Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

04-Sep-2006
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English text only

ECONOMICS DEPARTMENT

ASSESSING RUSSIA'S NON-FUEL TRADE ELASTICITIES: DOES THE RUSSIAN ECONOMY REACT "NORMALLY" TO EXCHANGE RATE MOVEMENTS?

ECONOMICS DEPARTMENT WORKING PAPERS No. 510

by

Christian Gianella and Corinne Chanteloup

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JT03212997

ABSTRACT/RESUMÉ

**Assessing Russia's non-fuel trade elasticities: Does the Russian economy
react "normally" to exchange rate movements?**

This paper attempts to assess the impact of exchange rate movements on Russian import and non-fuel export performance, using an error correction model. The estimation of trade equations shows that long-run price elasticities for imports and non-fuel exports are close to 0.6 and 0.7 respectively, hence relatively similar to those obtained for OECD countries. The Marshall-Lerner condition clearly holds. More precisely, we find that a 10% real appreciation (depreciation) of the currency leads on average to a non-fuel current account deterioration (improvement) of around 1% of GDP. Moreover, the short-term dynamics of the error correction model indicate that the response of the trade balance to exchange rate shocks is rapid, the adjustment being almost complete after one quarter. Finally, the evolution of import prices and non-fuel export prices of Russia, relatively to its competitors on domestic and third markets, suggests that the Russian economy lost already in 2004 the price-competitiveness advantage it had gained after the 1998 crisis.

JEL Classification: C22, F19, P27, O11

Keywords: Russia; foreign trade; non-fuel trade balance; exchange rate; price elasticities; price-competitiveness; cointegration.

**Évaluation des élasticités-prix du commerce extérieur hors hydrocarbures en Russie : l'économie
russe réagit-elle "normalement" aux mouvements de taux de change?**

Cette étude vise à évaluer l'impact des mouvements du taux de change sur les importations et les exportations hors hydrocarbures de la Russie, à partir d'un modèle à correction d'erreur. Les estimations d'équation de commerce extérieur montrent que les élasticités-prix de long terme pour les importations et les exportations hors hydrocarbures se situent respectivement autour de 0.6 et 0.7, soit des valeurs similaires à celles obtenues pour les pays membres de l'OCDE. La condition de Marshall-Lerner est clairement vérifiée. Plus précisément, une appréciation (dépréciation) réelle de 10% du taux de change conduit à une dégradation (amélioration) de la balance courante hors produits pétroliers d'environ 1%. Par ailleurs, la dynamique de court terme du modèle à correction d'erreur indique que la réponse de la balance commerciale aux chocs sur le taux de change est rapide, l'ajustement étant quasiment achevé après un trimestre. Enfin, l'évolution des prix à l'import et à l'export – hors hydrocarbures – de la Russie, relativement à de ses concurrents sur les marchés domestiques et tiers, suggère que l'économie russe a épuisé dès 2004 l'avantage de compétitivité-prix qu'elle avait gagné après la crise de 1998.

JEL Classification : C22, F19, P27, O11

Mots clés : Russie; commerce extérieur; balance commerciale hors hydrocarbures ; taux de change; élasticité-prix ; compétitivité-prix ; cointégration.

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ASSESSING RUSSIA'S NON-FUEL TRADE ELASTICITIES: DOES THE RUSSIAN ECONOMY REACT "NORMALLY" TO EXCHANGE RATE MOVEMENTS?

by

Christian Gianella and Corinne Chanteloup[1]

Introduction and summary

1.   This paper attempts to assess the impact of exchange rate movements on Russian trade performance. On the back of high oil prices and large foreign exchange inflows, the rouble appreciated markedly between 2000 and 2005 (by around 9% per year in real terms for the CPI-based real effective exchange rate), while import growth rates reached, and remained at, a very high level (averaging 18% per year in volume terms since 2001). Although part of the real appreciation may be seen as a catching-up process reflecting faster productivity gains in the tradable sectors (the Balassa-Samuelson effect), the difficulties confronting the manufacturing sector are growing, as indicated by production, employment and export performance. Given the already very narrow range of Russia's revealed comparative advantages (OECD, 2004), this deterioration in cost-competitiveness raises serious concerns about prospects for diversifying Russia's production and export structure if real appreciation continues at such a rapid pace.

2.   One of the questions that naturally arises in view of the growing difficulty of the manufacturing sector is whether the rouble is overvalued or not. No consensus has yet emerged. In the Russian case, analysis of the fundamentals is indeed hampered by the high degree of uncertainty regarding future oil price developments. At the aggregate level, several straightforward measures of an "equilibrium exchange rate", derived from the comparison of relative prices and relative incomes or the evolution of unit labour costs over time, hardly suggest an overvalued rouble (see IMF, 2005 or Westin, 2005). Relying on a more comprehensive model, which considers exchange-rate movements alongside productivity trends, the net flow of foreign assets and real oil prices,[2] Égert (2005) concludes that the rouble was close to equilibrium in 2003. Of course, the equilibrium exchange rate would have strengthened since then on Égert's methodology, but unless it has risen very rapidly indeed, his result would imply that the rouble is now at least slightly overvalued.

3.   One widely used alternative approach would define the equilibrium exchange rate as the real effective exchange rate that is consistent with a sustainable external position, the so-called Fundamental

2.   The underlying econometrics relies on the Balassa-Samuelson framework, but incorporated in a broader approach, the so-called "stock-flow" approach developed by Faruqee (1995).

Equilibrium Exchange Rate (FEER).[3] Focusing on the current account, however, is pointless in the case of Russia, precisely because real appreciation goes hand in hand with a growing external surplus, both of which are driven by rising commodity prices.[4] Therefore, any attempt to assess an equilibrium exchange rate at the aggregate level is fraught with difficulty. Computing competitiveness or real effective exchange rate (REER) indicators at a more disaggregated level, excluding the fuel sector, hence appears to be more relevant when assessing the pressure from foreign competitors on the Russian economy. Plekhanov (2005) has thus built an industry-related exchange rate and matched it with firm-level data. He finds that profitability and sales are positively correlated with exchange-rate depreciation.[5]

4.   Following the same underlying logic, this paper focuses on the response of the non-fuel trade balance to exchange rate movements, using both the relative non-fuel export prices of Russia *vis-à-vis* its competitors on third markets and relative import prices as real exchange rate indicators. Not surprisingly given the peculiar commodity structure of Russian trade, little empirical work on export and import price elasticities is available. It is sometimes argued that the relatively low level of diversification of the Russian economy and the high share of natural resources in exports "softens" the impact of exchange rate movements on trade performance, because goods produced in Russia would be complementary rather than substitutes to goods produced abroad (Sosunov and Zamulin, 2004; Westin, 2005). The estimation of trade equations conducted in this paper, using an error-correction model, does not support this view: long-run price elasticities for imports and non-mineral exports are found to be close to 0.6 and 0.7 respectively. The Marshall-Lerner condition clearly holds[6] and the short-term dynamics of the empirical model show that the non-fuel trade balance adjusts rapidly to exchange rate movements.

5.   In a second step, these estimations are used to assess the direct impact of changes in price competitiveness on the trade balance. We find that exchange rate movements were the major factor behind the trade balance improvement after the 1998 crisis. After a prolonged period of real appreciation, however, Russia lost its price-competitiveness advantage in 2004. This translated into a gradual deterioration of the non-fuel trade balance from 2000 to 2005. More precisely, we find that a 10% real appreciation (depreciation) of the currency[7] has led on average to a non-fuel current account deterioration (improvement) of around 1% of GDP. During the most recent period, however, booming oil export revenues have more that compensated for this trend, leading to a growing current account surplus. Compared with the situation in 1996, the trade balance improvement is in fact entirely due to oil-related revenues.

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3.   This approach was introduced by Williamson (see Williamson 1983 and 1994). It combines the realisation of a current account target (the external equilibrium) and an internal equilibrium condition (basically that production is at its potential).

4.   Therefore, at current oil prices, a very large rouble appreciation might occur before current account sustainability was in question.

5   In particular, the rapid appreciation of the rouble against the US dollar has had a greater negative impact on light manufacturing industry – which is in direct competition with China – whereas the exchange-rate pressure on the chemical industry has grown during phases of appreciation against the euro.

