The Dutch Disease in Kazakhstan: An Empirical Investigation

In this paper we investigate whether or not the Dutch disease is at work in, or poses a threat to, the Kazakh economy. For this purpose, we first summarize the mechanism through which fluctuations in the price of oil could possibly damage the non-oil manufacturing industry and thus the long-term growth perspectives of an economy that relies heavily on oil production. Subsequently, we seek to analyze the specific chains of this transmission mechanism in Kazakhstan. The analysis of annual data for the period from 1998 to 2005 suggests that non-oil manufacturing has so far been spared the perverse effects of oil price increases. However, the real exchange rate of the open sector has appreciated during the last couple of years chiefly due to the appreciation of the nominal exchange rate. In a second step, we analyze to what extent this appreciation is linked to oil price developments and oil revenues. Our econometric estimations based on the monetary model of the exchange rate and a variety of real exchange rate models provide us with some indication that the rise in the price of oil and in oil revenues might be linked to an appreciation of the U.S. dollar exchange rate of the oil and non-oil sectors. However, the appreciation is mainly limited to the oil sector for the real effective exchange rate and seems to be statistically insignificant for the non-oil manufacturing sector.

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1 Introduction

There is an ongoing debate on the role of natural resources in economic growth in developing and transition economies. According to the conventional wisdom advocated by, among others, Sachs and Warner (1995), the abundance of natural resources in a given economy leads, per se, to higher macroeconomic volatility and to lower long-term economic growth. However, a number of recent papers have cast doubt on this view, arguing that countries rich in natural resources do not need to suffer from the Dutch disease (Spilimbergo, 1999; Kronenberg, 2004; Papyrakis and Gerlagh, 2004; Stijns, 2005).[4] This question is particularly relevant from a policy perspective for economies of the former Soviet bloc with economic structures that rely to a great extent on the production of oil.

It is in this vein that we analyze the possible danger the Dutch disease may pose to the Kazakh economy. There are indeed very few papers with strong empirical foundations that analyze the case of the Kazakh economy and focus on country-specific features. Typically, papers either focus on large cross-sectional datasets to analyze the determinants of long-run growth (Sachs and Warner, 1995; Kronenberg, 2004; Papyrakis and Gerlagh, 2004; Davoodi, 2005) or rely on narrow time series setups to investigate the relationship

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[4] *"Dutch disease" refers to the deindustrialization of a small open economy where the export of natural resources drives up the exchange rate, making manufactured goods less competitive and crowding out industries where there are learning effects or economies of scale. The term was first used in the 1970s in reference to the impact of the discovery of large reserves of natural gas in the North Sea on the Dutch economy.*

between the real exchange rate on the one hand and some kind of a proxy for the Balassa-Samuelson effect and the real price of oil on the other hand (Kutan and Wyzan, 2005). Importantly, country-specific details relating to the presence of the Dutch disease in Kazakhstan are left unexplored in cross-sectional studies, and most of the chains of the transmission mechanism from the Dutch disease to long-run growth remain undetected in time series studies with a narrow focus.

Against this backdrop, we propose a careful analysis of the case of Kazakhstan in this paper, using the most disaggregated dataset ever applied when investigating the recent economic history of this country. We start by identifying the sub-channels through which changes in the price of oil are transmitted onto wages and prices in other parts of the economy, which in turn causes the real exchange rate to appreciate and thus leads to a loss in price competitiveness of the non-oil manufacturing sector. Bearing this in mind, we then go through the transmission channel in a meticulous way and attempt to provide empirical evidence for each chain in the transmission mechanism to find out (1) whether the transmission channel exists at all, and if it does, (2) whether it is complete or breaks down at some point. Our analysis indicates that thus far the effects of the rise in the oil price such as predicted by the standard Dutch disease hypothesis have not been carried forward to the rest of the economy. Nevertheless, the real exchange rate has appreciated somewhat. To what extent is the appreciation due to booming oil prices? To answer this question, we make use of two more general approaches that help link the exchange rate and the price of oil. The first one is the monetary model aimed at pinning down the determinants of the nominal exchange rate, and our second approach consists in estimating a variety of real exchange rate models.

The remainder of the paper is organized as follows: Section 2 summarizes the main symptoms of the Dutch disease phenomenon and studies each single symptom using annual data for Kazakhstan. Section 3 provides the theoretical foundations with regard to the relationship between oil prices and the exchange rate. More specifically, the oil price-exchange rate relationship is embedded in the monetary model of the exchange rate and in real exchange rate models. Section 4 describes the data sources and the estimation techniques and presents the estimation results. Finally, section 5 provides some concluding remarks.

2 The Dutch Disease

2.1 Background

It is a widely held view that countries with abundant natural resources and especially with economic structures that rely heavily on oil production can suffer from the so-called Dutch disease, resulting in boom-bust cycles and sluggish long-term economic growth.

Taking the example of an oil-producing country, an increase in the price of oil[5] encourages more investment in, and attracts more labor to, the oil-producing sector, which in turn increases sectoral output. A side-effect of the surge in investment in the oil sector might be that foreign capital flows into the oil sector but not into non-oil manufacturing. Wage increases in the oil

[5] *The discovery of new oil fields or an exogenous technological shock would have the same effect (Corden, 1984).*

sector attract labor from non-oil manufacturing and from the nontradable sector to the oil sector. Corden (1984) terms this phenomenon the *resource movement effect,* which leads to direct deindustrialization. In addition, indirect deindustrialization occurs as the relative price of nontradables rises, which draws labor from the non-oil manufacturing sector to the nontradable sector. The relative price of nontradables may rise for three reasons. First, as part of the resource movement effect, nontradable prices will increase because of the excess demand for nontradables, which is brought about by a fall in supply owing to less labor in the nontradable sector. Second, as nominal and real wages increase in the oil sector, wages will also rise in other parts of the economy, provided that wages tend to equalize across sectors. As a consequence of wage increases in the nontradable sector, the relative price of nontradable goods will increase. Third, the relative price of nontradables will rise in the event that higher profits and wages in the oil sector and the related tax revenues are spent on nontradable goods and provided the income elasticity of demand for nontradables is positive. This latter effect is also called the *spending effect.*

At the same time, the real exchange rate tends to appreciate. One reason for this is the rise in the relative price of nontradable goods because of the wage spillover from the oil-producing sector. This increase in the relative price of nontradables can overlap with the traditional Balassa-Samuelson effect[6] due to productivity gains in the non-oil manufacturing sector. If there is proportionate wage equalization across sectors and if increases in wages feed into nontradable prices in a one-to-one fashion, the Dutch disease will dominate the Balassa-Samuelson effect in the event that wage increases generated in the oil-producing sector outpace those in the non-oil manufacturing sector (due to productivity increases). This appreciation – regardless of whether it is attributable to the oil sector or to the Balassa-Samuelson effect – can be viewed as competitiveness neutral if it does not affect the real exchange rate of the non-oil manufacturing sector.

Nevertheless, this cannot be taken for granted, since the non-oil open sector's real exchange rate is another source of real appreciation;[7] it appreciates because of higher wages and prices generated by the wage equalization process stemming from the oil-producing sector. Note, however, that the effect of wages on prices may be cushioned by productivity gains in the non-oil manufacturing sector (Balassa-Samuelson effect). The real exchange rate appreciation of the non-oil open sector can be exacerbated by the appreciation of the nominal exchange rate due to the inflow of "petrol dollars" and FDI to the oil-producing sector.

As a consequence of a strong appreciation, the non-oil manufacturing sector loses ground because of the fall in its competitiveness, which manifests itself in a decline in output and employment, and, in the end, leads to

6 *According to the relative version of the Balassa-Samuelson effect, an increase in productivity of the open sector exceeding that of the closed sector may go in tandem with increases in real wages in the open sector without any loss in competitiveness, provided that relative PPP holds for the open sector (i.e. the real exchange rate is stable over time). Assuming wage equalization between the open and the market-based sheltered sectors, prices in the closed sector will increase. This productivity-driven inflation in market-based nontradables then results in higher overall inflation and a positive inflation differential, which in turn causes the real exchange rate to appreciate.*

7 *Note that the expressions "open sector" and "tradable sector" are used interchangeably in this paper. The same applies to "closed sector," "sheltered sector" and "nontradable sector."*

deindustrialization as the non-oil manufacturing sector fades away.[8] It is precisely the disappearance of the non-oil manufacturing sector, which gives rise to boom-bust economic cycles – during the downturn phase of the oil price cycle there is no non-oil manufacturing sector to step in to compensate for the decline in oil production. Hence, oil price fluctuations are strongly reflected in economic fluctuations.

