

**ECONOMIC POLICY AND THE  
REAL EXCHANGE RATE:  
RUSSIA SINCE 1998**

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**The Key Role of the Real Exchange Rate**

“Real Exchange Rate Economics” is a relative newcomer to our discipline. It is hard to find explicit mention of it in the literature of forty or fifty years ago, though aspects of it were surely present in the historic treatments of the transfer problem, of tariffs and customs unions and, to a degree, of changes in the terms of trade. It is our belief that one of the great impediments to its full incorporation in main corpus of economic theory has been the long tradition (in our literature) of treating international trade problems in terms of two countries (A and B) which were typically treated symmetrically in the analysis.

The development, mainly in the 1960s and 1970s of the economics of the “small open economy” was an important watershed in bringing real exchange rate economics into the fold. Above all, it served the function of eliminating the symmetry of treatment between countries A and B. Now we have a small country C, facing a vastly larger rest of the world (ROW), which is where the prices of all (or nearly all) traded goods and services are determined. The small open

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economy has to find its equilibrium in the face of all kinds of changes in the vector of prices generated by the ROW. The real exchange rate is the fundamental equilibrating variable of this process.

Think of the supply and demand for foreign exchange (dollars), each as a function of the real price of the dollar (its nominal price  $E$  divided by a general domestic price level  $\bar{p}_d$ ). The equilibrium of supply and demand will determine an equilibrium real exchange rate ( $E/\bar{p}_d$ ). Changing external prices of a country's imports and exports will cause the supply and/or demand functions of foreign exchange to shift. A rise in the world price of oil, for example, will generate a rightward shift in the supply of foreign exchange as a function of the RER, which in turn will make the dollar cheaper in real terms.

But it is not only world prices that influence the equilibrium real exchange rate. Capital inflows add to the supply of foreign exchange, capital outflows to its demand. Import restrictions artificially curtail the demand for foreign exchange, while export restrictions reduce its supply. Productivity increases also play a role -- which, however, is far from adequately appreciated in most contemporary discussions. Many such discussions seem to be based on the idea that productivity increases in general cause the real exchange rate to appreciate (i.e., the dollar to become cheaper in real terms). This is totally wrong. The correct statement is that productivity increases in the tradables sector of the economy (encompassing both importables and exportables) lead to a cheaper dollar in real terms, but productivity increases in the nontradables sector work in precisely the opposite direction, causing the equilibrium real price of the dollar to rise.

The above brief listing of the main types of exogenous shocks that can cause the equilibrium real exchange rate to change should be sufficient to convince readers that the RER is

a profoundly endogenous variable of the economic system. Governments can choose to fix the nominal exchange rate, and can implement this policy by buying and selling dollars at the stipulated nominal rate. But they cannot fix the real exchange rate in a similar fashion. A one-line explanation of this “policy impotence” is that one cannot in the final analysis determine a real variable through the use of purely nominal policy instruments. To have impact on the equilibrium real exchange rate, a country’s economic authorities have to find and be able to use (with sufficient force) one or more real instruments. Sterilized intervention is a wonderful example of such a real instrument. The type-case of sterilized intervention is for the Central Bank to float bonds on the local market, and then use the local currency (here rubles) thus obtained to enter the foreign exchange market and buy dollars. In this process there is no net issue of new money by the Central Bank. Purchasing power has been diverted from the local market by the sale of bonds, and then shifted to the foreign exchange market to buy dollars. Quite analogously, the central government could create a budgetary surplus, and then use those funds to purchase foreign exchange. This amounts, in effect to sterilized intervention carried out by the fiscal authorities.

Other ways of using real policies to influence the real exchange rate include raising or lowering tariffs (or other restrictions) on imports, and imposing taxes on or granting subsidies to exports. Somewhat more subtly, governments can shift the equilibrium real exchange rate by having different patterns in their expenditure of funds from the private sector expenditure patterns that were displaced in the process of raising those funds (either by taxation or by borrowing). In general, the raising of funds will displace demand partly from the tradables sector, and partly from the nontradables sector. It is obvious, then, that if the government spends all of those funds on tradables this will entail a net increase in demand in that sector, and lead to

a rise in the real price of the dollar. Similarly, if the government concentrates its spending entirely on nontradables, it is their price which will rise in real terms, causing the real price of the dollar to fall. From here it is but a small step to see that there will be some influence on the equilibrium real exchange rate so long as the government spends its funds in a pattern that is (significantly) different from the pattern in which private demand was displaced, as those funds were raised.

We hope that the above listing makes clear the many forces that operate on the RER, and the complexity of the interactions between policy measures and the equilibrium RER.

### **Background of the Russian Currency Crisis**

The purpose of the present paper is to take the reader on a sort of guided tour of economic development in the Russian economy over the last five years, using the real exchange rate as the main thread whose trail we will follow, and try to understand and explain. In the process we will be able to highlight some of the main policy issues that have faced the Russian authorities, and the means that they employed to confront these issues.

The starting point of our story is the Russian currency crisis of 1998. That crisis was preceded by an incredibly convoluted history, as the Russian economy transited from Communism to (or toward) a free-market system. That history is not part of our story, but a few key facts will help readers form a picture of what things were like.

To us, the key challenge facing the Russian economy in this transition was the disjunction between the pattern of prices (of goods and services) within the old Soviet economy on the one hand, and the pattern of prices ruling in the world market on the other. It is probably fair to say that all the industries that existed in the Soviet era were fully “protected” from world

market competition, regardless of their level of efficiency or capacity to compete. The system was so regulated that their survival was not an issue.