6.   I.e. the Russian trade balance improves (deteriorates) in case of real depreciation (appreciation).

7   Calculated on a CPI-based real effective exchange rate. Using a PPI or ULC-based real effective exchange rate would give similar sensitivity (OECD, 2006, shows that over long period all these indicators have evolved in a very similar pattern and been essentially driven by the movement of the nominal effective exchange rate).

Patterns of trade and specialisation

6.   Over the last decade Russia's export structure has not shown a tendency towards greater diversification. On the contrary, it has, in value terms, become increasingly dominated by commodities and basic metals. Hydrocarbons and metals account now for 82% of total export revenues – 85% for exports to non-CIS countries (Table 1). The rise in the share of oil and natural gas stems largely from an extremely favourable terms-of-trade shift. The prices of fuel products rose some 2.4-fold in dollar terms between 1996 and 2005.[8] Growth in volume terms, however, was held back by stagnating gas exports: whilst the volume of crude oil exports doubled, the overall export growth of fuel products was limited to approximately 70%. On the other hand, exports of non-mineral products more than doubled over the same period.[9] This latter trend was more pronounced during 1996-2000, particularly as non-fuel exports picked up after the crisis. After 2000, the growth of crude oil export volumes accelerated sharply,[10] with the result that exports of fuel and non-fuel products grew at roughly similar rates in volume terms (see Figure 1). The growth of non-mineral exports, however, was much more pronounced in trade with CIS countries, whose share in Russian non-mineral exports grew by 6 percentage points (Table 1).

Table 1. Exports of goods
Percentage of total exports

	Non-CIS			CIS			Total		
	1995	2000	2005	1995	2000	2005	1995	2000	2005
Foodstuffs and agricultural raw materials (excluding textile)	1.5	1.0	1.1	2.8	5.3	7.1	1.8	1.6	1.7
Mineral products	40.4	54.5	67.5	51.8	49.1	41.9	42.6	53.8	65.0
Oil			35.4			24.0			34.3
Oil products			15.5			5.8			14.6
Gas			n.a			n.a			13.2
Coal			1.5			2.8			1.6
Chemical products. rubber	9.9	6.7	5.5	10.8	10.2	9.7	10.0	7.2	5.9
Leather raw materials, fur	0.5	0.3	0.1	0.2	0.3	0.0	0.4	0.2	0.1
Wood, pulp-and-paper products	6.1	4.5	3.4	3.3	3.0	4.3	5.6	4.4	3.5
Textiles, textile articles and footwear	1.3	0.6	0.2	2.3	2.0	0.9	1.4	0.8	0.3
Metals, precious stones	30.7	23.5	17.7	9.1	10.4	12.4	26.7	21.7	17.2
Ferrous metals			7.9			6.2			7.7
Non-ferrous metals			6.6			5.7			6.5
Gems and precious metals			3.2			0.5			2.9
Machinery, equipment and transport means	8.3	7.5	3.6	18.2	17.0	21.1	10.2	8.8	5.3
Others	1.3	1.4	0.9	1.5	2.7	2.5	1.3	1.6	1.0
Total exports (US$ billions)	63.7	89.3	208.8	14.5	13.8	32.6	78.2	103.1	241.4
share	*81.5*	*86.6*	*86.5*	*18.5*	*13.4*	*13.5*	*100*	*100*	*100*
Exports excluding minerals (US$ billions)	38.0	40.6	67.9	7.0	7.0	18.9	44.9	47.6	86.8
share	*84.6*	*85.4*	*78.2*	*15.6*	*14.8*	*21.8*	*100*	*100*	*100*

Note : Decompostion of trade is calculated without Belarus (italicised figures).
*Source* : Federal Customs Service

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8.   Export prices for other goods and services fell by around 20% in dollar terms.

9.   According to Rosstat data, the global increase in exports was just below 90% at constant prices.

10   +70% between 2000 and 2005.

7.   While relative price movements may partly explain the decline in the manufacturing share in total exports since the mid-1990s,[11] recent developments indicate that the tradable sector faces some growing competitive pressure as the rouble appreciates. In particular, exports of machinery, equipment and vehicles decreased by 4.5% in 2005, while imports of the same increased by 40%. The share of this sector in total imports has increased steadily since the mid-1990s (Table 2), a tendency which may be viewed to some extent as encouraging given the need to modernise the capital stock, but this growth has accelerated since 2003.

Figure 1. Increase of export revenues by commodities
Percentage change, 2000-2005
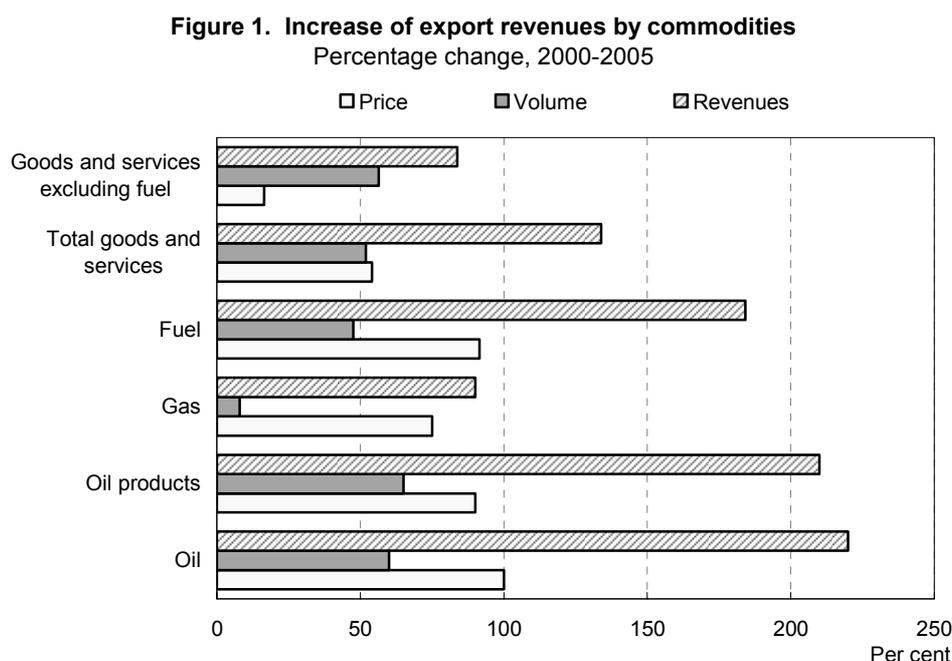
Source : Central Bank of Russia, Federal Service for State Statistics and OECD calculations.

8.   The analysis of revealed comparative advantages (RCA) at a more disaggregated level further highlights the concentration of Russia's export structure (see OECD, 2004). Apart from the two main sources of export revenues, hydrocarbons and metals, Russia exhibits a limited degree of specialisation only in power machines, cork and wood, and fertilisers.[12] On the other hand, Russia has strong comparative *dis*advantages in the broader sector of investment goods, electronic consumer goods, cars and pharmaceuticals. Moreover, these relative disadvantages have deteriorated significantly since 2000.

9.   Apart from the recent rouble appreciation, Russian trade has also been affected by the emergence of East-Asian countries, particularly China, as major competitors. Asia doubled its market share in Russia between 2000 and 2004 (Table A1 in appendix). This shift occurred mainly to the detriment of CIS countries, which now account for less than one-fourth of total Russian imports (as against one third in 2000). Coupled with the relatively more dynamic growth of non-fuel exports to CIS countries, the evolution of trade patterns by region would suggest that, at the present level of the exchange rate, Russian tradable sectors may have maintained some competitive advantages *vis-à-vis* CIS countries, while struggling much more to compete with Western European and Asian economies, given the existing quality differential.

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11.   Non-fuel exports also declined relative to GDP (below 17% in 2004, while the average over the whole period is 20%).