This is what we could refer to as the long-term Dutch disease: Economic growth is damaged in the long run because non-oil manufacturing is hollowed out. Even if non-oil manufacturing activity is maintained, however, economic fluctuations may remain strong in the short run due to fluctuations in the price of oil, simply because of swings in oil-related activities. The lower the share of the oil-producing sector in GDP, the lower the impact of the short-term or passive Dutch disease on overall economic activity.

Let us now take a closer look at the findings of the empirical literature. Sachs and Warner (1995) find strong empirical evidence in favor of the Dutch disease effect in emerging Asian economies and in Sub-Saharan Africa. Nevertheless, in the second half of the 1990s, an increasing number of papers put into question the general validity of the Dutch disease hypothesis, showing that it holds only under specific conditions, thus diminishing the policy implication of the findings of Sachs and Warner (1995). Simply put, the Sachs and Warner hypothesis is that countries with abundant natural resources should not exploit their natural resources because this puts at risk their long-term growth.

By contrast, Spilimbergo (1999) shows that the Dutch disease phenomenon is not at work in Chile and South Africa, countries with abundant natural resources. Kronenberg (2004) shows empirically that corruption is one of the main reasons for the Dutch disease in transition economies.[9] Papyrakis and Gerlagh (2004) suggest that when controlling for e.g. corruption, investment, openness and education, abundant natural resources do not decrease (as predicted by the Dutch disease hypothesis) but foster economic growth in the long run.

More generally, a high dependence on natural resources as the engine of economic growth can impede long-term growth in particular (1) in the presence of ill-defined property rights, imperfect or missing markets and lax legal structures, (2) if the fight for resource rents and the concentration of economic and political power hampers democracy and growth, and finally (3) if too many people get stuck in low-skill intensive natural resource-based industries (Gylfason, 2001). The implications of this are that strong institutions and a good educational system aimed at upgrading human capital (to enable new and higher value-added industries to settle in the country) may help avoid the Dutch disease.

[8] *It should be noted that the share of the nontradable sector in GDP and in total employment should decrease according to the resource movement effect and it should increase according to the spending effect (see Oomes and Kalcheva, 2006, for a summary of the effects of the Dutch disease). Note, however, that an increase in the share of nontradables in total employment may also occur if productivity gains are higher in manufacturing than in nontradables. The resulting rise in nontradable prices (Balassa-Samuelson effect) gives rise to an increase in the share of nontradables in GDP measured at current prices. This is something which can be observed in many advanced countries over time (Rowthorn and Ramaswamy, 1997).*

[9] *Abundant natural resources are conducive to corruption, and corruption hampers economic growth.*

2.2 Evidence from Descriptive Statistics

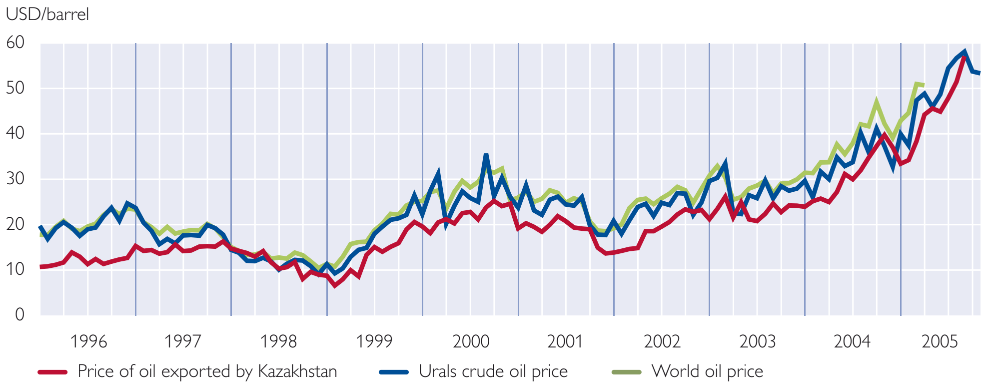
In this section, we look at the symptoms of the Dutch disease for the case of Kazakhstan in an attempt to establish whether or not there are signs of the Dutch disease at work. For this purpose, it is essential to formulate the symptoms and the specific transmission mechanism of the Dutch disease in empirical terms.

2.2.1 Increasing Oil Prices

Chart 1 below shows that after an initial drop from around USD 25 per barrel to USD 10 per barrel in the aftermath of the Asian crisis, the price of crude oil has more then quintupled from below USD 10 per barrel to above USD 50 per barrel by the second half of 2005. Although the price of oil exported by Kazakhstan is on average lower by some USD 6 per barrel over the period displayed, the price of exported Kazakh oil is very much synchronized with world market prices, implying that developments on the world market have an immediate impact on Kazakhstan.

Chart 1

Oil Price Developments



Source: Price of oil exported by Kazakhstan: Statistical Agency of the Republic of Kazakhstan; Urals crude oil price: Datastream; world oil price: IFS/IMF.

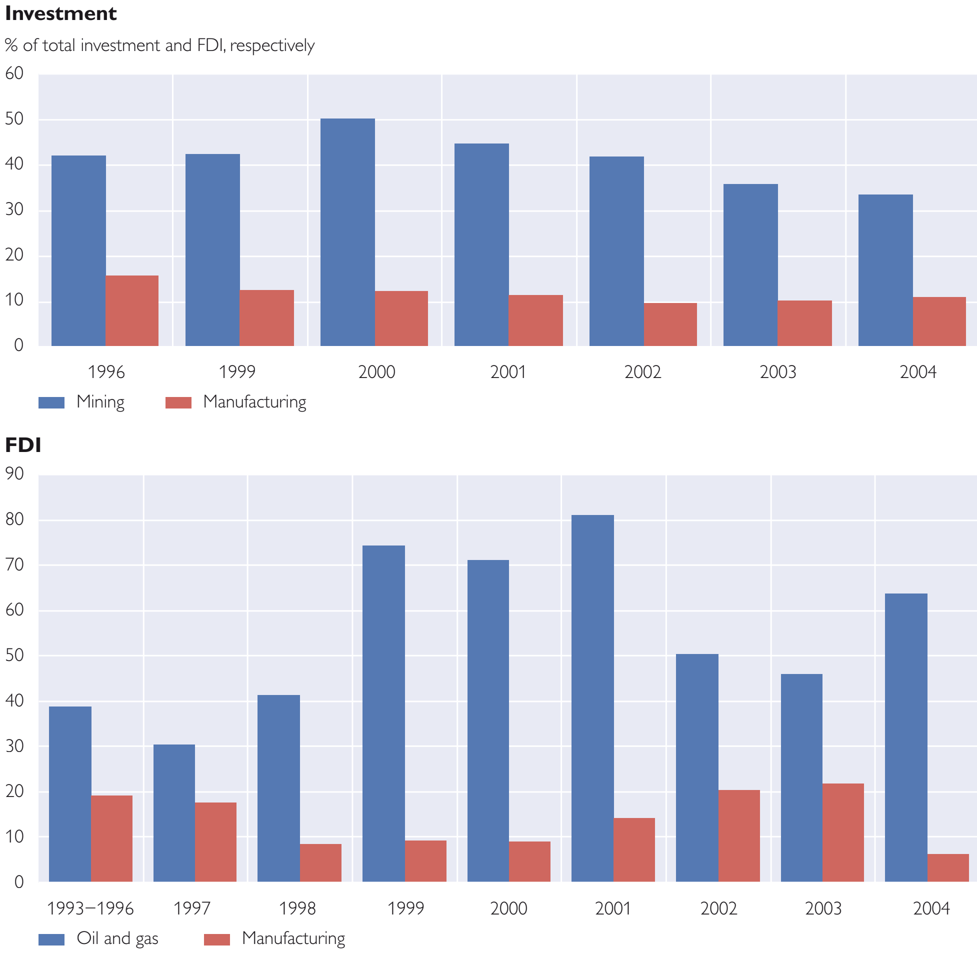
Note: The barrel price for Kazakh oil sales is converted from the price per ton (1 ton=7.3 barrels).

2.2.2 Massive Investment in the Oil Sector (Partly FDI)

Although the share of investment in the oil sector as a share of total investment is very large, it has been declining since 2000, while investment in manufacturing has remained relatively stable (chart 2, left). This seems to indicate no major overinvestment in the oil sector related to the increase in oil prices. At the same time, foreign direct investment flows to the oil sector recorded a surge from 1999 to 2001, when oil prices started to increase. However, the relative share of FDI in this sector has declined later on. The share of investment in the manufacturing sector remained relatively stable from 1996 to 2004, and FDI picked up slightly after 2000, which coincided with the drop in FDI in the oil sector.

Chart 2

Investment and FDI in the Oil Sector and in Manufacturing



Source: Statistical Agency of the Republic of Kazakhstan.