Then, all of a sudden, the move to a market economy was begun. It quickly became evident that a great many existing activities were non-viable at world-market prices. Under “normal” circumstances, such nonviable activities simply die; firms go out of business, or are taken over by others; industries disappear and are supplanted by new ones that better reflect the country’s comparative advantage. Some of this surely happened in Russia, but the outstanding feature of the Russian transition was how little of it occurred. Instead, one had the spectacle of patently nonviable enterprises surviving and continuing to produce. Partly this was made possible by subsidies from the state; partly it came from loans that were not repaid, or bills that were left unpaid. But in addition there was the so-called “barter system”. This system was very widespread, as well as complex. We certainly know of no simple and straightforward account of how it worked, and have urged our Russian colleagues to move quickly to assemble documentary evidence of the mechanisms of the barter system, before it recedes too far into the past.

A thumbnail description of the barter system is that the great bulk of old enterprises kept working, even when they could not sell their products. What happened then? The products that could not be sold were simply, in one way or another, unloaded via the barter system. Typically, serious losses would be involved in this, and these losses were somehow distributed between owners, managers, workers, suppliers, creditors, and government.

One reason why so many enterprises were involved in the barter system was that the real exchange rate was not favorable to their survival -- the dollar was relatively cheap in real terms.

The huge devaluation of 1998 changed all this, and all of a sudden the dollar became quite expensive in real terms. The shift to an expensive dollar had a huge impact on the so-called barter sector of the Russian economy. Almost automatically, many activities were shifted from “non-viable” to “viable”. While analytically we would expect this shift to function across the board, in point of fact in the Russian case the response to the RER stimulus seems to have been much more marked among import-competing activities than among export activities. In any case this experience puts the spotlight on another important aspect of the real exchange rate as the principal equilibrating variable of a country’s trade and payments -- in accomplishing this adjustment, the changing RER also determines which tradable activities will be viable and which will not. This makes the RER, in theory and in fact, the principal arbiter of a country’s comparative advantage.

Russia’s currency crisis occurred in the third quarter of 1998. The price of the dollar was 6.2 rubles at the end of June, and jumped to 16 rubles by the end of September. The devaluation process continued for a couple of quarters more, with  $E$ , the nominal exchange rate, reaching 20 rubles by December, 1998, and 24 rubles by March of 1999. Its upward drift then decelerated sharply, as it took until December to reach 28, where it (the nominal rate) was effectively stabilized.

To see the effect of the devaluation in real terms, let us consider the period from June, 1998 to March, 1999, during which the nominal exchange rate,  $E$ , was multiplied by 4. During this same period the consumer price index barely doubled. Since there was only a negligible change in the world price level (measured in dollars) one can say that Russia’s real exchange rate doubled in this period. This was the acme of the RER in the aftermath of Russia’s devaluation.

The real ruble price of the dollar suffered a slight decline in the second quarter of 1999, but the fall became much more significant in the wake of the oil price boom of that year.

### **A Brief Digression On Oil Prices**

The Russian financial and exchange rate crisis of 1998 was the end result of many factors and forces, including a weak financial system, a government budget that had been in constant deficit for years, a poor legal and institutional framework and a very low standing with the international financial and investing community, which had already been badly burned in the mid-1990s owing to the listed weakness, plus corruption, plus serious deficiencies in the Russian legal system.

It is thus very clear that one cannot put the blame for Russia's crisis on oil prices. Nonetheless it is true that the price of Russian oil fell below \$15 per barrel in early 1998, and stayed below that figure all the way to July of 1999. This caused a sharp reduction not only in the supply of foreign exchange to the Russian economy, but also in the fiscal revenues of the Russian government. At the same time it created more uncertainty about the future of the Russian economy, hence acted as a spur to capital outflows, carried out both by foreigners with portfolio investments in the country, and by Russian nationals seeking safer havens for their savings.<sup>1</sup>

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<sup>1</sup>Huge capital outflows of "Russian" money have been characteristic of the Russian economy since early in the transition. Much of this money is held in deposits and investment accounts in Cyprus, Switzerland and other havens. It is worth mentioning, however, that the flight from the ruble was not the exclusive preserve of big money interests within Russia. Small savers also could, and did, take similar precautionary steps by converting some of their ruble holdings into dollars. When such conversions entail buying dollar currency (as distinct from building up dollar deposits in the Russian banking system), they represent capital outflow just as much as a movement of capital to an external financial center.

The combination of all these forces produced the crisis of 1998, which hit Russia very hard. The country's international reserves had been fluctuating in the range of \$11 to \$12 billion since late 1997, and stood at \$11.2 billion at the end of June, 1998. At the same time the overall balance of payments had been running at a deficit of about \$2.5 billion per quarter), financed partly by reserves, partly by the use of IMF credits, and partly by "exceptional financing". Then all of a sudden in the third quarter of 1998, this deficit ballooned to \$11.7 billion -- in a single quarter!! This was the clearest manifestation of the gravity of the crisis, and, in spite of it all, Russia was lucky to be able to get through it, thanks to over \$9 billion of IMF plus exceptional financing. There was no way, however, for this kind of external patching to continue at such a pace. It was pretty clear that a major real devaluation was necessary in order to reflect a new equilibrium in which the dollar (and foreign currency in general) was much scarcer than before. In this new equilibrium the real price of the dollar ( $E/\bar{p}_D$ ) had to be much higher than before; and clearly it was much more expeditious to reach this new equilibrium by the nominal exchange rate ( $E$ ) rising sharply than by  $\bar{p}_D$  driving down in a long and painful process of grinding deflation. This -- a sharp rise in the nominal price of the dollar -- is how the Russian economy's RER adjustment actually took place.