12.   Arms could probably be added to the list (OECD, 2004).

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Table 2. Imports of goods
Percentage of total imports

	Non-CIS			CIS			Total		
	1995	2000	2005	1995	2000	2005	1995	2000	2005
Foodstuffs and agricultural raw materials (excluding textile)	29.4	23.8	17.0	25.2	17.9	20.7	28.3	21.8	17.5
Mineral products	2.9	1.7	0.9	15.1	15.1	16.7	6.2	6.3	3.2
Chemical products, rubber	11.4	20.7	17.9	9.6	12.6	11.8	10.9	17.9	17.0
Leather raw materials, fur	0.4	0.3	0.3	0.3	0.4	0.0	0.2	0.4	0.3
Wood, pulp-and-paper products	3.0	4.5	3.4	0.8	2.5	2.8	2.4	3.8	3.3
Textiles, textile articles and footwear	4.7	3.9	3.3	7.9	9.8	3.5	5.8	5.9	3.3
Metals, precious stones and articles	5.0	4.9	5.4	16.9	14.8	20.9	8.6	8.3	7.6
Machinery, equipment and transport means	38.7	36.3	48.2	21.3	22.1	21.6	33.6	31.4	44.4
Others	4.5	3.8	3.7	2.9	4.8	1.9	4.1	4.1	3.4
Total imports (%)	70.9	65.7	80.8	29.1	34.3	19.2	100	100	100

Note : Decompostion of trade is calculated without Belarus.
Source : Federal Customs Service.

Trade performance and competitiveness

Trade equations

10.   The main objective of the paper is to assess the response of non-fuel trade volumes to changes in relative competitiveness. It has sometimes been argued that goods produced in Russia are complementary rather than substitutes to goods produced abroad and that trade flows would therefore be inelastic to exchange rate movements. The rapid improvement of the non-fuel trade balance after the 1998 crisis, which returned to positive territory after having reached a deficit of more than 7% of GDP, would tend to indicate on the contrary a rather high price elasticity of trade. As shown in Figure 2, the trade balance excluding exports of oil, oil products and natural gas – that is, excluding around 42% of exports of goods and services – exhibits a fairly close correlation with real exchange rate movements over the whole period 1994-2004. Moreover, the adjustment of the trade balance to exchange rate shocks seems to be relatively fast.

11.   Little empirical work has in fact been done on trade elasticities, owing in particular to the pre-eminence of commodities on the export side. Focusing on the export side, and excluding fuel products, Algieri (2004) finds surprisingly high income and price elasticities, respectively around 3.3 and 2.4. His estimates are, however, based on monthly export values, for which no deflator is available.[13] Regarding the import side, Belomestnova (2002) finds a fairly standard value for the elasticity of imports with respect to the real exchange rate, at around -2/3.

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13.   There is in this case no opportunity to control for the exchange rate impact on export prices.

Figure 2. Non-fuel balance of goods and services and REER
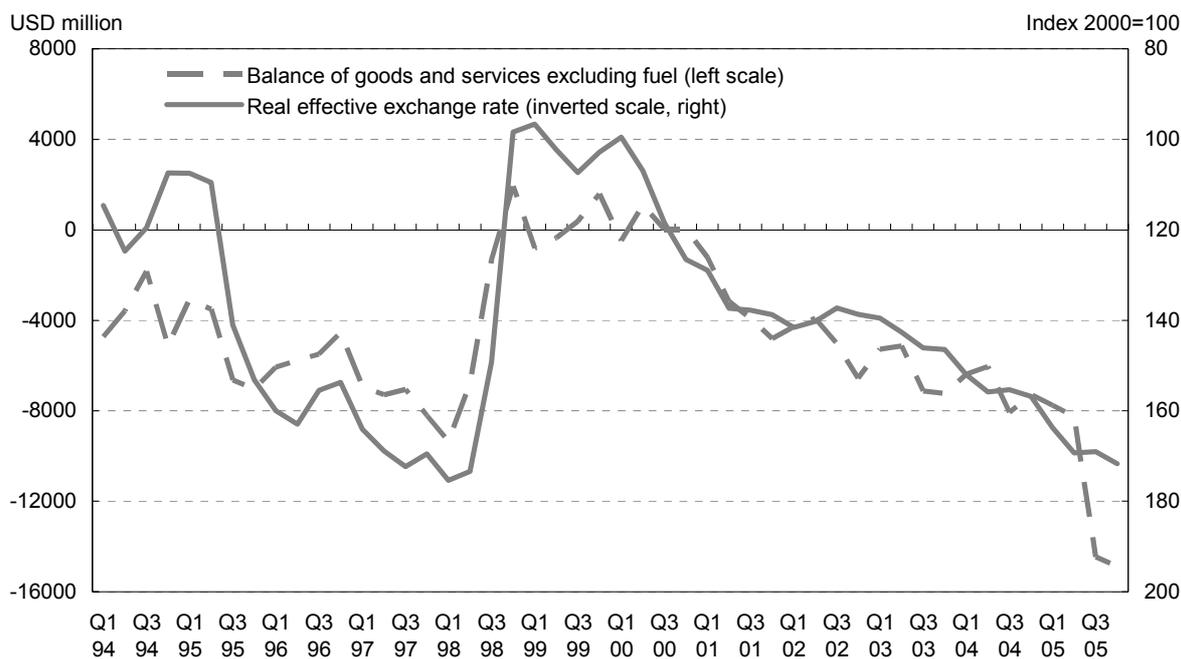
Source : Central Bank of Russia and IMF, *International Financial Statistics* .

12.   Traditional trade equations are based on the imperfect substitution model between differentiated consumer goods, which means that finite price elasticities can be estimated for the demand and supply of these goods (see Goldstein and Kahn, 1985 or Hooper, Johnson and Marquez, 2000). Empirical studies of trade usually focus on the demand side only, where export and import growth is explained by changes in foreign and domestic demand and by an indicator of competitiveness. If it is assumed that price elasticity on the supply side is infinite, the relationship between quantity of exports (or imports) and relative prices is indeed determined exclusively by the demand equations. If supply–price elasticity is not infinite, which is likely to be the case, specific econometric methods need to be used in order to correct for potential simultaneity bias. In this paper, we follow the same approach as Algieri (2004), using cointegration analysis.

Non-fuel export volumes

13.   As pointed out in the previous section, Russia's export structure is highly commodity intensive. This has to be taken into account in the estimation of export performance, as in the case of fuel products, the behaviour of trade flows is not adequately described by the imperfect substitution model. By contrast, oil and gas exports depends largely on a range of different factors like the discovery of new fields, the strategy towards foreign investment and the degree of privatisation (see *e.g.* Ahrend and Tompson, 2006). Hence, as observed also in the case of Russia, the link between supply and competitiveness is likely to be weak. For this reason, a deliberate choice has been made to exclude oil, oil products and natural gas from the export equation. The latter hence takes the following form:

$$X_{nonoil} = (ExtD_{nonoil})^{\eta_X} (CompetX_{nonoil})^{\varepsilon_x} \tag{1}$$

where X_{nonoil} denotes the export volume of goods and services excluding oil and natural gas, $ExtD_{nonoil}$ is the non-oil import volume of Russia's trade partners and $CompetX_{nonoil}$ an indicator of export

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competitiveness for non-oil and gas products. In a two-country model, the indicator of competitiveness could be written as ep_x^* / p_X, with e the nominal exchange rate, p_x^* the export price of competitors and p_X the Russian non-fuel export price. In a multi-country model, the foreign price p_x^* is calculated as the competitor's price on a third market, using a double weighting system.[14] The elasticity of exports with respect to external demand (η_x) and competitiveness (ε_X) is assumed to be constant.

Import volumes

14.   The import equation links import volumes to final domestic demand and the price of imported goods relative to domestically produced ones, respectively with the elasticity η_M and ε_M :

$$M = (FinalD)^{\eta_M} (CompetM)^{-\varepsilon_M} \tag{2}$$

where $CompetM = \dfrac{p_M}{p}$, with p_M the price of imports expressed in domestic currency.