2.2.3 Productivity, Real and Nominal Wages and Relative Prices

If real and nominal wages rise in the oil sector and if there is wage equalization across sectors, with the oil sector being the leader in wage setting, prices will increase in non-oil manufacturing and in the nontradable sector.

As depicted in chart 3a, average labor productivity rose by about 60% between 1998 and 2004 in the oil sector, as did real wages. Productivity gains in the manufacturing sector[10] exceeded those in the oil sector, while the development of real wages in manufacturing followed very closely that in the oil sector because of wage equalization between the two sectors. The ratio of nominal wages in the oil sector to those in the manufacturing sector, plotted

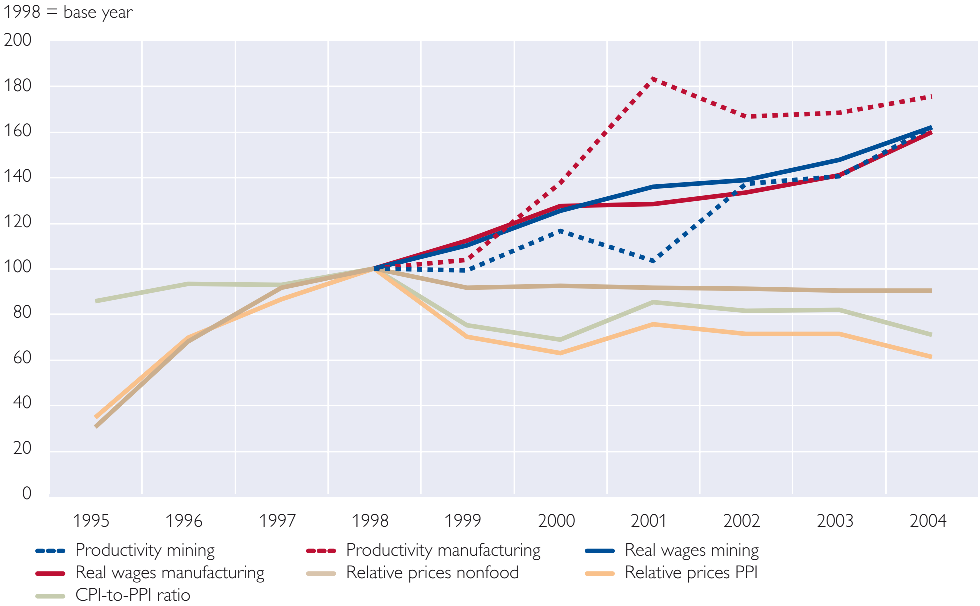
[10] *The share of oil-related industries (mining and manufacturing) in the Kazakh GDP was around 8% between 2000 and 2004; this figure increases to 12% if oil-related construction and transport services are also taken into account. At the same time, the share of non-oil manufacturing in the Kazakh GDP which is not directly linked to oil production was around 14% in 2000 and 2004. These figures are not particularly low when compared to those for other non-oil transition economies. The countries which exhibited shares of less than 20% in 2003 are Bulgaria (15.4% in 2002), Macedonia (15.8%), Poland (16.2%), Croatia (16.6% in 2002), Slovakia (19.1%) and Hungary (19.6%). Source: The Vienna Institute for International Economic Studies (wiiw), Annual Database, 2005.*

in chart 3b, indeed remains stable over time.[11] The fact that real wages progressed less than productivity in manufacturing suggests that wage pressures coming from the oil sector do not hamper competitiveness in the manufacturing sector.[12]

As shown in chart 3b, the nominal wage ratios show a downward trend, except for financial services. This indicates that nominal wages in certain market-based service sectors grow faster than nominal wages in the oil-producing sector. If this is an indication of a wage equalization process which is amplified in the services sectors, then the relative prices of market-based services should have been on the rise during the observed period. Yet, chart 3a shows that relative prices, measured in three different ways, have remained very much flat from 1998 onwards. Hence, wage increases did not translate into higher relative prices.

Chart 3a

Productivity, Real Wages and Relative Prices



Source: Author's calculations based on data obtained from the Statistical Agency of the Republic of Kazakhstan.

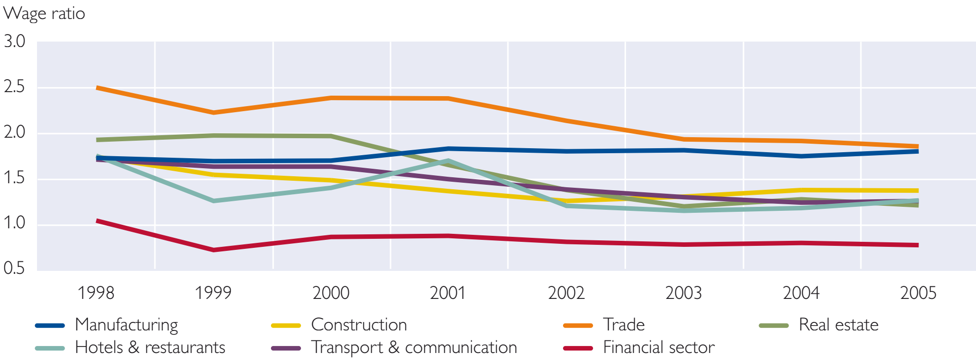
Note: *Relative prices nonfood and relative prices PPI refer to the relative prices of nontradables computed as market-based services divided by nonfood and the PPI, respectively.*

[11] *Wage equalization in levels would be verified if the ratio equaled 1, but this seems to be rejected by the data for all sectors (perhaps with the exception of the financial sector). However, absolute differences in wages may well be explained by differences in the required levels of qualification of the labor force in the different sectors. Hence, for wage increases in the oil sector to be transmitted to the rest of the economy, it suffices that the wage ratios remain stable over time (changes in oil-sector wages cause proportionate changes in wages in other sectors).*

[12] *These figures show that competitiveness did not change over time. It should be noted, however, that energy prices are highly subsidized in Kazakhstan. Hence, competitiveness may be maintained at an artificially high level. The question is how sustainable such subsidies are in the longer run, and what would happen to competitiveness if they were abolished.*

Chart 3b

Wage Equalization across Sectors



Source: Author's calculations based on data obtained from the Statistical Agency of the Republic of Kazakhstan.

Note: Monthly average nominal salary in the oil sector divided by the nominal salary of the corresponding sectors.

2.2.4 Appreciation of the Real Exchange Rate

The real exchange rate can, in principle, appreciate because (1) the relative price of nontradables increases, (2) the real exchange rate of the open sector appreciates due to a positive inflation differential in tradable prices or (3) because of the appreciation of the nominal exchange rate.[13]

Chart 4 shows that the real exchange rate in Kazakhstan depreciated in the aftermath of the Russian crisis and remained fairly constant until 2003, when it started to appreciate.[14] The fact that the relative price of nontradable goods was stable in the Kazakh economy after 1998 is reflected in the behavior of the overall (CPI-deflated) real exchange rate: the CPI- and PPI-based real exchange rates, measured against the U.S. economy and in effective terms, are very strongly correlated. However, even if relative prices rose, their overall impact on the CPI would be limited because of the low share of services in the CPI as shown in table 1.[15, 16]

Table 1

Shares of Different Goods and Services in the CPI from 1997 to 2005

%	1997	1998	1999	2000	2001	2002	2003	2004	2005
Food	55.40	52.40	52.00	51.70	50.50	50.30	50.10	50.00	49.00
Nonfood goods	23.30	24.10	23.80	22.90	24.00	23.90	24.00	24.10	24.60
Services	21.30	23.50	24.20	25.40	25.50	25.90	25.90	25.90	26.40

Source: Statistical Agency of the Republic of Kazakhstan.