### **Overshooting of the Real Exchange Rate**

The fact that the real price of the dollar moved rapidly to twice its initial level, and then receded from that peak, reflects a phenomenon with which students of currency crises are quite familiar. There are at least two underlying reasons for the overshooting phenomenon in such cases. The first has to do with the panic that typically ensues once a major devaluation starts under crisis conditions. As many have observed, "no one wants to be the last to take his money out." In the race to the door, the final deterrent becomes the prospect that the price of the dollar



will fall rather than rise. If one expects the price of the dollar to fall in nominal terms, it is better simply to hold rubles rather than buy dollars. If one expects it to fall in real terms the relevant strategy is to protect one's wealth by holding it in real assets (even groceries or coal) rather than in either nominal rubles or dollars.

The second explanation of overshooting is different from, but totally compatible with the first. It focuses on the time lags that are required for many economic adjustments. We all learn how supply curves are more elastic in the long run than in the short. Hence a short term adjustment (to close a newly opened gap between the supply and demand for foreign currency at the old real exchange rate) will entail a movement along a very short run supply curve of foreign exchange, producing a large rise in the real price of the dollar. As time passes and more adjustment can be made, the equilibrium is generated by the intersection of demand with ever more elastic supply curves, until the long-run supply curve is reached. This process typically entails the real price of the dollar rising to its peak quite early, then rather slowly drifting down as the full, long term supply response is gradually approached.

One important place in which the issue of supply dynamics is of some importance is the differential experience of import substitutes on the one hand and exports on the other. Typically, in cases of exports other than the most basic primary products, it takes longer to reach the final long-term adjustments (of production, marketing and sales), when one is dealing with foreign rather than domestic markets. This causes the adjustment process to be slower for exports than for import substitutes, which helps explain the observation, mentioned earlier, that import substitutes accounted for the great bulk of the expansion of manufacturing production that took place after the 1998 devaluation.

Once we see the phenomenon of overshooting as a natural and integral part of the process of adjusting the real exchange rate in the wake of a major negative shock, we should not in principle take it as a cause for concern when we observe, in the latter stages of such an adjustment, a gradual and continuing real appreciation of the local currency (the ruble). On the other hand, not every RER appreciation that we might see under such circumstances has to fall in the category of a “natural part” of that process.

Two alternative possibilities come immediately to mind as one considers the Russian situation in the post-crisis period. Each of them posits the existence of some new shocks, unrelated to the initial 1998 crisis itself, or to the economy’s adjustment in response to it. The clearest of these is the oil price rise that started in 1999. This obviously changed the supply and demand situation in the market for foreign currency in a very clear and straightforward fashion. It made dollars more abundant, with the natural consequence that they would tend to be cheaper in real terms.

The second possibility consists of real exchange rate appreciation that stems from monetary as distinct from real causes. It is not easy even to formulate a proper analytical description of such cases, because monetary emission can be either an endogenous or an exogenous (or policy) variable, depending on the exchange rate system (e.g., fixed nominal rate or fully free float) that is in force. In spite of this difficulty, however, we believe readers can imagine cases in which excessive monetary expansion causes the price level to increase, causing the real price of the dollar to fall -- not bringing the real exchange rates closer to equilibrium, but (quite to the contrary) actually creating an RER disequilibrium where none existed before.

We will explore the two mentioned cases as we deal with post-1998 developments in the Russian economy in subsequent sections of this paper.

### **The Oil-Price Boom of 1999**

June 1998 to February 1999 represented the low point (\$10 per barrel) in the trajectory of oil prices in recent years. One can be quite sure that what we were observing in the Russian economy up through then represented the natural denouement of the crisis of 1998. But subsequent months saw a huge rise in oil prices, which reached \$18 per barrel by July, \$21 by September, and \$25 by the end of 1999. They averaged about \$24 per barrel through most of 2000-02, punctuated by a spike to about \$30 per barrel in September-November, 2000, and by a tailing off to under \$20 per barrel in the last quarter of 2001 before reversing again to the level of \$24-25 per barrel.

The consequence of the oil price boom was a natural tendency for the dollar to become cheaper in real terms, above and beyond any natural working out of the overshoot that followed the 1998 devaluations. From the standpoint of the Russian economy as a whole, this improvement in its terms of trade has to be regarded as a benefit, but one that nonetheless had its darker side. This consisted of the threat of so-called Dutch Disease, which commonly accompanies a price boom for a major export product. Dutch Disease refers to the effect on other exportables and importables, stemming from the reduction in the real price of the dollar that comes as a result (in this case) of the oil price boom.