Data

15.   The empirical work has been undertaken using a quarterly data set covering 1995–2004 inclusive. While data on import volumes and prices for goods and services are directly available from the Federal Service for State Statistics (Rosstat), the construction of the main variables of interest for the non-oil export equation required information from a variety of sources: the Central Bank of Russia for the exports of non-oil goods and services, Rosstat and *Russian Economic Trends* data for Russian export prices (respectively for overall goods and services and hydrocarbon prices), COMTRADE for trade market share and non-oil imports of Russian partners, IFS data for the quarterly deflator in export markets and World Bank data for export prices in third markets[15] (see appendix for a detailed description of the variables).[16] The structure of export of goods and services once fuel exports are excluded is still relatively commodity intensive, since the share of metal and precious metal slightly exceeds one third (Figure 3). This peculiarity will have to be taken into account to some extent when interpreting the results, as the demand–price elasticity for basic metals is likely to be lower than for other tradable goods. This mean that the value of the parameter (ε_X) is potentially an average of rather heterogeneous elasticities for the range of goods and services Russia exports.[17]

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14.   See Annex C for the detailed construction of the competitiveness indicators. In theory, for the export price model, the foreign price should indeed be calculated as the competitor's price on a third market, using a double weighting system and the competitor's market share on a third market. As the construction of such an indicator is subject to data constraints (most of the price indexes are not available on a quarterly basis) and in order to check robustness of the relationship, we also used as a proxy the prices on the foreign market. Results for both indicators, where available, do not differ that much.

15.   The latter data were only available on an annual basis. The quarterly profile has been calculated according to domestic prices in the country where the competition for exports takes place.

16.   Data were seasonally adjusted using X-12 ARIMA.

17.   It is, however, worth noting that, in contrast to basic metal extraction, metal processing activities are probably much more sensitive to exchange-rate fluctuations, as quality differentiation between products leaves more scope for imperfect price competition. Afontsev (2006) finds for example that exports of aluminium products are much more affected by real appreciation than exports of basic aluminium.

Figure 3: Structure of Russian exports, 2004
(goods and services excluding fuel exports)
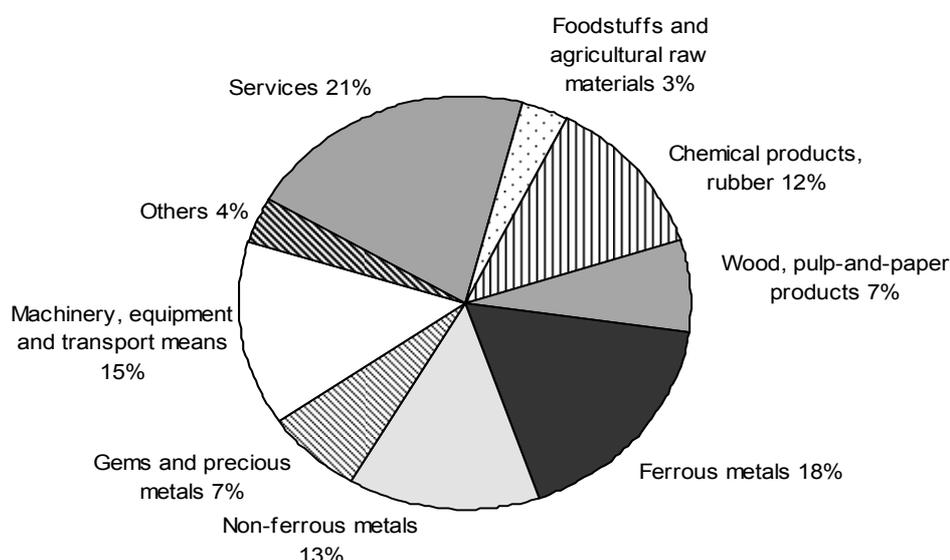
Source : Federal Customs Service

Empirical results

16.   First, the structural long-term relationship has been estimated in level according to the method developed by Stock and Watson (1993), after having checked that the variables of interest are indeed integrated of order one.[18] The Stock and Watson methodology for estimating cointegration relations allows the interpretation of the t-statistics.[19] The stationarity of the residuals is then ascertained in a second step. The main results are summarised in Table 3:

- Trade elasticities have the expected sign and are highly significant.

- Elasticity with respect to external market size (η_x) is close to one. A unitary elasticity actually means that Russian market share abroad does not depend on the size of the foreign market. The empirical result is thus in line with what theoretical arguments would predict.

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18.   Using both the augmented Dickey Fuller test and the Kwiatkowski, Philips, Schmidt and Shin test.

19.   This method allows us to correct for the potential correlation between regressors and the error term. For example, let assume (y_t, x_t) is a vector of cointegrated variables verifying the following relations:

$$\begin{cases} y_t = \beta x_t + \varepsilon_t \\ x_t = x_{t-1} + \eta_t \end{cases}$$ where the residuals ε_t and η_t are correlated.

The solution proposed by Stock and Watson is to correct for the correlation by isolating the projection from ε_t over η_t and estimate the model $y_t = \beta x_t + \sum_{i=-p}^{i=p} \gamma_i \Delta x_{t+i} + \widetilde{\varepsilon}_t$. They show that the t-statistics conform to standard probability laws where p is high enough. In the regression shown in table 3, we took p=3.

- Results for the estimates of (η_M), the elasticity of imports with respect to domestic demand, appear to be highly dependent on the inclusion (or exclusion) of a deterministic trend. While the presence of a trend would capture the gradual integration of Russia in world trade, it can also be argued that imported goods in Russia have the characteristics of "luxury" goods, which could explain why the elasticity (η_M) is much higher than one. In theses circumstances, it is not easy to discriminate between specifications on theoretical grounds.

- Fortunately, the price elasticities estimates – which are the main variable of interest – are much more stable. The estimate of the value of ε_X appears in particular to be precise and robust. Moreover, the estimate of ε_M is not much affected by the inclusion or not of a deterministic trend.

- The price elasticities ε_X and ε_M are relatively high at around 0.75 and 0.6, respectively, for the average estimate, thus satisfying the standard Marshall-Lerner condition.

Table 3. Trade equations: cointegration relations

		Non-fuel export			Import	
		No trend	trend		No trend	trend
Demand elasticity	η_x	0.98	1.06	η_M	1.60	0.88
		[6.75]	[3.32]		[6.64]	[4.77]
Price elasticity	ε_X	0.74	0.75	ε_M	0.53	0.67
		[9.19]	[7.58]		[4.94]	[14.39]
trend		-	-0.0016		-	0.009
			[0.06]			[4.50]

Note: t-statistics in brackets
Source: Authors' calculations

17.   In a second stage, the error-correction model (ECM) approach has been used, allowing a simultaneous estimation of the short-term dynamics and the long run relationship. Different specifications are tested, in particular for the import equation, which is highly sensitive to the presence of a deterministic trend. Furthermore, we systematically conduct estimations for which unitary demand elasticity is imposed in the long run. As stated before, these restrictions on the coefficients η_x and η_M mean that exports and imports increase by 1% if external demand or final domestic demand rise by 1%. In general, the ECM confirms the previous long-run estimates for both price elasticities, although the value for the export price elasticity is found to be slightly lower. The explanatory power of the export equation is weaker,[20] but the short-run dynamics are highly consistent with the long-run relationship (Box 1). For the import equation, the short-run dynamics are less satisfactory when a deterministic trend is added (Box 2). It is, however, worth noting that the price elasticity of imports has about the same value in the short term as in the long term. This once again highlights the high speed of adjustment to an exchange-rate shock (most of the adjustment takes place in a quarter). For the main parameters of interest, ε_X and ε_M, we will finally retain

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20.   A dummy variable has been added to the export model just after the beginning of the 1998 crisis. The actual volume of exports is too low in this quarter and this comes from an export price deflator in the Rosstat data that is apparently too high (for example in comparison with the exchange rate depreciation).

the value of 0.7 and 0.6 respectively, taking as a benchmark the estimation given in Table 3. The elasticity of non-fuel exports ε_X might appear somewhat larger than expected, given the large share of non-fuel commodity exports. On the other hand, the share of high value added goods is however very low. This means that, in comparison with countries exporting high value added goods, Russian exports of non-commodity goods and services are in general less differentiated and thus more subject to price competition. This should imply a higher elasticity of exports (Algieri 2004).[21] Finally, the results we obtain here are perfectly coherent with the movements of the trade balance described in Figure 2, which clearly indicate that the Marshall-Lerner condition must hold.