[13] *The nominal and real exchange rates are defined as domestic currency units over one unit of foreign currency. Hence, a decrease (increase) is an appreciation (depreciation).*

[14] *We do not show the real exchange rate for the period from 1994 to 1998 because it was very volatile and oil prices were fairly stable during this period.*

[15] *The impact of changes in the relative price of nontradables on overall inflation can be calculated using the following formula:* $pt = (1 - ø)(p_t^{NT} - p_t^{T})$ *where* p_t^{NT} *and* p_t^{T} *are the price of nontradable and tradable goods, respectively, and* $(1 - ø)$ *measures the share of nontradables in the CPI basket.*

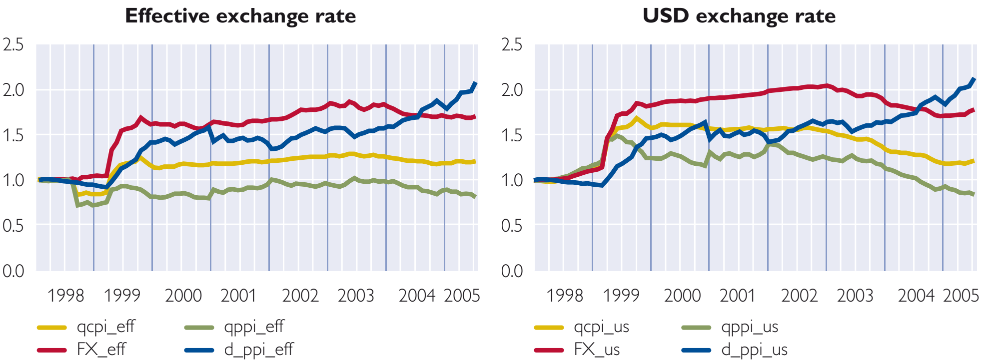
[16] *Note that even though the domestic relative prices in Kazakhstan did not change, the real exchange rate can appreciate if relative prices in the foreign economy decrease.*

Hence, the development of the Kazakh real exchange rate is closely related to the evolution of the nominal exchange rate and the tradable inflation differential vis-à-vis the foreign benchmark. Chart 4 shows that both factors contributed to the real appreciation of the exchange rate as the inflation differential started to rise and the nominal exchange rate began to appreciate in 2003. The data also indicate that the real appreciation was more pronounced against the U.S. dollar, mainly because of the stronger nominal appreciation against the U.S. dollar. However, the positive tradable inflation differential is the result of the high oil price, reflected in the producer price index. As can be seen in chart 5, there is indeed a strong co-movement between the selling price of oil in Kazakhstan and the producer price index, which in turn shows a strong correlation with producer prices in mining and extraction and in the metallurgical industry.[17] By contrast, prices in the manufacturing sector remained rather flat and followed the movement of the oil price only to a lesser extent. Accordingly, the real exchange rate of the non-oil open sector, obtained using the non-oil PPI, started its appreciation later and appreciated less against the U.S. dollar than the real exchange rate based on the overall PPI (see chart 6). This is due to the fact that the appreciation is mainly associated with a nominal appreciation of the Kazakh tenge.[18] Remarkably enough, the non-oil real effective exchange rate did not appreciate at all after 1999.

Chart 4

Real and Nominal Exchange Rates and the Tradable Inflation Differential

1998 = base year



Source: Authors' calculations based on data obtained from the Central Bank of Kazakhstan and the Statistical Agency of the Republic of Kazakhstan.

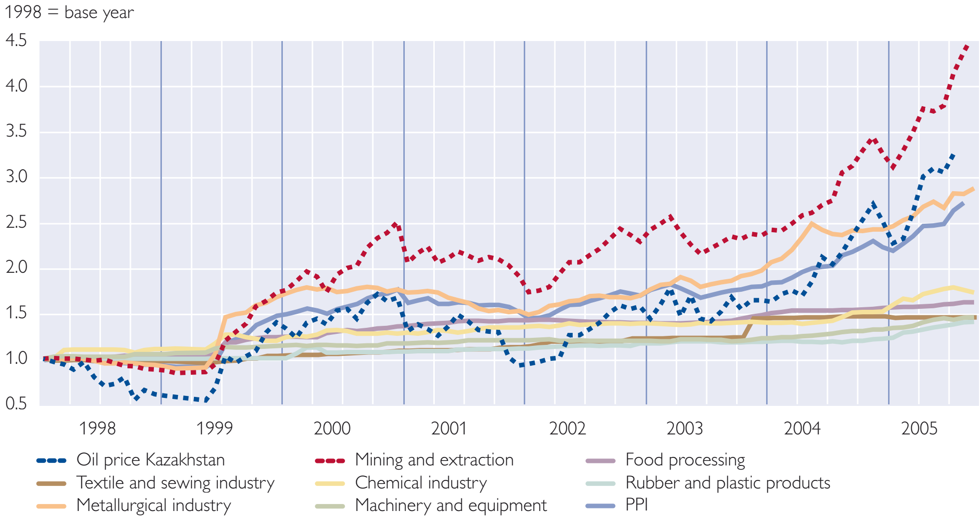
Note: qcpi and qppi are the CPI- and the PPI-deflated real exchange rates, FX and d_ppi denote the nominal exchange rate and the inflation differential based on the PPI. _eff and _us refer to the effective benchmark (composed of the U.S.A., Russia and the euro area) and the U.S. economy.

[17] *This is because commodity and metal prices have risen in tandem with oil prices.*

[18] *Real exchange rates can be connected to terms-of-trade developments. Rising oil prices, set in U.S. dollar, imply improving terms of trade in the oil sector. A rise in the U.S. dollar price of oil is automatically reflected in higher oil prices in the domestic currency, which in turn is reflected in higher inflation of oil products, and, as a consequence, in an appreciation of the real exchange rate of the oil sector. Improved terms of trade stimulate oil-related exports, and this leads to a nominal appreciation. If there is a nominal appreciation, domestic oil prices decrease automatically (because they are set in U.S. dollar), but the real exchange rate may remain unchanged, depending on the degree of nominal appreciation. For non-oil industries, possible real appreciation comes from the nominal appreciation of the Kazakh tenge, and perhaps to a lesser extent, from oil price increases in the domestic currency (this depends on the oil intensity of, and the price-setting behavior in, the non-oil manufacturing sector, provided the terms of trade of the non-oil industry remain unchanged).*

Chart 5

Oil Price and Subcomponents of the Producer Price Index

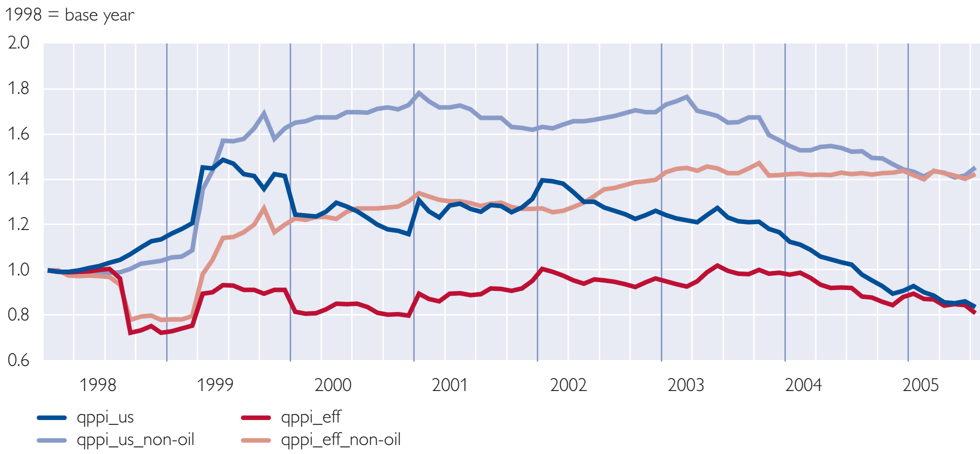


Source: Statistical Agency of the Republic of Kazakhstan.

Note: Oil price Kazakhstan refers to the price of oil exported by Kazakhstan.

Chart 6

Real Exchange Rate of the Open Sector and the Non-Oil Open Sector



Source: Author's calculations based on data obtained from the Central Bank of Kazakhstan and the Statistical Agency of the Republic of Kazakhstan.

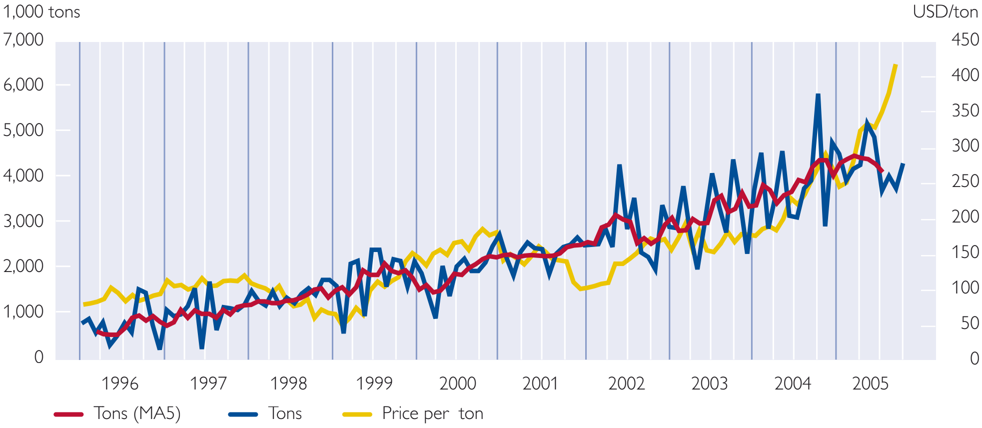
Note: qppi_us and qppi_eff are the PPI-deflated real exchange rates against the U.S. dollar and in effective terms, respectively. _non-oil indicates that the oil component is eliminated from the Kazakh PPI.