Many questions arose as the oil price boom asserted itself. Should (ideally) the economic authorities intervene to mitigate its effect on the real exchange rate? What policy instruments were available for them to use for this purpose? What were the factors limiting the degree to which these instruments could be used, or the power they had to affect the RER? Since in actual fact the nominal exchange rate between the ruble and the dollar remained pretty close to constant once the 28-ruble level was reached, we will frame the main thread of our discussion in that

context (i.e., not elaborating on the possibility of allowing the nominal ruble price of the dollar to fall as a consequence of the oil price boom). In this context, then, the natural process by which the RER adjusted to its new level would come from the Russian Central Bank buying newly-generated petrodollars via an expansion,  $\Delta B$ , in the supply of base money. The money multiplier,  $\mu$  would then come into play, leading to a greater quantitative increment  $\Delta M_{2x} = \mu \Delta B$  in the broad money supply  $M_{2x}$ . At least some of this extra money would likely be in excess of what people were willing to hold, leading to incremental spending on both tradable and nontradable goods, as people tried to get rid of the unwanted portion of their cash balances. The extra spending on tradable goods would cause an increase in imports **or a decline in exports** of the affected commodities (i.e., **exports other than oil and gas, whose price rise generated the shock**), thus tending to drain away some of the petrodollars acquired by the Central Bank. **The extra spending on nontradables would tend to produce an increase in their price. In Russia an important additional source of increase ??? was the stepwise upward adjustment of electricity, gas and railway rates. These ??? of nontrading??? have the dual effect of:** a) leading to an increase in the desired nominal holdings of  $M_{2x}$ , increases in the price level implying greater nominal holdings for any government??? of real holdings, and b) causing a shift in the pattern of demand away from nontradables and toward tradables. The increased demand for tradables thus generated works to increase imports and further offset the inflow of petrodollars.<sup>2</sup>

If one considers the transition from one steady-state equilibrium to another, caused by a single upward jump in the price of oil from, say, \$10 to, say, \$25 a barrel, one would find the

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<sup>2</sup>[WHERE DOES THIS GO???]  $M_{2x}$  is the official Russian designation of a broad money (M2) concept that includes foreign currency deposits in the banking system. This is the concept reflected in the sum of Row 34 (Money) and 35 (quasi-money) in the IMF's International Financial Statistics.

balance of payments in equilibrium both before and after the price shock. In the new equilibrium there would be more imports and less non-oil exports, these two changes being sufficient to exactly offset the increment in the dollar value of the oil exports.

In the new steady-state situation, the prices of tradables other than oil would presumably be unchanged, being determined by world prices converted to rubles at a fixed exchange rate. But the prices of nontradables would be higher, in an amount sufficient to induce the expenditure shift referred to above. The demand,  $M_{2x}^d$  for nominal money balances would also be higher, influenced: a) by the rise in real income represented by the oil-price increase itself, (which would cause a rise in desired real cash balances,  $M_{2x}(\bar{p}_d)$ , and b) by the rise in the equilibrium price level of nontradables, which, by causing  $\bar{p}_d$  to rise, would generate an increase in the demand for nominal  $M_{2x}$  even if the demand for real cash balances remained the same.

As the relative price of tradables (other than oil and gas) fell due to the declining real price of the dollar, the natural consequence was a shift in the pattern of production away from these tradables and toward the now-booming nontradables sector. This adjustment is brought about also by a rise in the nominal wage rate in all sectors, driven by the burgeoning demand for nontradables. In the process, labor moves tradables to the nontradables sector, attracted by the higher nominal wage growth there. The attraction of labor toward nontradables tends to be ????, as some tradables activities choose to reduce their labor force in response to increased foreign competition combined ??? rising local wage rates.

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### **Varieties of Sterilization**

Standard sterilization enters this picture simply by blunting the force of the initial shock. It does so by creating a counter-shock through an outflow of capital (or accumulation of additional international reserves by the Central Bank). Thus, if an extra \$10 billion arrives due to the oil-price boom, and sterilization operations cause \$6 billion to flow out, the size of the required adjustment is reduced by 60%. Such sterilization operations could be represented by increased accumulation of “sterilized” international reserves by the Central Bank (vis-a-vis the level of accumulation prevailing before the oil-price shock). Alternatively, there could be repayment of foreign debts by the government (or other Russian debtors) at rates higher than the repayment rates that prevailed before the oil boom. Both these mechanisms fit the standard concept of sterilization.

We might consider to be “nonstandard” sterilization anything that causes people to want to hold higher real cash balances. In the Russian case, as mentioned, the oil boom itself caused real income to increase, which would naturally lead to an increase in desired holdings of for  $M_{2x} / \bar{p}_d$ . But in addition the Russian economy was experiencing a major renewal of confidence, precisely in the period of the oil-price boom. Some of this may simply be due to the fact that the huge turmoil of the 1998 crises had to a considerable degree subsided. Some, almost certainly, was due to the very successful administration provided by the Russian government under Vladimir Putin, first, as prime minister and later as President.

Table 2 summarizes the supply of and demand for foreign exchange in the Russian economy for the period since 1997. There one can see immediately (by comparing rows 1 and 2) that the increased flow of trade dollars was offset to a significant degree by greater payments of debts or movements of capital abroad. Most observers believe that the great bulk of the Errors

and Omissions item (row 3) represents undetected capital outflows. This adds, in a sense, to the above interpretation, but note that even though these presumed outflows were very substantial (averaging around \$9 billion), they did not change much over the entire period, hence did not in that sense help to absorb the new shock represented by the oil-price boom.

Table ? shows that the main sources of outflows that tended to offset Russia's huge trade surpluses between June 1999 and December 2002 were the corporate sector (with a total outflow of \$36,4 billion), the government sector (total outflow = \$46,6 billion) and the central bank's total accumulation of international reserves = \$36.7 billion). If we take errors and omissions to represent private "informal" accumulation of dollars (cash or foreign balances), this source amounts to \$35.5 billion over the three-year period.