Box 1. Export equation: empirical results

Without restriction

$$d \ln(X_{nonoil}) = \underset{(0.53)}{0.18} + \underset{(3.25)}{0.61} . d \ln(ExtD_{nonoil}) + \underset{(2.90)}{0.53} d \ln(CompetX)$$

$$- \underset{(1.60)}{0.06} * 1_{98q4} - \underset{(4.14)}{0.56} \left[\ln(X_{nonoil})_{-1} - \underset{(6.28)}{0.95} . \ln(ExtD_{nonoil})_{-1} - \underset{(5.20)}{0.64} . \ln(CompetX)_{-1} \right]$$

R²=0.48   SE=0.04   DW=2.11

With restriction

$$d \ln(X_{nonoil}) = \underset{(1.86)}{0.07} + \underset{(3.38)}{0.62} . d \ln(ExtD_{nonoil}) + \underset{(2.93)}{0.52} d \ln(CompetX)$$

$$- \underset{(1.60)}{0.06} * 1_{98q4} - \underset{(4.19)}{0.55} \left[\ln(X_{nonoil})_{-1} - \ln(ExtD_{nonoil})_{-1} - \underset{(9.23)}{0.61} . \ln(CompetX)_{-1} \right]$$

R²=0.47   SE=0.04   DW=2.12

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18.   The coherence between short- and long-run elasticities is a sign of robustness, but one may wonder if such relations have been stable over time, particularly after the 1998 crisis. Given the limited length of the time series, the usual stability tests (Chow tests) are not particularly relevant here. The behaviour of the ECM equations has therefore been tested over a short sub-period, from the second quarter of 1999 (just after the crisis) to 2004. The explanatory power becomes very low for the export equation and the long-run relationship in level in the ECM equation becomes hardly significant. An estimation of the long-run cointegration relation using the Stock and Watson methodology over 1999-2004, however, confirms the stability of the values of both elasticities η_x and ε_X. For the import equation, coefficients remain significant in an ECM specification at the 5% level and, above all, no dramatic change of the parameters of interest is observed.

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21.   Algieri (2004) finds a very high elasticity for non fuel Russian exports, 2.4, but his estimates are based on nominal exports and not export volumes.

Box 2. Import equation: empirical results

With a trend, without restriction

$$d\ln(M) = \underset{(0..38)}{-0.25} - \underset{0.11}{0.03}\,d\ln(FinalD) - \underset{(8.65)}{0.63}\ln(CompetM) - \underset{(4.02)}{0.09}*1_{98q2}$$

$$- \underset{(5.38)}{0.68}\left[\ln(M)_{-1} - \underset{(3.77)}{0.87}\ln(FinalD)_{-1} + \underset{(9.78)}{0.63}\ln(CompetM)_{-1} - \underset{(4.71)}{0.009}*trend\right]$$

R²=0.89   SE=0.02   DW=2.19

With a trend, with restriction

$$d\ln(M) = \underset{(3.32)}{-0.62} + \underset{(0.26)}{0.05}\,d\ln(FinalD) - \underset{(10.66)}{0.61}\,d\ln(CompetM) - \underset{(4.25)}{0.09}*1_{98q2}$$

$$- \underset{(5.38)}{0.68}\left[\ln(M)_{-1} - \underset{c}{\ln(FinalD)_{-1}} + \underset{(9.78)}{0.63}\ln(CompetM)_{-1} - \underset{(4.71)}{0.009}*trend\right]$$

R²=0.89   SE=0.02   DW=2.11

Without trend, without restriction

$$d\ln(M) = \underset{(6.67)}{-1.04} + \underset{(3.40)}{1.41}\,d\ln(FinalD) + \underset{(2.66)}{0.52}\,d\ln(FinalD)_{-1} - \underset{(6.13)}{0.51}\,d\ln(CompetM)$$

$$- \underset{(3.14)}{0.08}*1_{98q2} + \underset{(2.24)}{0.14}*1_{98q4} - \underset{(2..33)}{0.35}\left[\ln(M)_{-1} - \underset{(5.77)}{1.47}\ln(FinalD)_{-1} + \underset{(5.18)}{0.59}\ln(CompetM)_{-1}\right]$$

R²=0.85   SE=0.02   DW=2.36

Exchange-rate movements and trade balance

Competitiveness and trade balance movements

19.   Thanks to the estimation of the long-run trade elasticities ε_X and ε_M, it is possible in a second stage to measure the direct impact of price competitiveness on the trade balance itself. The methodology simply consists of decomposing the variations in the overall trade balance between price and volume movements. More precisely, the changes in the trade balance are expressed as a function of five different factors: fuel exports, a non-fuel terms-of-trade effect, a competitiveness effect on trade volumes, the effect of the initial position of the non-fuel trade balance[22] and finally a residual effect (Annex D). This latter factor includes, non-price competitiveness factors such as quality or delivery time and the difference in business cycles between Russia and its partners.[23] As we focus here on the long-run impact of the exchange

---

22.   If the balance is initially in deficit, an equally rapid increase in the volume of exports and imports would still lead to a deterioration of the trade balance.

23.   As we are not interested here in the effect of demand on trade, this factor is also considered as residual.

rate – and also because of the very high seasonality of the trade balance – the decomposition has been carried out on an annual basis using long-run elasticities (0.7 for ε_X and 0.6 for ε_M).[24]

20.   The results of the decomposition are summarised in Figure 4. The year 1996 is taken as a reference (the current account surplus reached 2.7% of GDP that year) and the cumulative contributions of each of the different factors to the variation of the overall trade balance are represented.[25] Several interesting conclusions may be drawn:

- The first remarkable trend is, as expected, the growing importance of the fuel sector, especially since 2002. The increase in revenues from exports of oil, oil products and natural gas explains almost entirely the relative improvement of the trade balance from 1996 to 2005.

- The improvement after the 1998 crisis, however, was driven initially by gains in competitiveness, which contributed to an increase in the trade surplus of $ 40 billion. Clearly, the Marshall-Lerner condition holds, and the positive volume effect more than offset the negative terms-of-trade effect after the rouble collapse.[26]

- Starting from 2000, real rouble appreciation led to a progressive reduction in the positive contribution of price competitiveness. This deterioration was relatively limited in 2001–02, thanks to a moderation in export price growth in the context of a large drop in external demand,[27] which put pressure on exporters to reduce margins.[28]

- After 2002, the remaining price competitiveness advantage accumulated following the 1998 crisis shrank rapidly and it was exhausted already in 2004, mostly on account of deterioration on the import side. Relative import price competitiveness decreased markedly, which led the already high import growth rate to rise further (from 18% in 2003 to 24% in 2004). In general the exchange-rate pass-through to export prices is much weaker than to import prices. This is hardly surprising given the structure of Russian exports. As a result, import volume movements explain around 2/3 of the competitiveness factor dynamics over the whole period**.**

- As the non-oil trade balance started to deteriorate again after 2001, the growing imbalance led to a growing negative contribution from trade growth (the so-called "initial position" effect: non-oil export earnings covered only around 80% of total imports in 2004).

- Finally, other factors have been rather neutral on average (these factors include differences in the business cycle but also non-price competitiveness), except for 1998, for the reasons already mentioned. In 2004, the performance of the steel sector may have contributed to more dynamic export growth than the equation would have predicted. Steel exports increased in fact by

---

24.   It should be emphasised that the derivation of equation (D5) assumes that the first-order approximation holds in practice. This is, of course, a bold assumption (the same problem would have been encountered for a decomposition conducted on a quarterly basis, given the high seasonality and fluctuations of Russian exports and imports).

25.   In other words, the figure explains the change in the trade balance in comparison with the year 1996.

26.   The reaction was very rapid and a J-curve type of adjustment is hardly observed.

27   As a consequence, there has been for this particular year, a decoupling between real exchange rate changes measured in relative CPI (which continued to appreciate) and relative export price competitiveness (which improved).

28.   In 2002, real appreciation was somewhat weaker and price competitiveness was broadly maintained.

approximately 10% in 2004, against a backdrop of record high prices.[29] In this case, higher export prices were, of course, not a sign of deteriorating competitiveness, but the result of a shift of the demand curve.