2.2.5 Declining Output, Employment and Exports in Non-Oil Manufacturing

There appears to be a relatively tight correlation between the U.S. dollar price for one ton of crude oil and the volume of oil production in Kazakhstan, at least as far as ocular econometrics allows us to state so on the basis of chart 7a. At the same time, although real growth in the oil sector outpaced that in the rest of the Kazakh economy, real GDP growth remained strong in the non-oil manufacturing sector after 2000, and economic growth in the market-based nontradable sectors did not exceed growth in manufacturing by far. This means that while growth in the oil sector was underpinned by strong oil prices, this

Chart 7a

Selling Price of Oil and Oil Production in Kazakhstan

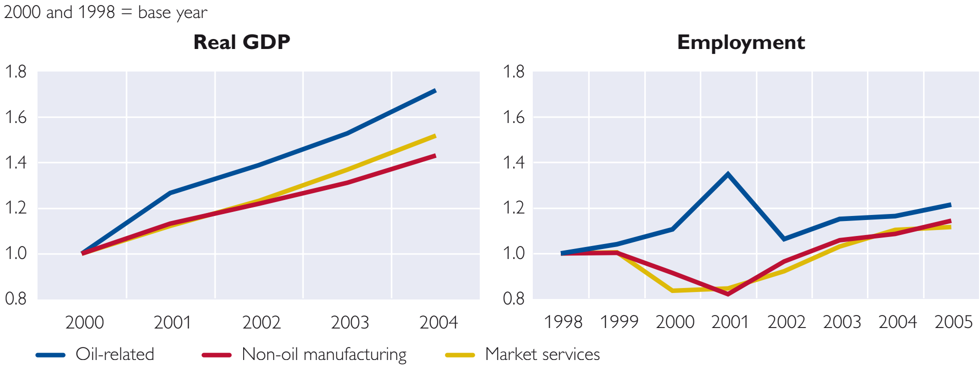


Source: Statistical Agency of the Republic of Kazakhstan.

Note: MA5 refers to a 5-month moving average.

Chart 7b

Real GDP and Employment in the Economy



Source: Statistical Agency of the Republic of Kazakhstan.

Note: Author's calculation based on data obtained from the Statistical Agency of the Republic of Kazakhstan.

development had no major impact in the manufacturing sector. Along the same lines, no major reallocation of labor took place as reflected in the growth rate of sectoral employment.[19, 20]

According to table 2, which reviews the transmission channels, it appears that some of the symptoms of the Dutch disease can be observed in Kazakhstan while others cannot. First, while the price of oil increased from 1998 to 2005, this did not lead to disproportionate growth in investment in the oil sector nor did it have an effect on the relative price of nontradables and non-oil tradables through the wage channel. Second, the real exchange rate appreciated due to a nominal appreciation. This does not seem to have impacted on growth and employment in the manufacturing sector until now.

[19] *Note that the pick-up in employment in the oil sector and the drop in employment in manufacturing and services is due to methodological changes. This can be also observed in the productivity figures shown in chart 3a.*

[20] *The share of the nontradable sector in GDP and in total employment should decrease according to the resource movement effect and it should increase according to the spending effect.*

Table 2

Overview of the Symptoms of the Dutch Disease between 1998 and 2005

STAGE	FINDING
1. Rise in the price of oil	YES
2. Increase in investment in the oil sector due to high oil prices	Tendency to NO
3. Wages and relative prices in the rest of the economy driven by developments in the oil sector	NO
4. Appreciation of the real exchange rate due to	YES
4a. the relative price of nontradables	NO
4b. the relative price of non-oil tradables	NO
4c. a nominal appreciation	YES
5. Growth hampered in manufacturing	NO

3 Oil Prices and the Exchange Rate

The question emerging from table 2 is whether there is a relationship between the observed rise in oil prices and the appreciation of the nominal and the real exchange rate in Kazakhstan. In this section, we propose two approaches which help us embed the relation between the oil price and the exchange rate in a more general framework. The first approach relies on variants of the monetary model of the exchange rate which aims at modeling changes in the nominal exchange rate. The second approach rests on modeling the development of the real exchange rate on the basis of a set of fundamentals. Based on these two approaches we seek to estimate econometrically the relationship between oil prices and the exchange rate.

3.1 Nominal Exchange Rate

The monetary model has been widely used for industrialized countries in the past to explain observed movements of the nominal exchange rate and also to forecast exchange rates (Groen, 2000).[21] The baseline version of the monetary model expresses the nominal exchange rate as a function of money demand, income and interest differential across the home and foreign economies:

$$e_t = m_t^D - m_t^{D*} - \alpha_1(y_t - y_t^*) + \alpha_2(i_t - i_t^*) \quad (1)$$

where e_t is the nominal exchange rate, expressed as units of domestic currency over one unit of foreign currency,[22] m^D_t, y_t and i_t are money demand, income and the interest rate, respectively, with small letters denoting log-transformed variables. The asterisk refers to the foreign economy. α_1 and α_2 are the income and interest elasticity of money demand, and it is assumed that $\alpha_1 = \alpha_1^*$ and $\alpha_2 = \alpha_2^*$.

One strong assumption of the standard monetary model is that PPP holds for the economy as a whole, i.e. the real exchange rate is stable over time. However, according to the well-known Balassa-Samuelson effect, the real exchange rate may appreciate systematically because of the impact of

[21] This revival comes after the seminal paper of Meese and Rogoff (1983), which showed that a random walk outperforms exchange rate models (among others the monetary model) in forecasting exchange rates.

[22] This implies that an increase (decrease) in the exchange rate is a depreciation (appreciation) of the domestic currency vis-à-vis the foreign currency.

productivity gains in the open sector on the relative price of nontradables. The Balassa-Samuelson (B-S) augmented monetary model[23] can be derived under the assumption that PPP holds for the open sector ($e = p_t^T - p_t^{T*}$):[24]

$$e_t = m_t^D - m_t^{D*} - \alpha_1 (y_t - y_t^*) + \alpha_2 (i_t - i_t^*) - (1-\phi)((a_t^T - a_t^{NT}) - (a_t^{T*} - a_t^{NT*})) \quad (2)$$

If we think of the implications of the Dutch disease for the nominal exchange rate, according to which an increase (decrease) in the oil price (p_t^{OIL}) causes the nominal exchange rate to appreciate (depreciate), it seems reasonable to add the oil price to the standard or the B-S-augmented monetary model:

$$e_t = m_t^D - m_t^{D*} - \alpha_1 (y_t - y_t^*) + \alpha_2 (i_t - i_t^*) - \alpha_3 p_t^{OIL} \quad (3)$$

$$e_t = m_t^D - m_t^{D*} - \alpha_1 (y_t - y_t^*) + \alpha_2 (i_t - i_t^*) - (1-\phi)((a_t^T - a_t^{NT}) - (a_t^{T*} - a_t^{NT*})) - \alpha_3 p_t^{OIL} \quad (3')$$

As we are primarily interested in the effect of oil prices on the exchange rate, the standard version (equations 4a and 4b) and two variants of the B-Syaugmented monetary models (with relative productivity (equations 5a and 5b) and with relative prices (equations 6a and 6b)) completed with oil prices are employed. Not only the U.S. dollar price of Urals crude is employed but also a variable capturing the total revenue from oil production (production volume multiplied by the selling price). The latter stands for the potential inflow of "petrol dollars."