This makes it quite clear that the government and the private sector accounted for most of the "sterilization" that took place, either rendering Central Bank purchases of dollars unnecessary, or buying back dollars initially acquired by the Central Bank. One can hardly imagine how severe Russia's adjustment to the petrodollar boom would have been, if these "external" sources of sterilization had been absent.

Even so, the adjustment process entailed a considerable rise in Russia's internal price level, mitigated by a significant increase in real monetary ( $M_{2x} / \bar{p}_d$ ) balances. These developments are examined in the next sections.

### **Sterilization via Government Deposits at the Central Bank**

A widespread consensus could be obtained among economists for the proposition that the government, by adding to its deposits at the Central Bank, in effect offsets a like amount of incremental base money issued by that entity. But it is not as easy to find a similar consensus as

to how to measure this effect when looking at a country's monetary and banking history over any extended period of time.

One could, for example, consider that each increment of government deposits,  $\Delta D_{gt}$ , represents at that moment in time an immobilization of potential real purchasing power

$(\Delta D_{gt})/P_t$ , and build a cumulative time series  $\sum_{t=0}^k [(\Delta D_{gt})/P_t]$ . This has clear meaning at each

step, but the accumulation of successive real increments is dubious whenever there are significant changes in the price level over time. The reason is that an increase of 100 in government deposits can represent the immobilization of 100 of purchasing power at the time the deposit is made (say, when the price level equals 1.0), but will represent the immobilization of only half that purchasing power by the time the price level has risen to 2.0, and only a quarter by the time the price index  $P_t$  reaches 4.0.

Thus it is quite different from an act of sterilization in which the government, instead of accumulating Central Bank deposits, goes out and buys dollars directly. Here the sterilizing force would be represented by the amount of dollars that were accumulated, which in turn could

be expressed simply as  $\sum_{t=0}^k (\Delta FX_{gt})$ . Here  $\Delta FX_{gt}$  is the net increment of foreign exchange

(dollars) bought by the government at time  $t$ . But this is equal to  $SFX_{gt}/E_t$  -- that is, rubles spent on foreign currency ( $SFX_{gt}$ ) in time  $t$  divided by the exchange rate ( $E_t$ ) at that time.

Thus we have

$$\sum_{t=0}^k \Delta FX_{gt} = \sum_{t=0}^k [SFX_{gt}/E_t],$$



which is a form similar to  $\sum_{t=0}^k [(\Delta D_{gt}/P_t)]$ . What makes the two expressions different, in terms of their usefulness or relevance, is the fact that the government's holding of foreign exchange does not erode as  $E_t$  rises, while the government's holding of Central Bank deposits does erode in real terms as  $P_t$  rises.

For the purposes of the present paper we will consider the amount of sterilization to have taken place via government deposits from  $t=0$  up to  $t=k$  to be equal to  $(\sum_{t=0}^k \Delta D_{gt})/P_k$ . In this metric we can compare it directly with real base money  $(B_k/P_k)$  or, if that should be of interest, with real GDP at period  $k$  or at any other point in time.

Table 3 presents the main facts in connection with sterilization via government deposits in the period since June 1997. In June 1999, i.e., before the onset of the petrodollar boom, government deposits at the Central Bank represented an offset equal to about a seventh of the monetary base  $B$ , but by December 2002 they amounted to more than twice that fraction. Looked at in a different, but perhaps more relevant way the increment to real government deposits from June 1999 to December 2002 amounted to well over half of the increment of real base money in the same period.<sup>3</sup>

It is important to recognize that only one offset is involved if the government first builds up deposits in the Central Bank and then later uses them to buy dollars to repay some of its

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<sup>3</sup>Base money (reserve money in definition of IFS) does not include government deposits at the Central Bank, so it is perhaps clearer to think of a "potential" base equal to  $B$  plus government deposits, and of government deposits then acting to sterilize their portion of this potential base. Looked at in this way the offset was equal to 12.3% [=15.4/(109.4+15.4)] in June 1999 and to 22.1% [= 53.3/(187.9+53.3)] in December 2002. Similarly the increment of real government deposits between these two periods (37.9 billion real rubles) would have offset 32.5% of the increment of 116.4 (= 37.9+78.5) real rubles in the potential base.

foreign debt. We are not, however, double counting as between Tables 1 and 2. If government deposits were used to buy dollars to pay foreign debt in, say 2000, these deposits would have been eliminated before December 31 of that year, which is the date for which we record the December 2000 figure for government deposits at the Central Bank.

### **Sterilization by the “Public”**

Our story up to now starts with a surge of petrodollar income, some of which stays abroad in the hands of the companies that earned it, some of which goes to other private entities to finance capital flight, some of which goes to the government and is used to make debt service payments abroad, and some of which “comes home” and is exchanged for rubles at the Central Bank. In the previous section, we saw that part of the latter ended up as sterilized government deposits at the Central Bank.

In this section we concentrate on the role of the public in effectively sterilizing an additional portion of the increased issuance of base money by the Central Bank. The key element here is that the public’s desired holdings of real monetary balances ( $M_{2x} / \bar{p}_d$ ) change through time. If real desired holdings go down, a rising price level will ensue even if the nominal quantity of  $M_{2x}$  remains constant. Conversely, if real desired monetary balances go up, that would generate deflationary pressure if  $M_{2x}$  were held constant in nominal terms. Put another way, if real desired holdings go up by 10%, that means that the authorities can generate a 10% increase in  $M_{2x}$  without causing the price level to rise. It is in this sense that an increase in desired real monetary holdings can “absorb” and thus in effect sterilize that increment to  $B$  which would just support the desired increment in  $M_{2x}$ .

