EXCHANGE RATE EFFECTS ON THE CURRENT ACCOUNT (WOULD THE DEVALUATION IMPROVE THE UKRAINIAN CURRENT ACCOUNT)

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Arts in Economics

Economic Education and Research Consortium

1999

Approved by ____

Chairperson of Supervisory Committee

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Program Authorized
to Offer Degree ____

Date ____

The National University of

"Kyiv-Mohyla Academy"

Abstract

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Devaluation is a theoretically conventional tool to improve trade balance and accordingly current account, which rests on the assumption that Marshall-Lerner condition holds. However, estimated aggregate export and import demand equations with quarterly data for 1994-1998 show that in Ukraine it would not work, at least during a one year period. The weighted sum of medium run (one year) export and import elasticities is less than unity implying the Marshall-Lerner condition does not hold. The demand equations' coefficients are more plausible and significant for ROW (rest of the world) region than for FSU (former Soviet Union). Elasticities of trade with ROW rise over time suggesting the J-curve pattern of trade balance response to devaluation as the theory predicts. The weighted sum equals 0.5 over half a year leading to worsening of trade balance. The estimated elasticities for FSU region are more variable across different specifications and imply inverse J-curve response. The sum of trade with FSU' elasticities is greater than unity over 7 quarters period, implying that Marshall-Lerner may hold in trade with FSU. This result could be explained by higher degree of substitutability between Ukrainian and FSU goods, comparing to ROW goods.

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ACKNOWLEDGMENTS

The author wishes to thank Dr. Juan Carlos Herken Krauer for large improvements suggested. I am grateful to his wife Iryna Piontkivska for technical assistance in implementing this research. Also, the valuable comments of Dr. James W. Dean, Dr. Klaus Wallner, Dr. Arjun S. Bedi, Dr. Lance E. Brannman and Dr. Yochanan Shachmurove are gratefully acknowledged. I thank Dr. Andrew Rose for providing the article and Dr. Paul R. Krugman for his influential writings that inspired my digging into the issue.

Section 1

INTRODUCTION

The question of how does a devaluation affect the current account (CA) has been extensively explored in the theory of international economics as well as in empirical studies. Devaluation is often seen as a remedy for decrease trade deficit and improve the competitiveness of the country. During its seven years of independence, Ukraine has run a current account deficit, and accumulated a substantial foreign debt. Many policymakers claim that a devaluation will solve the problem. On the other hand, devaluation potentially makes the citizens of the country worse off in terms of decreasing purchasing power over imports, so the government might be tempted to avoid it.

The current account of the balance of payments plays several roles in policymakers' analyses of economic developments. On the one hand, it reflects the domestic residents' transactions with foreigners in the markets for current goods and services. On the other hand, current account determines the evolution over time of a country's stock of net claims on the rest of the world, reflecting the intertemporal decisions of domestic and foreign residents (Knight and Masson, 1998, p.4).

The goal of policymaking is often stated to maintain a sustainable CA. A theoretical criterion for CA sustainability, which is not particularly stringent, is that any path of the CA such that the present discounted value of all future CA is equal to the initial foreign debt of the country is consistent with solvency (Sachs and Larrain, 1993, p.171-172). Supporters of the intertemporal approach to the CA state that “it is a puzzle, that ratios of foreign debt to output seldom exceed 1:1, when plausible parameters estimates suggest that ratios of 5:1 or 10:1 could easily be sustainable” (Obstfeld and Rogoff, 1995, p.1793). A non-increasing foreign debt to GDP ratio is seen as a practical sufficient condition for sustainability (Roubini and Wachtel, 1997 p.5).

Ouanes and Thakur (1997, p.107) define a sustainable current account as one that can be maintained assuming a continuation of present policies into the future under an unchanged macroeconomic environment. Milesi-Ferretti and Razin (1996, p.3-5) argue that a current account balance tends to be less sustainable if: a) the imbalance is large relative to GDP; b) the imbalance is due to a reduction in national saving rather than an increase in national investment rates; c) national savings rates are low.

The role of the exchange rate in affecting CA is controversial. The now dominant intertemporal paradigm stresses the importance of consumption smoothing and investment as an explanation for CA dynamics. In models with fully flexible nominal prices and monetary neutrality a devaluation is unlikely to have important effects. Barro (1997, p.631) concludes, “movements in real exchange rate provide little or no information about what the current account is doing”. However, in traditional Keynesian analysis, the exchange rate is often seen as a key instrument to influence CA. According to this view, real devaluation switches expenditure from foreign to domestic goods, improving trade balance and hence CA. Krugman (1988, p.72) points out on two highly desirable features of devaluation as an expenditure-switching policy: it is administratively simple and provides decentralized incentives.