Figure 2.6. Cumulative variation of the balance of goods and services compared with 1996 and factor contributions

$ billion
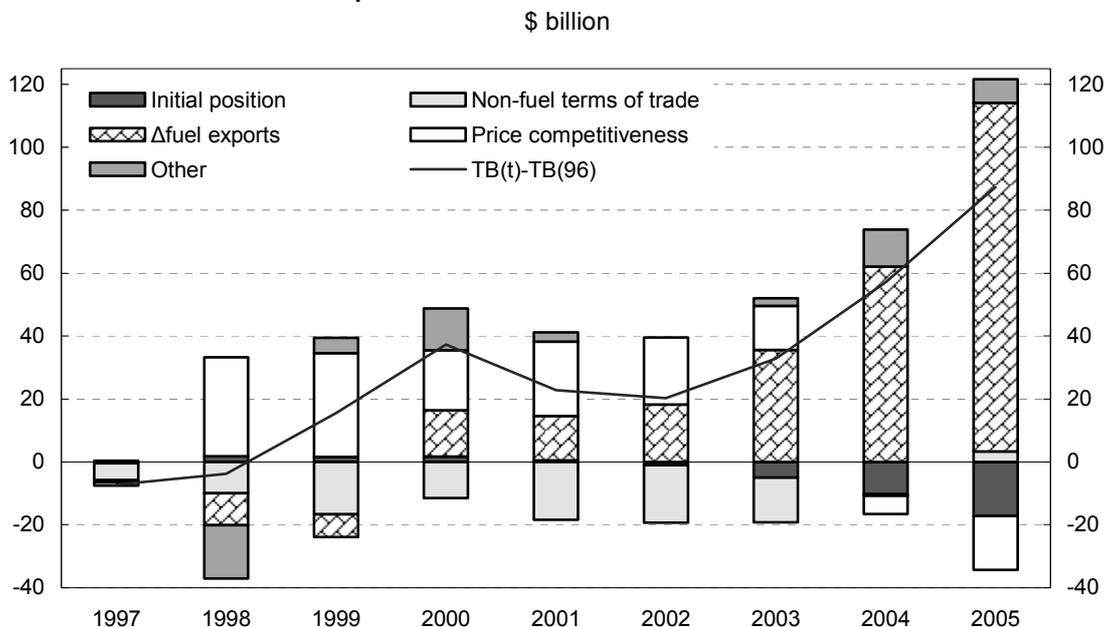
Source: Central Bank of Russia and OECD calculations.

Trade balance sensitivity to rouble appreciation

21.   Ultimately, our estimates of trade elasticity also make it possible to address the issue of the sensitivity of the trade balance to exchange-rate movements. In the current context of rapid REER appreciation, this question is highly relevant for the conduct of exchange rate policy. Using a Marshall-Lerner approach, the impact of the exchange rate on the trade balance, assuming the latter is close to equilibrium, is simply given by the sum of export and import elasticity minus one.[30] The Marshall-Lerner condition needs, however, to be modified to take into account, first, the fact that the initial balance could be in deficit or surplus, and, secondly, the possibility of an incomplete pass-through to trade prices, which occurs when firms are also pricing-to-market (Gust and Sheets, 2006). Under these circumstances, importers and exporters face a trade-off in the price-setting mechanism between indexing their product prices on domestic prices/costs (thus keeping their mark-up constant) and bringing their prices into line with international ones. In such a situation, it is nevertheless straightforward to express the response of the non-fuel trade balance to a variation of the nominal effective exchange rate e (see annex C):

$$\frac{dTB_{nonoil}}{p_m M} = \left[\tau(1 - \gamma + \gamma\varepsilon_x) - \delta(1 - \varepsilon_M)\right]\frac{de}{e} \qquad (3)$$

---

29.   Hot-rolled steel prices rose price from around 300 US $/t in 2003 to 500 $/t in 2004.

30.   As the sum of the elasticities exceeds 1 according to our estimates, this would mean that a rouble depreciation (appreciation) would lead to an improvement (deterioration) of the non-fuel trade balance.

where τ is a cover rate of imports by non-fuel exports, γ the coefficient determining the responsiveness of Russian firms' export prices to marginal cost and δ the elasticity of foreign firms' export price with respect to their marginal costs.[31] The extended Marshall-Lerner condition holds if $[\tau(1-\gamma+\gamma\varepsilon_x)-\delta(1-\varepsilon_M)]>0$.

22.   In the Russian case, the data clearly show that the exchange-rate pass-through to export and import prices is incomplete. Estimation of cointegration relations between the nominal effective exchange rate and trade prices over the period 1996-2004 gives a value of 0.41 for γ and of 0.87 for δ. Not surprisingly given the structure of Russian exports, the pass-through to export prices is much weaker.[32] This confirms what the previous analysis of the trade balance variation showed, namely that exchange rate pass-through to trade went primarily via import prices, which have reacted more to nominal exchange rate variation than export prices. Using the value of the estimated coefficients, it is straightforward to express the trade balance variation in terms of GDP (equation 4 below). A numerical application shows that a 10% real exchange rate appreciation (in CPI terms) would increase the non-fuel trade deficit (of goods and services) as a share of GDP by approximately 1%, given the current ratio of import cover (80%) and the current import share in GDP (22%):[33]

$$\frac{dTB_{nonoil}}{pY}=\frac{dTB_{nonoil}}{p_mM}\frac{p_mM}{pY}\frac{de}{e}=0.1\frac{de}{e} \tag{4}$$

23.   Equation (4) could be used in turn to conduct several simulations, assuming for example the continuation of steady real appreciation or, by contrast, looking at the exchange rate adjustment that would be needed in the event of a dramatic fall in oil prices. A drop in the Brent price to $30 per barrel would, other things being equal, reduce the current account surplus, net of interest rate payments on external debt, to around 4% of GDP,[34] that is below the historical average level of capital flight (around 5% of GDP, see Table 4). If the objective were to bring the sum of the current account surplus – net of interest rate payments – and of capital flight to zero, the exchange rate would then have to depreciate by only 10%.[35] This straightforward example highlights the relatively comfortable buffer from which Russia benefits when it comes to external account sustainability. However, this is not the most appropriate way to look at Russian competitiveness. Table 4 also shows that that the non-fuel trade balance[36] is already below its historical average (–4.5% over the period 1995-2004). The continuation of rapid rouble real appreciation at its current rate (around 8% in 2005) is likely to be very detrimental to the non-fuel and non-metal tradable sector.

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31.   This formula is derived assuming nominal exchange rate fluctuations are not too large. We then can neglect the impact of exchange rate changes on domestic prices (expressed in local currency).

32.   The incomplete pass-through for export prices is likely to be amplified by the nature of Russian exports, as relative prices of Russian exports do not perfectly match the prices of goods consumed on the markets where Russia competes. Prices of goods such as metals or timber are overweighted in Russian export prices, whereas the basket of goods entering the structure of its partners' exports is much more diversified.

33.   The numerical application is conducted with the following values of the parameters: τ=0.8,   δ=0.87,
γ=0.41, ε_X =0.74 and ε_M =0.67 and $\frac{p_mM}{pY}$ =0.22

34.   With interest rate payment at around 1.4% of GDP in 2005.

35.   If interest rate payments on debt are excluded from the current account, the drop in oil prices would have to be even larger in order to generate an increase in net external debt (almost to 25 $ a barrel).

36.   Of the balance of goods and services.

Table 4: Russian Balance of Payments (% GDP)

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Current account	2.7	0.0	0.1	12.6	18.0	11.1	8.4	8.2	10.3	11.1
Non-fuel current account	-6.8	-9.5	-10.2	-3.2	-2.3	-5.9	-7.9	-8.9	-7.0	-8.4
Non-fuel balance G&S	-5.4	-7.3	-5.7	0.4	0.3	-4.3	-5.7	-5.7	-4.6	-5.9
Fuel exports	9.5	9.5	10.3	15.8	20.3	17	16.3	17.1	17.2	19.5
Capital flight	-4.4	-5.0	-6.6	-6.9	-1.5	-5.2	-5.4	-5.5	-5.9	-5.1

Source: Central Bank of Russia

Conclusion

24.   The aim of this paper was to shed some light on the link between competitiveness and the trade performance of the Russian economy. Given the very specific nature of Russian specialisation, mainly in mineral and metal products, we could indeed expect that this link might differ significantly from what is observed in OECD countries. However, once the fuel sector is excluded, the trade equations exhibit rather standard elasticities with respect to price competitiveness. The main peculiarity lies in a weaker link between relative non-fuel export price indicators and exchange rate indicators, which, not surprisingly, is due to the specifics of price-setting for metal products. It implies that most of the adjustment to nominal exchange rate shocks occurs on the import side.