For the present calculation we will assume that, at any point in time  $t$ , the money multiplier for increments in the monetary base  $(\partial M_{2x} / \partial B)_t$  is the same as the average multiplier

$(M_{2xt}/B_t)$  observed at that point in time. This means, of course, that an increment to base money could be neutralized by an offsetting change in the multiplier, with the same level of  $M_{2x}$  now being supported by a larger base. We mention this in passing because our calculations will simply take each period's money multiplier as given. We will build it into our calculations, but will not inquire as to why it might have changed from period to period.

Nor will we attempt to isolate a degree of sterilization due specifically to it. Actually, the money multiplier in Russia increased very moderately CAN'T READ INSERT over the period we are studying, so that its changes operated to cause the price level to be higher. So changes in the money multiplier worked as an anti-sterilizer in the process. We do not neglect this effect in our measurements, but we commingle it with the effects of changes in the public's demand for real monetary balances.

The basic idea is as follows: we observe a certain change in desired real cash balances -- from  $(M_{2x0}/P_{d0})$  at time zero to  $(M_{2xt}/P_{dt})$  at time  $t$ . We want to ask how much extra real monetary base is needed to support this increment in real balances. To answer this we first calculate the required real base, which we take to be  $(B_0/M_{2x0})(M_{2x0}/P_{d0})$  for the initial period, and  $(B_t/M_{2xt})(M_{2xt}/\bar{p}_d)$  for any later period  $t$ . So, as if by magic, the increment in real base "needed" to support the change in desired real  $M_{2x}$  balances is simply the change in the actual real monetary  $[(B_t/\bar{p}_{dt}) - (B_0/\bar{p}_{d0})]$ .

Readers should be aware that our procedure incorporates all the reasons why the demand for real monetary balances could have changed in the period under review. In Russia at this time, real GDP was growing quite rapidly. The actual rate of inflation was coming down, which would normally lead to a fall in the expected inflation rate (which is the variable relevant for discussions about real monetary holdings). Also, starting in 2000, the presence of Vladimir

Putin at the head of the government brought a greater degree of order, and a corresponding increase in economic confidence and expectations. These and any other causal variables we may have neglected to mention are all included by our treatment of actual real  $M_{2x}$  balances as being equal to the desired ones.

The calculations referred to above are shown in Table 3. Real  $M_{2x}$  balances rose by 79??? percent between June 1999 and December 2002. This would have led to an equal percentage increase in  $B/\bar{p}_d$  had it not been for the indicated increase in the money multiplier. As it turned out, the rise in  $B/\bar{p}_d$  was 72%. This is the amount of sterilization that we attribute to the willingness of the public to hold higher real cash balances, as mediated through the Central Bank via the money-multiplier.

It follows that the nonsterilized portion of the increment in base money is precisely the fraction  $(\Delta P/P)$  that was reflected in a rising price level.

### **Different Perspectives on Sterilization**

From the foregoing analysis we can easily see that the great petrodollar boom had some important effect upon the Russian price level, which ended up doubling between June 1999 and December 2002. Yet this effect was not nearly so great as it might have been. Other actors entered the scene to mitigate what might otherwise have been the price level consequences of the boom.

In what follows we look at the same set of facts through a series of different lenses. Readers should bear in mind that we really are dealing with the same basic facts, not with mutually incompatible scenarios, as we go through the exercises the follow.

In Row A of Table 5, we show the actual increment (900 billion) of nominal  $B$ , between June 1999 and December 2002. Of this amount we attribute 527 billion to sterilization by the

public. This number is found by taking the increment of real rubles (78.5 billion) shown in Table ??? and multiplying it by the December 2002 price index (6,718). This exercise shows the public as sterilizing more than half of  $\Delta B$ .

In Row B we simulate the case in which the increment of government deposits at the Central Bank (306.8 billion rubles between June 1999 and December 2002) represents rubles which were (actually or hypothetically) issued as base money by the Central Bank, and then extinguished as base money when the government placed them on deposit. Looked at in this light, sterilization by government accumulation of deposits at Central Bank amounts to 25% of the initial issue.

In Row C of Table 4 we carry out a similar exercise, in this case incorporating the net outflows arising from capital outflows and government debt service. For the purpose of this exercise we have just taken the flows for the period from June 30, 1999 to December 31, 2002, converting each period total into rubles at the average exchange rate of the respective period. The scenario here treats these flows of funds as if they too had passed through the Central Bank, with that institution having first issued rubles in the amounts indicated and then later reabsorbed the same rubles as it sold foreign exchange to capital flow and debt service customers.

We hope readers recognize that it really makes no difference whether the operations that we suppose in Rows B and C to have passed through the Central Bank actually did so. The ultimate effect is the same if: a) an economic agent buys \$1 million in the open foreign exchange market or if b) the Central Bank issues 30 million rubles to buy \$1 million, and then reabsorbs the same 30 million rubles as it sells the million dollars to the agents in question. Both cases end up with a million dollars of capital placed abroad, and with no net emission of rubles by the Central Bank. Put in other words, one can consider a million dollars of trade surplus to

have in effect been sterilized if it ended up as a capital outflow, even if it did not actually pass through the Central Bank in the process.