The underlying goal of exchange rate changes is to bring it to a level compatible with sustainable CA. Edwards (1994, p.89) argues that "the autonomous forces that move the real exchange rate back to equilibrium operate fairly slowly, keeping the country out of equilibrium for a long period of time. These results in fact indicate that if a country is indeed in disequilibrium, nominal devaluations can greatly help to speed up the real exchange rate misalignment". However, as Williamson (1994, p.2) notices “sometimes a market can develop a very well-defined view that a rate being defended by the authorities is inconsistent with the fundamentals, … but that is very different from claiming that the market always had a well-defined view of what the equilibrium rate is”.

Recent exchange rate and CA developments in transition economies generated a variety of explanations. Some authors (Kraynyak and Zettelmejer 1998, p.309-312) view the recent real appreciation of exchange rates in transition economies as a correction of the “excess” depreciation (overshooting) that occurred in the early stages of the transition process. On the contrary, Roubini and Wachtel (1997, p.25) argue that while some equilibrium real appreciation might have taken place, some of the real exchange movements suggest significant loss of competitiveness that has exacerbated the CA imbalances.

The effects of devaluation depend on the conditions in which it is undertaken. The currency may be devalued by government with an intention to return it to 'equilibrium level' in favourable circumstances or a devaluation can be triggered by external shock. The analysis is based on the structural export and import demands equations under assumption of small economy. These are rooted in the traditional micro analysis of the substitution and income effects. The relative price change represents the devaluation itself, while the activity variable- income represent the general conditions of economic environment.

Much attention of both academics and policymakers to the behavior of trade flows can be explained by two reasons. First, the underlying theoretical framework for the determination of trade volumes and prices familiar from consumer demand and production theory with relatively few explanatory variables. Second, the estimated income and price elasticities of demand have a lot of applications to important macroeconomic policy issues, including the international transmission of changes in economic activity and prices, the impact of both the expenditure-reducing (monetary and fiscal) policies and expenditure-switching (devaluation, tariff, subsidy) policies on a country's trade balance (Goldstein and Khan, 1985, p.1042).

A necessary and sufficient condition for devaluation to improve trade balance (CA)[1] is the Marshall-Lerner condition. It is usually assumed to hold in policy debates and it is incorporated in many widely used open economy models, such as Mundell-Fleming model (Caves et al, 1996, p.531-572) and internal-external balance model (Miller and Williamson, 1991, p.203-205). So the question whether the Marshall-Lerner condition is satisfied become crucial when one tries to use the models for analyzing of the Ukrainian economy.

Therefore, the first goal of my paper is to check whether Marshall-Lerner condition holds in the case of Ukraine, using the generalized elasticities approach. The higher the price elasticities, the more competitive is the international market for exports of the particular

[1] CA includes not only trade in goods but also trade in services, net income from abroad and current transfers. However, I assume those to be exogenous. Therefore, further in the text terms TB and CA are used interchangeably.

country, and thus the more successful will a real devaluation be in promoting export revenues and improving trade balance and hence CA. The higher the income elasticity of the export demand, the more powerful will export be as an engine of growth (Montenegro and Senhadji, 1998, p.4). The lower the income elasticity of import demand, the less deterioration of CA would be associated with long-run output growth.

The second objective is to test the hypothesis that trade flows with non-former Soviet Union countries (rest of the world or ROW) are better described by structural demand equations, than flows with former soviet union (FSU) countries. The rationale is that a large part of trade with FSU, especially Russia, is based not only on economic but on political and other considerations, as well as on inertia. Therefore inefficiencies persist: trade in goods at above market prices, such as sugar, trade in actual non-tradables, such as cement, arrears repayments in kind on non-market prices.

This paper reveals that price and income effects do play a role in determining the Ukrainian trade flows. However, Marshall-Lerner condition does not hold for total Ukrainian trade. As expected, elasticities in trade with ROW are more significant, but of lower magnitude than those with trade with FSU.

The elasticities approach was first developed by Alfred Marshall in the days of gold standard. It was enriched after the Keynesian revolution with the work of Abba Lerner and Joan Robinson (Miller and Williamson, 1991, p.192). The neat, though simplified, exposition of the approach was presented by Caves, Frankel and Jones (1996) and other international economics textbooks. Goldstein and Khan (1985) provide a comprehensive survey of empirical studies of trade elasticities, concluding that devaluation does effect trade balance. The recent literature is divided on the ability of a real devaluation in affecting imports and exports. Rose (1991) finds that a real devaluation has generally no significant impact on the trade balance, while Senhadji (1997) and Senhadji and Montenegro (1998) provide strong support to the view that devaluation generally improves the trade balance.