25.   More specifically, the non-fuel export and import price elasticities are found to be respectively close to 0.7 and 0.6. Given the large exchange rate fluctuations, this means that the competitiveness factor was – together with oil prices – one of the main drivers in trade balance movements. The recent deterioration in Russia's competitiveness, analysed from a non-fuel trade balance perspective, would also indicate that the rouble could at its current level hardly be considered undervalued. Moreover, a rule-of-thumb calculation suggests that a 10% real appreciation of the rouble (which is slightly higher than the current annual pace) would reduce the trade balance by 1% of GDP.

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ANNEX A. RUSSIAN FOREIGN TRADE

Table A1 . Russian foreign trade
In percentage

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Exports										
With CIS	**18.5**	**18.4**	**19.5**	**19.0**	**14.8**	**13.4**	**15.9**	**14.6**	**15.5**	**16.5**
of which:										
Ukraine	8.9	9.0	8.5	7.7	6.6	4.9	5.6	5.5	5.7	6.0
With non-CIS	**81.5**	**81.6**	**80.5**	**81.0**	**85.2**	**86.6**	**84.1**	**85.4**	**84.5**	**83.5**
of which:										
European Union	45.3	45.3	46.9	45.2	47.0	52.9	53.2	49.2	51.1	49.8
Germany	7.8	8.0	7.7	8.0	8.5	9.0	9.3	7.5	7.8	7.5
Netherlands	4.1	3.9	5.4	5.5	4.9	4.2	4.4	6.7	6.5	8.6
United Kingdom	4.0	3.8	3.3	4.1	3.9	4.5	3.6	3.5	3.6	3.2
Other European countries	9.2	10.0	10.4	10.4	9.9	9.7	7.9	10.4	10.4	11.1
Switzerland	4.8	4.7	4.4	4.5	4.8	3.9	1.7	5.0	4.4	4.4
Asia	14.6	13.4	12.2	10.5	12.6	11.7	11.4	13.0	13.5	12.8
China	4.4	5.6	4.7	4.4	4.8	5.1	4.6	6.3	6.2	5.6
Japan	4.1	3.5	3.4	3.0	2.9	2.7	2.8	1.7	1.8	2.0
America	9.4	9.0	8.0	11.4	11.4	8.8	7.8	6.9	5.6	5.7
United States	6.6	7.6	5.8	8.4	8.9	7.7	6.8	6.1	4.6	4.7
Africa and Middle East	2.5	2.6	2.5	3.3	3.8	3.3	3.5	4.3	3.9	3.9
Imports										
With CIS	**29.0**	**31.8**	**26.9**	**25.9**	**27.5**	**34.4**	**26.8**	**22.5**	**23.4**	**23.5**
of which:										
Ukraine	14.3	14.1	7.6	7.5	8.3	10.8	9.2	7.1	7.7	8.1
With non-CIS	**71.0**	**68.2**	**73.1**	**74.1**	**72.5**	**65.6**	**73.2**	**77.5**	**76.6**	**76.5**
of which:										
European Union	48.2	43.0	45.5	43.8	42.6	39.0	42.9	47.2	45.9	45.0
Germany	14.1	11.6	12.7	12.6	13.9	11.5	14.0	14.3	14.0	14.0
Netherlands	3.5	2.3	2.3	2.1	2.3	2.2	2.1	2.4	2.2	1.8
United Kingdom	2.4	2.5	2.8	2.8	2.2	2.5	2.4	2.4	2.5	2.7
Other European countries	4.9	4.5	4.9	4.0	3.6	3.4	3.7	3.9	3.9	4.0
Switzerland	1.5	1.1	1.0	1.0	1.0	0.8	1.0	0.9	0.9	0.9
Asia	7.6	8.7	9.3	10.0	9.2	8.8	11.3	13.2	14.8	17.5
China	1.9	2.2	2.4	2.7	2.9	2.8	3.9	5.2	5.8	6.3
Japan	1.6	2.2	1.9	1.9	1.5	1.7	2.0	2.1	3.2	5.2
America	8.1	8.7	10.6	13.1	12.9	11.2	12.2	10.5	9.8	7.9
United States	5.7	6.5	7.8	9.4	7.9	8.0	7.8	6.4	5.2	4.2
Africa and Middle East	1.2	1.0	1.5	1.4	2.0	1.7	1.5	1.7	1.6	1.5

Source : IMF, Direction of Trade Statistics.

ANNEX B. DATA DESCRIPTION

Data sources: United Nations, *COMTRADE database*, Central Bank of Russia, IMF, *International Financial Statistics,* World Bank, National sources, OECD Economic Outlook.

The formulae used in the paper to calculate the main variables of the export equations are the following :

External demand for non fuel goods :

$$\sum_{i=1}^{N} \alpha_i * \frac{M_{GNFD}(i \leftarrow Russia)}{P_{GDP}(i)} * \frac{1}{ER_i}$$

Where :

$M_{GNFD}(i \leftarrow Russia)$ = value of non fuel imports of country (i) from Russia, in \$

$P_{GDP}(i)$ = GDP Price deflator for country (i) , in local currency

ER_i = Exchange rate for country (i), vis-à-vis the \$

α_i = share of country (i) in total Russian non fuel exports (fuel defined as category 3 in SITC)

Export competitiveness indicator

For the export price model, the foreign price is the competitors' price, which is calculated using a double

$$CompetX_{nonoil} = \sum_{i=1}^{N} \alpha_i * \left(\sum_{\substack{j=1 \\ j \neq Russia,i}}^{N} \frac{X_{GD}(j \rightarrow i)}{X_{GD}(world \rightarrow i) - X_{GD}(Russia \rightarrow i)} * P_{XGSD}(j) \right) \Bigg/ P_{X_{nonoil}}(Russia)$$

where :

α_i = share of country (i) in total Russian non fuel exports

$X_{GD}(j \rightarrow i)$ = goods exports values from country (j) to country (i)

$P_{XGSD}(j)$ = goods and services export prices index for country (j), in \$

$P_{X_{nonoil}}(Russia)$ = non fuel goods and services export prices index, in \$

Non fuel exports volume

$$X_{nonoil} = \frac{X_{GS} - X_{FUEL}}{P_{X_{nonoil}}}$$

where: X_{GS} = goods and services export values, in \$

X_{FUEL} = fuel exports value, in \$

$P_{X_{nonoil}}(Russia)$ = non-fuel goods and services export prices index, in \$ (computed from the export price index in roubles, the exchange rate *vis-à-vis* the \$ and an export price index of oil, oil product and gas exports, in \$).

Figure B1. Export and Import volumes
Index 1996 =100
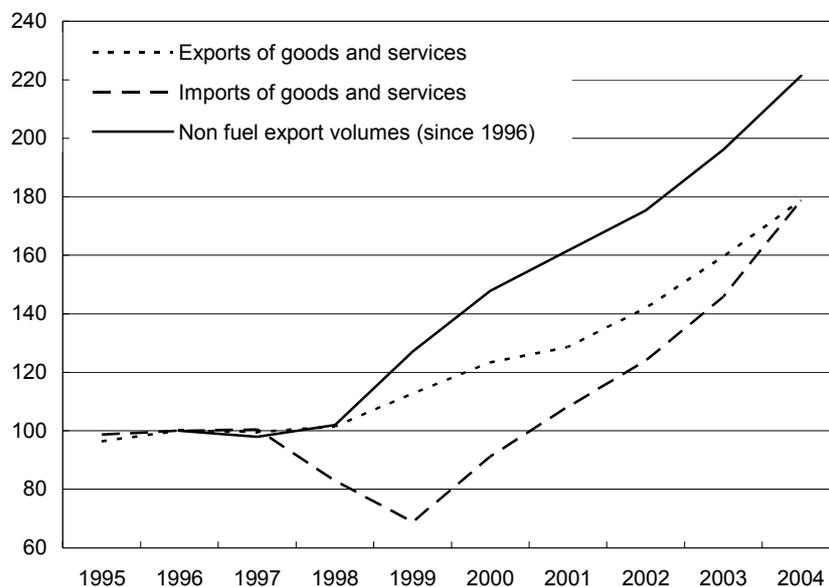
Source : Federal Service for State Statistics, OECD calculations.