The main message to be drawn from this exercise is that the Russian economy has been very lucky. One can hardly imagine the turmoil it would have gone through had all the proceeds of the trade surplus gone to the Central Bank, with none of the resulting ruble issues being offset by any of the three sources of sterilization listed in Table 4.

As things worked out, the petrodollar boom resulted in a doubling of the price level, spread over 2 1/2 years. In the next section we inquire into how we should interpret this price rise.

### **The Rising Price Level -- Is It Inflation Or Real Exchange Rate Adjustment?**

Between June of 1999 and December of 2002, the international reserves of Russia's Central Bank rose from \$8.2 billion to \$44.1 billion, an increase of almost \$36 billion. The first question to ask is, what would likely have happened if, instead of acquiring all these dollars, the Central Bank had pursued a strict price level target, letting the market set the exchange rate.

Working in the framework of the preceding sections, this counterfactual scenario would have called for some increase in  $B$  -- to satisfy the public's increased demand for  $(M_{2x}/P)$ . We have calculated this increase as representing 72% of initial base money, or 78 billion real rubles. Converting these real rubles to nominal ones at the initial price level (3.32), we obtain an increment of nominal  $B$  equal to 258.9 billion rubles. At an average exchange rate of, say, 28.5 rubles per dollar, this increment would absorb \$9,08 billion of the \$35.9 billion by which Central Bank reserves in fact increased.

In our counterfactual scenario, then, the remaining \$26.8 billion would simply not have been bought by the Central Bank. They would instead have been left on the market, where the nominal exchange rate would have to adjust downward to a new, lower equilibrium level.

How can we determine what the equilibrium nominal exchange rate would be under these circumstances? The easy route to an answer is to posit that the real exchange rate would have followed the identical path that it actually followed over the same period.

Table 6 carries out the relevant calculations. The actual nominal rate is divided by the price level to get the actual real rate (here defined as  $E/\bar{p}_d$ ). Column (4), giving the counterfactual nominal rate, simply multiplies the real rate by the initial price level, which is assumed to be constant in the counterfactual scenario.

Readers should fix firmly in their minds that in the counterfactual scenario, the real rate follows exactly the same course as it did in the actual historical [path](#).

We find nothing unreasonable about the counterfactual trajectory shown for the nominal exchange rate in Column (4) of Table 6. That is to say, we feel this “could plausibly have been” the path of a free-market exchange rate, compatible with a policy of price level stability starting in July 1999. It follows, then, that the rise in the price level since that date “could have” been mainly the simple reflection of an equilibrium real exchange rate adjustment.

Under this interpretation we would have to label as inflationary the actual move of the nominal exchange rate from 27.00 to 31.78 (an increase by 17.7 percent). But the remainder of the 69.3% increase in the price level between December 1999 and December 2002 would then be attributed to real exchange rate adjustment. Thus we have  $1.438 = 1.693 \div 1.177$ ; i.e., our price level increase of 103% would be composed of a “genuine inflationary force” of 17.7% over the ??? year period, together with a real exchange rate adjustment of 43.8% over the same period.

TABLE 1  
THE STRUCTURE OF PAYMENTS IN RUSSIAN INDUSTRY

	1997	1998	1999	2000	2001	2002
Credit In Goods	8.3	14.8	7.1	4.1	1.0	1.4
Barter	53.5	64.7	50.7	31.7	20.3	15.2
Cash Payments	38.2	20.5	42.2	65.2	78.7	83.4

QUESTIONS FOR ANDREI AND OXANA: Can I merge “credit in goods” and “barter”?

Also, what source should we put for this table?



TABLE 2  
 SUPPLY AND DEMAND FOR FOREIGN CURRENCY  
 (Annual Flows In Billions of U.S. Dollars)

	<u>1997</u>	<u>1998</u>	Total	<u>1999</u>		<u>2000</u>	<u>2001</u>	<u>2002</u>
				1st Half	2nd Half			
1. Balance of Trade In Goods & Non- Financial Services	8.3	11.8	32.6	11.4	21.1	53.8	39.0	37.?
2. Net Flows** On Capital Account (Including Income From Capital)	2.5	-7.3	-22.2	-8.6	-13.6	-28.7	-20.6	-18.?
2a Government	13.1	7.1	-8.5	-3.9	-4.7	-11.9	-17.1	-13.?
2b Financial Sector	8.0	-6.1	-4.0	-2.6	-1.4	-0.8	4.7	2.?
2c Individuals	-13.4	0.8	1.0	1.2	-0.2	-0.9	-0.8	-0.?
2d Corporate Sector	-5.2	-9.2	-10.7	-3.4	-7.3	-15.1	-7.4	-8.?
3. Errors & Omissions	-8.8	-9.8	-8.6	-2.1	-6.4	-9.2	-10.2	-7.?
4. ΔCentral Bank Reserves***	-1.9	5.3	-1.8	-0.6	-1.1	-16.0	-8.2	-11.?

\*Estimate

\*\*Net Inflow (+), Net Outflow (-)

\*\*\*Increase in Reserves (-), an Outflow of Funds  
 Decrease in Reserves (+), an Inflow of Funds

Source: ANDREI AND OXANA -- please get source of table.

