	-6371	6909	3116	-25611
79	-37161	-181733	-24374	4625	8098	-31420
80	-29411	9146	791	926	1715	-573
81	-199961	556	5544	-16429	4893	-125
82	91782	327541	91764	37052	46327	598
83	101929	393359	162880	56615	76864	9496
84	4417288	6890448	4023304	1622368	-188732	145530
85	2400235	2263321	1126282	1121238	179919	84628
86	43618	-175610	43	-37876	-1340	6527
87	1378552	-4493328	1797663	152235	921665	122741
88	129739	1054286	-859	5844	19408	1412
89	84457	136404	-56398	-9159	1293	-3412

Source: Eurostat. 2002.

Table C:

EU balance of trade with Norway. Russia and selected countries in chapters 2709 and 2710. 1997
- in 1.000 ECU -

Partner countries	Norway	Algeria	Libya	Nigeria	Saudi Arabia	Syria	Russia
270900	-13825.9	-2405.6	-6136.9	-3830.1	-8651.1	-1607.1	-6965.8
2710	-533.1	-1142.1	-914.9	40.2	-160.7	-47.7	-2803.9

Source: Eurostat. 2002.