Figure B2. Export and Import Prices
Index 1995 =100, US$
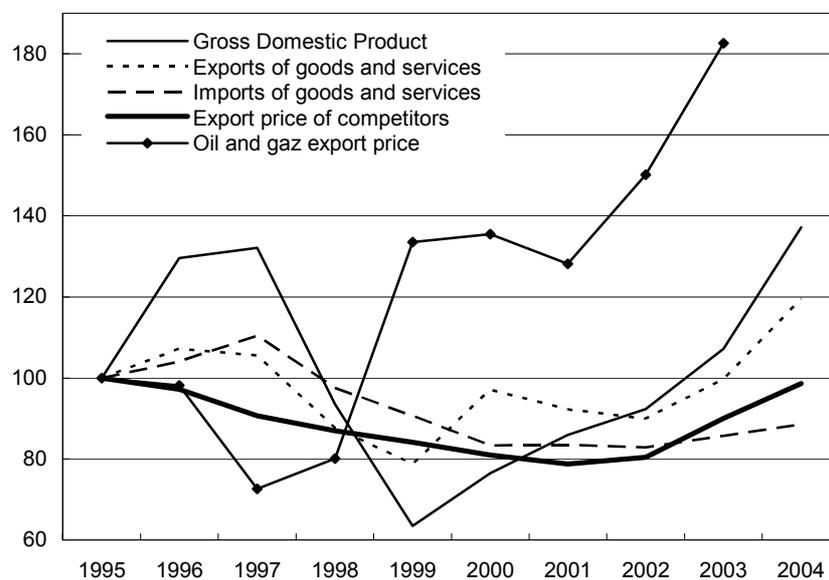
Source : Federal Service for State Statistics, OECD calculations.

ANNEX C. DECOMPOSITION OF THE TRADE BALANCE VARIATION

1) Let *(TB)* denote the trade balance and TB_{nonoil} the non-fuel trade balance:

$$TB = p_x X_{nonoil} - p_M M + p_{oil} X_{oil} = TB_{nonoil} + p_{oil} X_{oil} \tag{C1}$$

with X_{nonoil} and M respectively non-fuel export and import volumes, p_X and p_M respectively non-fuel export and import prices expressed in domestic currency.

Differentiating equation (C1) we obtain:

$$dTB_{nonoil} = p_x X_{nonoil} \left(\frac{d p_x}{p_x} + \frac{d X_{nonoil}}{X_{nonoil}} \right) - p_M M \left(\frac{d p_M}{p_M} + \frac{dM}{M} \right) \tag{C2}$$

After some rearrangements, (C2) can be expressed:

$$dTB_{nonoil} = p_x X_{nonoil} (\frac{d X_{nonoil}}{X_{nonoil}} - \frac{dM}{M}) + p_x X_{nonoil} \left(1 - \frac{p_M M}{p_X X_{nonoil}} \right)\left(\frac{dM}{M} + \frac{d p_M}{p_M} \right) + p_x X_{nonoil} \frac{d\left(\frac{p_x}{p_M}\right)}{\frac{p_x}{p_M}}$$

2) Denoting $\alpha = \frac{p_x X_{nonoil}}{p_M M}$ the share of imports covered by non oil exports (α<1) and $\tau = \frac{p_x}{p_M}$ the non-fuel terms of trade, the variation of the non-fuel trade balance can be easily decomposed in a volume term (A), the effect of the initial position (B) and a terms of trade effect (C) :

$$dTB_{nonoil} = \underbrace{p_x X_{nonoil} (\frac{d X_{nonoil}}{X_{nonoil}} - \frac{dM}{M})}_{A=changes\ in\ volumee} + \underbrace{(\alpha - 1).d(p_M M)}_{B=initial\ position\ effect} + \underbrace{p_x X_{nonoil} \frac{d\tau}{\tau}}_{C=term\ of\ trade} \tag{C3}$$

Rewriting the symmetric decomposition with imports value as a reference, and taking half of the sum, equation (C4) can be rewritten:

$$dTB_{nonoil} = \underbrace{\frac{p_X X_{nonoil} + p_M M}{2}(\frac{d X_{nonoil}}{X_{nonoil}} - \frac{dM}{M})}_{A} + \underbrace{(\alpha - 1)\frac{d(p_X X_{nonoil} + p_M M)}{2}}_{B} + \underbrace{\frac{p_X X_{nonoil} + p_M M}{2}\frac{d\tau}{\tau}}_{C}$$

4) Hence, the overall variation of trade balance can finally be decomposed the following way:

$$dTB = \underbrace{\Pi\left(\frac{d X_{nonoil}}{X_{nonoil}} - \frac{dM}{M} \right)}_{A} + \underbrace{(\alpha - 1)d\Pi}_{B=initial\ position\ effect} + \underbrace{\Pi \frac{d\tau}{\tau}}_{C=term\ of\ trade} + \underbrace{d(p_{oil} X_{oil})}_{D} \tag{C4}$$

with $\Pi = \dfrac{p_X X_{nonoil} + p_M M}{2}$ is a weighted average of non-fuel exports and imports (hence an indicator of the size of trade)

Thanks to our estimate, the term A itself can be decomposed between the contribution of exchange rate (A1) and other factors, which includes factors such as the differential in business cycle in Russia and abroad, as well as non price competitiveness factors (and the residual):

$$A = \Pi\left(\frac{dX_{nonoil}}{X_{nonoil}} - \frac{dM}{M}\right) = \Pi\left[\underbrace{\varepsilon_x d\ln competX + \varepsilon_M d\ln competM}_{A1=competitiveness\ \text{factor}} + \underbrace{d\ln(ExtD) - d\ln(Final) + residual}_{A2=other\ factors}\right]$$

ANNEX D. EXTENDED MARSHALL-LERNER CONDITION

1) Keeping the same notation for the trade balance *(TB)* and the non-fuel trade balance (TB_{nonoil}):

$$TB = p_x X_{nonoil} - p_M M + p_{oil} X_{oil} = TB_{nonoil} + p_{oil} X_{oil} \tag{D1}$$

Differentiating the non oil trade balance we obtain:

$$dTB_{nonoil} = p_x X_{nonoil} \left(\frac{dp_x}{p_x} + \frac{dX_{nonoil}}{X_{nonoil}} \right) - p_M M \left(\frac{dp_M}{p_M} + \frac{dM}{M} \right) \tag{D2}$$

Using equation (1) and (2) of the paper, which gives the expression of the volume of non-fuel export and import as a function of demand and prices, equation (D2) becomes (D3):

$$dTB_{nonoil} = p_x X_{nonoil} \left[\frac{dp_X}{p_X} + \eta_x \frac{dExtD}{ExtD} + \varepsilon_x \frac{dCompetX}{CompetX} \right] - p_m M \left[\frac{dp_M}{p_M} + \eta_m \frac{dFinalD}{FinalD} - \varepsilon_M \frac{dCompetM}{CompetM} \right] \tag{D3}$$

2) We assume importers and exporters face a trade-off between indexing their prices on their cost or the international prices. Hence import and export prices could be modelized as the following weighted average:

$$p_x = w^\gamma \left(ep_x^* \right)^{1-\gamma} \tag{D4a}$$

$$p_M = p^{1-\delta} \left(ew^* \right)^{\delta} \tag{D4b}$$

where (w) and (w^*) are respectively a domestic and a foreign cost index, (γ) the coefficient determining the responsiveness of a Russian firm's export prices to marginal cost and (δ) the elasticity of foreign firms' export price with respect to their marginal cost, (p) denotes Russian domestic prices and (p_x^*) foreign export prices. The prices (p) and (p_x^*) are assumed to be exogenous.

3) Equations (C4a) and (C4b) allows to express the competitiveness indicators as a function of the nominal exchange rate and the volume and price elasticities of trade. If the impact of the exchange rate on the activity in Russia and abroad is neglected, the differentiation of the non-oil trade balance can be written:

$$dTB_{nonoil} = p_x X_{nonoil} \left[(1-\gamma) \frac{de}{e} + \varepsilon_x \gamma \frac{de}{e} \right] - p_m M \left[\delta \frac{de}{e} - \varepsilon_M \delta \frac{de}{e} \right] \tag{D5}$$

Finally, we obtain:

$$\frac{dTB_{nonoil}}{p_M M} = \left[\tau(1 - \gamma + \gamma \varepsilon_x) - \delta(1 - \varepsilon_M) \right] \frac{de}{e} \tag{D6}$$

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