The major line of criticism to elasticities approach is that it is essentially static and short-run. Senhadji (1997) responded to it by deriving structural demand equations explicitly from intertemporal optimization. The only difference is that activity variable is not income but income minus exports.

The reminder of this paper is organized as follows. Section 2 explains the theory of exchange rate effects on the CA. Section 3 describes the data on Ukrainian trade flows and chooses the specifications for estimation. Section 4 discusses the results and provides policy implications. Section 5 is a conclusion.

S e c t i o n 2

THEORY

For devaluation to have an effect on the trade balance (CA) some variable must be sticky in the short run. A nominal devaluation reflected in as equal increase in all nominal magnitudes would have no real effect. I assume that the sticky variable is the price of export goods, that is the devaluation changes the relative price of export and import goods. However, the sticky variable can adjust over time. If the price level is sticky it adjusts via excess demand (Caves et al, 1996, p.474-475).

According to general equilibrium theory, consumer demand is the function of relative prices and real income. The most known form of the Marshall-Lerner condition, however, is characterized by the partial equilibrium nature because it keeps incomes constant, concentrating on relative prices.

In this section I begin with explanation of the partial equilibrium case, based on a number of assumptions. These include: capital flows are constant or exogenous; the economy is small in the world markets, so supply is infinitely elastic; domestic residents look at prices expressed in domestic currency; trade is balanced initially. Later some of the assumptions would be relaxed. Notably I would allow for a general equilibrium feature, adding incomes as explanatory variables, and consider Laursen-Metzler-Harberger effect. Then the posibility of non-balanced trade, lags in response of quantities to real exchange rate changes, and its inflation consequences would be discussed. A generalized Marshall-Lerner condition, which incorporates the above mentioned features is derived.

2.1 Partial Equilibrium Case

The trade balance is measured as the value (quantity multiplied by price) of exports minus imports. A devaluation (or depreciation) of the currency increases the price of import working to worsen the trade balance. But second (quantity) effect works to improve the trade balance, because devaluation of the domestic currency increases the quantity of exports demanded by foreign residents and decreases the quantity of imports. Figure 1a shows that a devaluation, an increase in E, lowers the price of exports to foreign residents. This is a movement down the curve, increasing the quantity of exports demanded, X_d. The devaluation also raises the price of imports to domestic residents, reducing their demand, M_d. This is represented in Figure 1b as a proportionate downward shift of the entire import demand curve, because the curve is drawn contingent on the exchange rate.

The proceeds from exports form the supply of foreign exchange, while import spending generate the demand for it. The question whether a devaluation improves the trade balance under the assumption of no capital flows is identical to the question of the stability of exchange market: does an increase in exchange rate increase the net supply of foreign exchange (Caves et al., 1996, p.358).

If demand is elastic, export receipts will necessarily increase, and the supply curve of foreign currency will slope upwards. But if the demand is inelastic, the value of export receipts will fall when the exchange rate increases, and hence the supply curve of dollars will bend back. This may not change the conclusion that the devaluation will reduce the excess demand for foreign currency, where the decline in the demand induced by devaluation exceeds the decline in supply (figure 2a). However, if the demand for imports happens to be very inelastic, it is possible that the demand for foreign currency declines less than supply at a higher exchange rate (figure 2b). [illegible] devaluation worsens the trade balance because the elasticities are low. Algebraically, if $E_x + E_m < 1$ devaluation worsens trade balance; if $E_x + E_m > 1$ devaluation improves it (Miller and Williamson, 1991, p.195-196).

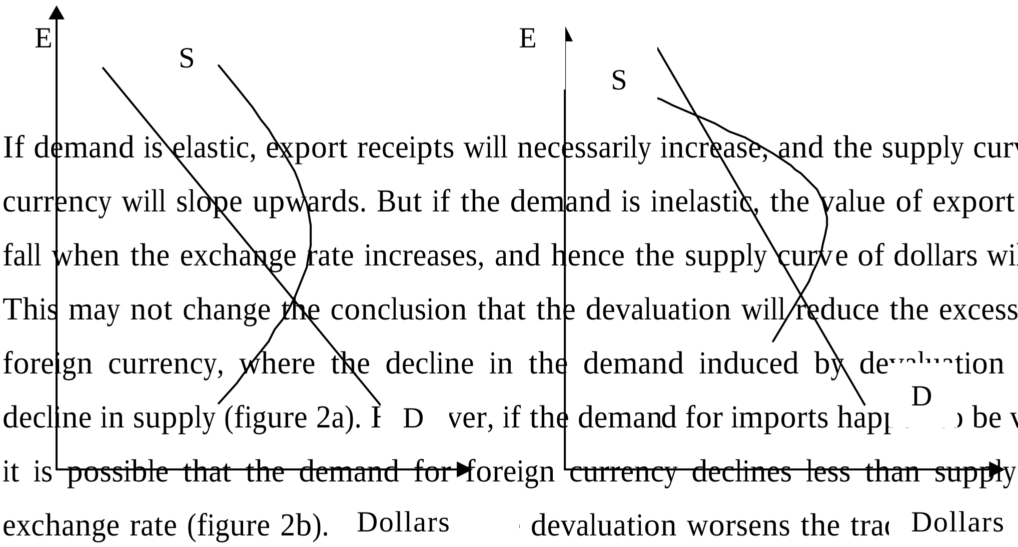

Figure 2a. Figure 2b.