TABLE 3  
GOVERNMENT DEPOSITS IN CENTRAL BANK  
(Billions of Rubles, Nominal or Real)

<u>Date</u>	<u>Gov. Deposits (nominal rubles)</u>	<u>Base<sup>a</sup> Money (B)</u>	<u>Price Index<sup>b</sup> (1995=100)</u>	<u>Govt. Deposit (real rubles)</u>	<u>Real Base Money B/<math>\bar{p}_d</math> (real rubles)</u>
June 1999	51.0	362.7	342	14.9	106.1
Dec. 1999	75.9	439.7	402	18.9	109.4
Dec. 2000	240.5	739.8	504	47.7	146.8
Dec. 2001	294.9	951.3	578	51.0	164.6
Dec. 2002	357.9	1262.6	671.8	53.3	187.9
June 1999 Minus Dec. 2002	306.8	899.9	-	37.9	78.5

<sup>a</sup>B = base money = row 14 (reserve money) of International Financial Statistics.

<sup>b</sup>The price index used throughout this paper is the simple average of the producer price index and the consumer price index of Russia, each calibrated to a base of 1995 (average of the 12 months) = 100.

TABLE 4  
STERILIZING EFFECT OF CHANGES IN  
DEMAND FOR REAL MONETARY BALANCES

<u>Date</u>	<u>Real Monetary Balances</u> ( $M_{2xt}/P_{dt}$ ) (1)	<u>Money Multiplier</u> $\mu_t = M_{2xt}/B_t$ (2)	<u>Implied Required Real Money Base = (1)÷(2)</u> (3)	<u>Price Level</u> (4)
June 1999	237	2.17	109	331.5
Dec. 1999	248	2.24	111	396.8
Dec. 2000	310	2.11	147	502.5
Dec. 2001	367	2.23	164	578.5
Dec. 2002	423	2.25	188	671.8
Dec. 2001 Minus June 1999	186	--	79	
Dec. 2002 ÷ June 1999	1.79		1.72	2.03

Source: ???

$M_{2x}$  = row 34 (money) plus row 35 (quasi-money) from International Financial Statistics.

TABLE 5  
DIFFERENT VIEWS OF “STERILIZATION”  
IN RUSSIA 1999-2002

(In Billions of Nominal Rubles as of December 2002)

	<u>Rubles Issued To “Purchase” Foreign Exchange</u>	<u>Sterilized By Public</u>	<u>Sterilized By Gov. Deposits At Cent. Bank</u>	<u>Sterilized By Capital Flows + Debt Service</u>	<u>Sterilized By Debt Service</u>	<u>Non- Sterilized Part</u>
A	899.9 <sup>a</sup>	527.6 <sup>b</sup>				372.3
B	1206.7	527.6	306.8 <sup>c</sup>			372.3
C	4366.0	527.6	306.8	3159.3 <sup>d</sup>	1287.5	372.3

<sup>a</sup>899.9 billion rubles =  $\Delta B$  from Table 2.

<sup>b</sup>527.6 billion rubles =  $78.5 [\Delta(B/\bar{p}_d)]$  from Table 2 times 5.78 (Dec. 2002 price index).

<sup>c</sup>306.8 billion rubles =  $\Delta$  government deposits at Central Bank, from Table 2.

<sup>d</sup>3159.3 billion rubles = Sum of items 2 plus 3 from Table 1, for the period June 1999 -?? December 2002??? for 2002 converted at the average exchange rate for corresponding period (27.6 rubles per USD).

TABLE 6  
EXCHANGE RATE TRAJECTORIES

<u>Date</u>	No. of Rubles		Real Rate [(1)÷(2)]×100 (3)	Con????? Nominal Rate <sup>a</sup> [(3)×(2 for Dec. 1991)] (4)
	<u>Per U.S.\$ Nominal Rate</u> (1)	<u>Price Level</u> (2)		
June 1999	24.22	331.5	7.31	24.22
Dec. 1999	27.00	396.8	6.80	22.54
Dec. 2000	28.16	502.5	5.60	18.56
Dec. 2001	30.14	578.5	5.21	17.27
Dec. 2002	31.78	671.8	4.73	15.68
Dec. 2002 June 1999	1.336	2.027	.647	.647

aBased on the assumption [CAN'T READ LARGE BLOCK -- FADED] ... while the real price of the U.S. dollar followed the actual path shown in column (3).

Price increase of 102.7% reflects real exchange rate appreciation of 54.6% and [1.546 = (1/.647)]??? and "true inflation" of 33.6% between June 1999 and December 2002.

TABLE 7  
EXCHANGE RATE TRAJECTORIES

<u>Date</u>	<u>Nominal Rate</u> <u>Rubles per SDG</u>	<u>Price</u> <u>Level</u>	<u>Real Rate???</u> <u>[(1)÷(2)]×100</u>	<u>Con????</u> <u>Nominal Rate<sup>a</sup></u>
Dec. 1999	35.06	396.8	8.84	35.06
Dec. 2000	36.70	502.5	7.30	28.97
Dec. 2001	87.88	578.5	6.55	25.99
Dec. 2002	43.22	671.8	6.43	25.51
<hr/>				
<u>Dec. 2002</u> <u>Dec. 1999</u>	1.233	1.693	.727	.727

Price level increase of 69.3% reflects real exchange rate appreciation of 37.6% and “true inflation” of 23.3% over the three year period covered.

<sup>a</sup>Based on the assumption that the price level had remained stable at its level of December 1999 while the real price of the SDR followed the actual path shown in column (3).