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{p_t^{OIL}}) \quad (4a)$$

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{vol * p_t^{OIL}}) \quad (4b)$$

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{(a_t^T - a_t^{NT}) - (a_t^{T*} - a_t^{NT*})}; \overset{-}{p_t^{OIL}}) \quad (5a)$$

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{(a_t^T - a_t^{NT}) - (a_t^{T*} - a_t^{NT*})}; \overset{-}{vol * p_t^{OIL}}) \quad (5b)$$

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{(p_t^{NT} - p_t^T) - (p_t^{NT*} - p_t^{T*})}; \overset{-}{p_t^{OIL}}) \quad (6a)$$

$$e_t = f(\overset{+}{(m_t^S - m_t^{S*})}; \overset{-}{(y_t - y_t^*)}; \overset{+}{(i_t - i_t^*)}; \overset{-}{(p_t^{NT} - p_t^T) - (p_t^{NT*} - p_t^{T*})}; \overset{-}{vol * p_t^{OIL}}) \quad (6b)$$

[23] *It has been first proposed by Clements and Frankel (1980) and applied recently to transition economies by Crespo Cuaresma, Fidrmuc and MacDonald (2005) and Crespo Cuaresma, Fidrmuc and Silgoner (2005).*

[24] *Given the fragility of some of the strong underlying assumptions, we suggest a few notes of caution when applying the monetary model to transition economies. The first assumption is the existence of a stable money demand function. This issue is not even uncontroversial for industrialized countries; the stability of the money demand function is probably too strong a hypothesis for transition economies with multiple changes in the real economy and in the monetary policy framework. Second, PPP fails not only for the overall real exchange rate but also for the real exchange rate of the open sector (crucial for establishing the relationship between the exchange rate and money demand) as documented in e.g., Égert, Halpern and MacDonald (2006). Finally, the homogeneity imposed on some of the elasticities in different versions of the monetary model may fail in practice. For instance, Knell and Stix (2003) emphasize systematic cross-country differences in the α_1 and α_2 terms (hence, $\alpha_1 \neq \alpha_1^*$ and $\alpha_2 \neq \alpha_2^*$). The same applies to ϕ and ϕ^* given that the share of nontradable goods in the consumer price index is considerably lower in developing countries (around 25% in Kazakhstan in 2005, table 1) as compared to industrialized countries (around 45% in the euro area).*

An increase in relative money supply and the interest differential is expected to lead to a depreciation (positive sign), while an increase in relative income, relative productivity, the price of oil and total oil revenues is assumed to cause an appreciation of the exchange rate (negative sign).

3.2 Real Exchange Rate

3.2.1 Productivity and the Real Exchange Rate

When it comes to modeling the real exchange rate (q_t), a widely accepted view for the failure of PPP in the case of catching-up economies is the much-cited Balassa-Samuelson effect, which is due to productivity gains. However, New Open Economy Macroeconomics (NOEM) models have recently demonstrated that higher productivity growth in the open sector can have an effect on the real exchange rate not only through nontradable prices but also through tradable prices. MacDonald and Ricci (2002), Benigno and Thoenissen (2003) and Unayama (2003) put forward that a rise in productivity in the tradable sector causes the real exchange rate of the open sector to depreciate through the terms-of-trade channel. Whether the real exchange rate of the whole economy depreciates or appreciates in the aftermath of an increase in the productivity of the open sector depends on whether the depreciation of the open sector's real exchange rate is outweighed by the real appreciation induced by the Balassa-Samuelson effect.

In contrast to NOEM models stands the view that the open sector's real exchange rate in transition economies may undergo a trend appreciation because of the transformation process. The argument goes as follows: The transition from plan to market entails productivity increases in the tradable sector and enables the home economy to produce a growing number of goods of better quality. The increase in the quality of tradable goods goes unfiltered in the CPI (because quality changes are too fast and statistical offices too inexperienced in coping with quality adjustment). In addition, quality improvements cause a shift in (domestic and foreign) consumer behavior in favor of domestically produced goods[25] and an increase in reputation, which allows higher prices to be set for goods produced in the home economy. This entails a positive inflation differential for tradable goods and leads to a real appreciation of the real exchange rate. Since productivity gains in the open sector are a consequence of FDI inflows and the subsequent quality improvement, an increase in productivity in the open sector is associated with a real appreciation of the open sector's real exchange rate (Égert et al., 2003).

All in all, productivity may bear a negative as well as a positive relationship with the real exchange rate.

3.2.2 Other Explanatory Variables

The risk-adjusted real interest parity relationship, which has been used extensively in the literature, provides a convenient general framework for modeling the relationship between the real exchange rate and economic fundamentals (other than productivity). It is in this framework that net foreign assets, public consumption, openness, terms of trade or real oil prices can be

[25] *At the beginning of the transition process, there was a rush on foreign goods.*

easily connected to the real exchange rate (see e.g. Faruqee, 1995; MacDonald, 1998a,b).

An increase in net foreign assets is expected to be linked to an appreciation of the real exchange rate in order to offset the surplus in the trade balance.[26,27] The time varying risk premium can be approximated by public or foreign debt. Higher debt is reflected in an increase in the risk premium, which leads to a real depreciation. Finally, the real interest differential can be viewed as a medium-term factor. The real price of oil (and the oil revenue variable) is expected to have a negative sign, i.e. an increase in this variable leads to a real appreciation. The same applies to the public expenditure and the terms of trade variables. By contrast, an increase in openness is assumed to be related to a depreciation of the real exchange rate (positive sign).[28]

3.2.3 Testable Equations

Kutan and Wyzan (2005), the only paper we are aware of that uses country-specific data for Kazakhstan, estimate a real exchange rate model which includes the real effective exchange rate, productivity, the price of oil and the inflation rate. We go beyond this framework not only because we also analyze the determinants of the nominal exchange rate, but also because we look at the real exchange rate of the whole economy (CPI), of the open sector (PPI) and of non-oil manufacturing (PPI excluding oil prices), and because we use a score of control variables.

A number of specifications are estimated for the real exchange rate (q_t) using the CPI, the PPI and the PPI excluding oil prices. Our baseline specification contains productivity (prod) and, alternatively, relative prices (rel), as they turn out to be a very robust variable in empirical testing, and includes the real price of oil (roil) or the oil revenues variable (revoil), which is the variable of interest here. Additionally, a number of macroeconomic variables are used, such as the public debt-to-GDP ratio (pdebt), the public expenditure-to-GDP ratio (exp), openness (open), terms of trade (tot) and net foreign assets (nfa):

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t} / \overset{-}{revoil_t}) \tag{7}$$

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t} / \overset{-}{revoil_t}, \overset{+}{pdebt_t}) \tag{8}$$

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t} / \overset{-}{revoil_t}, \overset{-}{exp_t}) \tag{9}$$

[26] *Net foreign assets were also incorporated into real exchange rate models via the so-called stock-flow approach advocated by Faruqee (1995), Aglietta et al. (1997), Alberola et al. (1999, 2002) and via the NATREX (NATural Rate of EXchange) model of Stein (1994, 1995).*

[27] *However, the expected sign is not clear-cut for transition and emerging economies. The reason for this is that these economies need foreign savings to finance economic growth and the catching-up process. Thus, an inflow of foreign capital, mainly FDI, may cause the real exchange rate to appreciate. However, in the longer term, once net foreign liabilities attain a critical level, the home country will have to start servicing its net foreign liabilities. As a result, any additional increase in net foreign liabilities would lead to a depreciation of the real exchange rate. This corresponds to the long-run relationship between net foreign assets and the real exchange rate.*

[28] *See e.g. MacDonald (1998a,b) for a general discussion on the variables and Égert, Halpern and MacDonald (2006) for a discussion for transition economies.*

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t / revoil_t}, \overset{+}{open_t}) \quad (10)$$

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t / revoil_t}, \overset{-}{tot_t}) \quad (11)$$

$$q_t = f(\overset{-/+}{prod_t / rel_t}, \overset{-}{roil_t / revoil_t}, \overset{-/+}{nfa_t}) \quad (12)$$

Evidence from cross-sectional regressions (not reported here) indicates a large initial undervaluation of the real exchange rate in 1994. This was corrected for very quickly, but it was followed by another, rather prolonged and stable undervaluation period. Although initial undervaluation might pose a problem for the econometric estimations for the period from 1994 to 1998, there appears to be no long-lasting and indeed a steadily declining undervaluation.

4 Estimation Results

As the series turn out to be I(1) for the periods studied,[29] we implement three alternative cointegration techniques, namely the residual-based Engle and Granger cointegration tests applied to the residuals of the long-run relationships obtained by using first ordinary least sqares (OLS) and then the dynamic ordinary least squares (DOLS) suggested by Stock and Watson (1993), and the bounds testing approach relying on an auto-regressive distributed lag (ARDL) model developed by Pesaran, Shin and Smith (2001).[30]

4.1 Nominal Exchange Rate

The cointegration analysis is carried out for the whole period (1994/1995 to 2005) and for the post-Russian crisis period (1999 to 2005). This split is motivated by the desire not only to filter out the effect of the Russian crisis (although a dummy capturing the period from September 1998 to June 1999 is employed for the whole period) but also to cope with the problem related to a possible initial undervaluation. Overall, the estimation results show that it is difficult to establish robust cointegrating vectors, given that we most often find weak evidence for cointegration. At the same time, our results also show the absence of cointegrating vectors in some cases, especially for the whole period for the U.S. dollar exchange rate, and find strong evidence for cointegration mostly for the subperiod for the DOLS estimations.

[29] *We use the following standard unit root and stationarity tests: the augmented Dickey-Fuller (ADF), the Phillips-Perron (PP) and the Elliott-Rothenberg-Stock (ERS) point optimal unit root tests and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity test. In some cases, the tests produce conflicting results. However, they never indicate unambiguously that the series are stationary in level. This is why we conclude that the series are I(1). These results are available from the authors upon request.*

[30] *Before turning to the model estimations, it is important to make sure that no major initial undervaluation is observed for Kazakhstan at the earlier stages of the transition process. Maeso-Fernandez, Osbath and Schnatz (2005) were the first to note that in the presence of an initial undervaluation of the real exchange rate, the estimated coefficients and the constant term in the real exchange rate equation could be biased. A simple first check for a possible initial undervaluation consists in regressing the level of the real exchange rate on GDP per capita in Purchasing Power Standards (PPS) against the USD for cross-sectional data. The fitted value of the real exchange rate for Kazakhstan gives us the level of the real exchange rate, which would be consistent with the country's level of development (measured by GDP per capita) when considering the average relationship for 169 countries.*

Regarding the entire sample period, there is a great amount of instability of the coefficient estimates of the monetary model for the period as a whole, as the coefficient estimates are either statistically insignificant or have the wrong sign for most of the variables even though we control for the Russian crisis with a dummy variable.[31] With this caveat in mind, we would be well advised to interpret the result for the oil price and total oil revenue variables with care. As far as the price of oil is concerned, the estimated coefficients turn out to be either insignificant or to have a positive sign, meaning that a rise in this variable is associated with a nominal depreciation. When it comes to total oil revenues, they are, not surprisingly, mostly significant and have the expected negative sign three times and the wrong positive sign once.

For the subperiod running from 1999 to mid-2005, the first obvious observation is that the monetary model as a whole performs much better than for the entire period. Nonetheless, this does not mean that the estimation results are very robust across different estimation methods and alternative foreign benchmarks (effective exchange rate or against the U.S. dollar).[32] Against this background, both oil variables seem to systematically enter the estimated equations with a negative sign, indicating that an increase in the price of oil and in oil revenues results in an appreciation of the exchange rate. Note, however, that the oil revenue variable is found to be somewhat fragile

Table 3

Estimation Results – Monetary Model

	1994:01/1995:01–2005:07						1999:06–2005:07					
	Effective exchange rate			USD exchange rate			Effective exchange rate			USD exchange rate		
	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA
	Coefficient estimates of the nominal Urals crude oil price											
Eq(4a)	0.120***	0.126***	0.121	0.005	–0.02	–0.914	–0.056***	**–0.041**	–0.065**	–0.129***	**–0.122***	–0.136
Eq(5a)	0.107***	0.101**	0.098	–0.007	0.163***	–0.053	–0.055***	–0.289***	–0.063**	–0.122***	**–0.125***	–0.135
Eq(6a)	0.206***	0.127***	0.224**	–0.294***	0.081	–0.772	–0.055**	**–0.234***	–0.169***	–0.166***	**–0.508***	–0.245*
	Coefficient estimates of the USD revenues of oil production (volume times price)											
Eq(4b)	–0.045**	–0.222***	–0.09	0.077	0.164**	0.178	–0.017	**0.041**	–0.032	–0.074***	**–0.078***	–0.145**
Eq(5b)	0.008	–0.095**	0	**–0.014**	–0.17 ***	**–0.182**	–0.011	**–0.011**	–0.035	–0.052***	**–0.058***	–0.164**
Eq(6b)	0.005	0.013	0.02	–0.008	0.004	0.309	–0.005	**0.070**	–0.021	–0.073***	**–0.087***	–0.163**

Source: Authors' estimates.

*Note: EG, DOLS and BTA denote the Engle-Granger, Dynamic OLS and the bounds testing approach. Shaded cells indicate that no cointegration could be established. Bold figures indicate that both formal tests of cointegration and the error correction terms reject the null of no cointegration (strong evidence for cointegration). Unmarked cells show that only one of the tests was significant (weak evidence for cointegration). *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.*

[31] *These results are not reported here because of space constraints. However, they are available from the authors upon request.*

[32] *Despite the fact that the variables turn out to be occasionally insignificant, the main variables such as relative income, relative money supply and the interest differential have the expected sign. A notable exception is the productivity differential and the relative price variable, which usually bear a positive sign instead of the negative one that one might expect. The finding that an increase in the productivity differential or in the relative price of nontradables does not cause an appreciation but leads to a depreciation or has no effect at all on the nominal exchange rate corroborates the preliminary evidence from chart 3a, where increases in productivity in the open sector are not accompanied by a rise in relative prices as the Balassa-Samuelson effect would have predicted.*

when the effective nominal exchange rate is used but is fairly robust for the U.S. dollar exchange rate.[33]

4.2 Real Exchange Rate

In this section, we discuss only the estimation results for the real exchange rate based on the PPI and the real exchange rate deflated by means of the non-oil PPI.[34] The CPI-based real exchange rate is not considered here because, as we have seen earlier using descriptive statistics and the monetary model, the relative price of tradables is very flat and does not seem to influence the exchange rate, suggesting the absence of the Balassa-Samuelson effect in Kazakhstan. The second reason for not presenting these results is that they are very similar to the ones for the PPI-based real exchange rate. This is another piece of evidence for the absence of the Balassa-Samuelson effect.[35]

Similar to the monetary model, we mostly find weak evidence for cointegration.[36] As far as the general robustness of the coefficient estimates is concerned, it seems that the estimation results for the real exchange rate are slightly more robust than those for the monetary model, given that the fundamentals have a significant effect on the real exchange rate.[37]

Let us now start analyzing the oil revenue variable.[38] The general pattern that emerges is that this variable has a negative significant effect on the real exchange rate vis-à-vis the U.S. dollar, irrespective of whether we use the overall PPI or the non-oil PPI for the computation of the real exchange rate and regardless of the period studied. In other words, an increase in oil revenues is associated with an appreciation of the U.S. dollar real exchange rate. However, the magnitude of this effect turns out to be larger for the overall PPI than for the non-oil PPI.

When it comes to the effective exchange rate, the results are also interesting. For the whole period, the oil revenue variable bears no relationship with the overall PPI-deflated real exchange rate, whereas it is positively related to the non-oil PPI-based real exchange rate (an increase in the oil variable leads to a real depreciation). For the period from 1999 to 2005, during which the oil revenue variable rose sharply, an increase in oil revenues is generally found to be linked to an appreciation of the overall PPI-based real exchange rate, but it appears to lead to a real depreciation if the non-oil PPI is employed. This is probably so because the appreciation of the nominal effective exchange rate is

[33] *Note also that a sensitivity check is performed with regard to different data definitions. Not only nominal GDP but also industrial production as a proxy for nominal GDP — as often done in the literature (e.g. in Crespo Cuaresma, Fidrmuc and MacDonald, 2005) — is used. The results do not change quantitatively.*

[34] *These results are also available from the authors upon request.*

[35] *Note that the Balassa-Samuelson effect should explain the difference between the CPI- and the PPI-based real exchange rate. If PPP holds for tradables, the B-S effect has the potential to drive overall exchange rate movements. Otherwise it has a partial influence. By contrast, if the relative price of nontradable goods enters with very similar coefficients both the PPI- and CPI-deflated real exchange rate equations, this indicates that something else is going on.*

[36] *As in the nominal exchange rate estimations, a Russian crisis dummy is used for the entire period.*

[37] *The signs mostly meet our expectations. For instance, public expenditures usually have a negative sign, as have net foreign assets and terms of trade. With the exception of a few instances, the sign on the openness and public debt variables is positive. As for the productivity variable, the estimated coefficients have, as a rule, a positive sign.*

[38] *Estimation results for the real price of oil are not reported because they are fairly similar to the ones obtained using the oil revenue variable.*

Table 4a

Estimation Results for the Real Exchange Rate, Full Sample

	Effective exchange rate						USD exchange rate					
	Based on the PPI			Based on the non-oil PPI			Based on the PPI			Based on the non-oil PPI		
	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA
	Coefficient estimates of the USD revenues of oil production (volume times price)											
Eq (7)	0.012	0.017	−0.061	**0.09** ***	**0.111*****	0.061	−0.159***	**−0.426*****	**−0.489*****	−0.135***	**−0.318*****	−0.427**
Eq (8)	−0.034**	**−0.171*****	−0.09	**0.06** ***	0.083***	0.071	−0.127***	**−0.47** ***	**−0.416*****	−0.053**	−0.21 ***	−0.22 **
Eq (9)	0.018	0.018	−0.031	**0.095*****	**0.117*****	0.11	−0.141***	**−0.392*****	**−0.536*****	−0.068***	−0.188***	**−0.177*****
Eq (10)	0.008	0.012	−0.062	**0.082*****	0.103***	0.02	−0.159***	−0.431***	−0.476**	−0.152***	**−0.321*****	−0.453**
Eq (11)	0.018	0.029	−0.037	0.103***	**0.122*****	0.056	−0.141***	**−0.401*****	**−0.397*****	−0.157***	−0.336***	−0.414**
Eq (12)	0.005	0.007	0.005	**0.102*****	**0.131*****	0.212**	−0.08 ***	−0.285***	**−0.253*****	−0.031	−0.402***	−0.1

Source: Authors' estimates.

Note: See table 3.

Table 4b

Estimation Results for the Real Exchange Rate, 1999 to 2005

	Effective exchange rate						USD exchange rate					
	Based on the PPI			Based on the non-oil PPI			Based on the PPI			Based on the non-oil PPI		
	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA	EG	DOLS	BTA
	Coefficient estimates of the USD revenues of oil production (volume times price)											
Eq (7)	−0.041**	−0.053**	−0.185**	0.068***	0.079***	0.087	−0.19***	**−0.366*****	−0.393***	−0.093***	**−0.134*****	−0.106
Eq (8)	−0.095***	−0.183***	**−0.232*****	0.04 ***	0.049***	0.032	−0.212***	−0.356***	**−0.439*****	−0.091***	**−0.128*****	−0.127
Eq (9)	−0.046**	−0.059***	−0.142	0.069***	0.077***	0.061	−0.191***	−0.319***	−0.419**	−0.091***	−0.13 ***	−0.108
Eq (10)	**−0.013**	−0.048***	−0.084**	0.073***	0.09 ***	0.071	−0.172***	−0.312***	−0.362***	−0.098***	**−0.146*****	−0.111
Eq (11)	**0.011**	**0.007**	**0.007**	**0.085*****	0.098***	0.11 **	**−0.13** ***	**−0.269*****	−0.263***	−0.085***	**−0.132*****	−0.093
Eq (12)	0.024	**0.034***	0.01	**0.085*****	**0.133*****	0.166***	−0.137***	**−0.213*****	−0.275***	−0.079***	−0.122***	−0.07

Source: Authors' estimates.

Note: See table 3.

not large and prolonged enough to show up in statistically significant and negative coefficient estimates for the non-oil sector. Still, an increase in oil revenues causes a real appreciation of the open sector via the positive inflation differential (owing to a rise in oil prices).

5 Conclusions

This study sought to uncover whether or not the Dutch disease is at work in Kazakhstan. We first identified the mechanism through which fluctuations in the price of oil could possibly damage the non-oil manufacturing industry and thus the long-term growth perspectives of an economy that relies heavily on oil production. In a second step, we sought to empirically analyze the specific chains of this transmission mechanism in Kazakhstan. The analysis of highly disaggregated annual data from 1998 to 2005 suggests that non-oil manufacturing has so far been spared the perverse effects of oil price increases. Our econometric estimations show that this is mainly because the real exchange rate of the non-oil open sector is not linked to the real price of oil, implying that oil price increases do not lead to a real appreciation of this sector's exchange rate.

Estimations based on the monetary model of the exchange rate carried out for the period from 1994 and 1999, respectively, to 2005 using monthly data indicate that the rise in the nominal price of oil and in nominal oil revenues might be linked with an appreciation of the nominal exchange rate, in particular vis-à-vis the U.S. dollar but less so for the effective nominal exchange rate.

Notwithstanding this relationship between the nominal variables, the real exchange rate models indicate that only the real exchange rate of the entire tradable sector including oil production (but not that of the tradable sector excluding oil production) appreciated following a rise in the oil variable during the period under study. The reason for this is that prices did not rise more in Kazakh non-oil manufacturing than they did abroad and that the appreciation of the nominal effective exchange rate was not large and prolonged enough to have an effect on the non-oil sector.

This result makes us cautious about the use of aggregated data when studying the Dutch disease, because an apparent link between oil prices and the overall real exchange rate, which was also identified by Kutan and Wyzan (2005), does not automatically imply the existence of a relationship between oil prices and the non-oil open sector's real exchange rate.

However, our results, which indicate that non-oil manufacturing has so far been spared the negative effects of oil price increases, may provide only temporary relief for policymakers in Kazakhstan. If oil prices remain high in the future, the nominal and real exchange rates will continue to appreciate, thus putting pressure on non-oil industries. Against this background, policymakers would be well advised to implement structural measures aimed at improving competitiveness to counteract possible exchange rate appreciations in the future.

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Appendix

Data Sources and Definitions

Monetary model (monthly data if not indicated otherwise)

Nominal exchange rates of the Kazakh tenge:
against the U.S. dollar: period average (IFS/IMF via Datastream: KZI..RF)
against the euro: computed using the USD/EUR cross rate (Datastream code: EMEBXUSD)
against the Russian ruble: computed using the RUB/USD cross rate (Datastream code: RSXRUSD).

Nominal GDP (annualized and interpolated linearly from quarterly to monthly frequency):
Kazakhstan: KZI99B..A
U.S. economy: Main Economic Indicators/OECD via Datastream: USI99B.CB
Euro area: Eurostat via Datastream: EMESNGDPB
Russia: Datastream: RSOSN014B.

Industrial production:
Kazakhstan: Datastream: KZIPTOTQA; nominal quarterly data interpolated to monthly frequency and deflated by the PPI
U.S. economy: Main Economic Indicators/OECD via Datastream: USOPRI38G
Euro area: Eurostat via Datastream: EMESINPRG
Russia: IMF/IFS via Datastream: RSIPTOT.H.

Money supply (M2):
Kazakhstan: Datastream: KZM3....A
U.S. economy: FED via Datastream: USM2....B
Euro area: ECB via Datastream: EMECBM2.B
Russia: Datastream: RSOMA002B.

Short-term interest rates:
Kazakhstan: money market rate, Central Bank of Kazakhstan
U.S. economy: treasury bill rate; IFS/IMF via Datastream: USI60C..
Euro area: three-month money market rate; Eurostat via Datastream: EMESSFON
Russia: three-month interbank rate; Datastream RSINTER3.

Real exchange rate models (monthly data if not indicated otherwise)
Productivity:
Industrial production (quarterly data interpolated to monthly frequency) divided by employment figures in industry or manufacturing. As data are not available for services, productivity in this sector is assumed to be equal to 0 in all four economies. If productivity gains are comparable in the four economies, this zero growth assumption has little effect on the variable.
Employment in industry (quarterly data interpolated to monthly frequency):
Kazakhstan: IFS/IMF via Datastream: KZI67...F
U.S. economy: Bureau of Labor Statistics via Datastream: USEMPMANO
Euro area: Eurostat via Datastream: EMESEMPIH
Russia: IFS/IMF via Datastream: RSI67...F.

Real exchange rate (nominal exchange rate multiplied by foreign prices over domestic prices):
Real exchange rate, whole economy: CPI
Real exchange rate, tradables: PPI is used as a proxy for tradable price inflation
Real exchange rate, non-oil manufacturing/tradables: PPI excluding oil prices.

CPI:
Kazakhstan: Statistical Agency of the Republic of Kazakhstan via Datastream: KZCONPRCF
U.S.economy: Main Economic Indicators/OECD via Datastream: USOCP009E
Euro area: Eurostat via Datastream: EMCONPRCF
Russia: wiiw via Datastream: RSCONPR2F.

PPI:
Kazakhstan: overall PPI: Statistical Agency of the Republic of Kazakhstan via Datastream: KZPROPRCF; non-oil PPI: Statistical Agency of the Republic of Kazakhstan; constructed on the basis of the PPI series for food processing; textile and sewing industry; chemical industry; rubber and plastic products; and machinery and equipments. As no weights are available, an arithmetic average is taken.
U.S.economy: Main Economic Indicators/OECD via Datastream: USOPP019F

Euro area: Eurostat via Datastream: EMESPPIIF
Russia: WIIW via Datastream: RSPROPRCF.

Relative prices: CPI-to-PPI ratio
Terms of trade: Statistical Agency of the Republic of Kazakhstan
Openness: Statistical Agency of the Republic of Kazakhstan; export and imports of goods over nominal GDP
Public debt to GDP: cumulated government deficit to GDP; Datastream: KZQ80...A; (quarterly data interpolated to monthly frequency).

Net foreign assets: cumulated current account deficits; Statistical Agency of the Republic of Kazakhstan
Public expenditure to GDP: Datastream: KZQ82...A; (quarterly data interpolated to monthly frequency)
Urals crude: Datastream: OILURAL
Oil revenues: selling price of oil multiplied by quantity; Statistical Agency of the Republic of Kazakhstan.

The effective variables are computed as the weighted average of the three series (U.S., euro area and Russia) based on constant weights derived from foreign trade shares.