Source: Williamson, John and Miller, Chris, 1991. *The World Economy: A Textbook in International Economics.* Henkel Hempstead: Harvester Weatsheaf, p..197

2.2 Activity Variables

In accordance with conventional demand theory, the consumer always tries to maximize utility subject to a budget constraint. The resulting demand functions for exports and imports thus represent the quantity demanded as a function of the level of income in the importing region, the imported good's own price, and the price of domestic good. The additional assumption is made that the consumer has no money illusion, so that a doubling of money income and all prices leaves demand constant. Such homogeneity of the demand function implies that the two arguments of the demand function become the level of real income and the relative price of imports (Goldstein and Khan, 1985 p.1046).

Exogenous increase of real income in domestic economy, ceteris paribus, increases the quantity of import demanded, worsening the trade balance. Similarly, exogenous rise of foreign income leads to higher import from domestic country, improving the trade balance.

Laursen-Metzler-Harberger effect is observed when consumers reduce their savings to maintain living standards in the face of the worsened terms of trade. The implication is that the fall in saving or increase in expenditures has a negative effect on the trade balance. In addition to price effect of a devaluation, the stimulus to domestic real income from increased exports will raise imports to an extent that depends on the domestic marginal propensity to import, and the fall in foreign real income from the fall in foreign exports will lower their import to an extent that depends on the foreign marginal propensity to import. Thus, the effect of devaluation depends on the magnitudes of the elasticities compared to the marginal propensities to import. $E_m+E_x>1+m+m^*$ (Caves et al., 1996 p.413-414).

2.3 Non-balanced Trade

In practice a country seldom devalues unless it starts from a position of deficit, rather than balanced trade, that is $P^*M>XP/E$. The difference it makes for the Marshall-Lerner condition to be satisfied is that more weight is given to import elasticity of demand. The higher the import elasticity, the more would import decline in response to devaluation. As initial import bill is higher than export bill, proportional decrease of imports contributes more to improving the trade balance.

2.4 Generalized Marshal-Lerner Condition

Incorporating the income and the non-balanced trade effects Marshall-Lerner condition can be generalized as follows: (*derivation* is *provided in Appendix* 1)

$$?\left(e_X^* ? \frac{EP_M^* M}{P_X X} e_M ? 1\right)(\overset{?}{P_M^*} ? \overset{?}{P_X} ? \overset{?}{E}) ? \frac{EP_M^* M}{P_X X} \overset{?}{P_M^*} ? e_Y^*(\overset{?}{Y^*} ? \overset{?}{P_M^*}) ? \frac{EP_M^* M}{P_X X} e_Y(\overset{?}{Y} ? \overset{?}{P_X}) ? ? 0$$

Where X- export, M- import,

$\boldsymbol{e_X}$ - relative price elasticity of foreign demand for home goods

$\boldsymbol{e_M}$ - relative price elasticity of home demand for foreign goods

$\boldsymbol{e_{Y^*}}$ - foreign income elasticity of demand for home goods

$\boldsymbol{e_Y}$ - domestic income elasticity of demand for foreign goods

Y^* - foreign income

Y – domestic income

P^* - level of foreign prices

P – level of domestic prices.

Trade balance is measured in foreign currency terms. The resulting change in trade balance after devaluation is:

$$\frac{P_X}{E} X ?\left(e_X^* ? \frac{EP_M^* M}{P_X X} e_M ? 1\right)(\overset{?}{P_M^*} ? \overset{?}{P_X} ? \overset{?}{E}) ? \frac{EP_M^* M}{P_X X} \overset{?}{P_M^*} ? e_Y^*(\overset{?}{Y^*} ? \overset{?}{P_M^*}) ? \frac{EP_M^* M}{P_X X} e_Y(\overset{?}{Y} ? \overset{?}{P_X}) ?$$

Thus, a nominal devaluation E would improve the TB (CA) if: it is not compensated by changes in price levels in the two regions; the weighted sum of elasticities is not only greater than unity but also compensates the real income induced changes. Two particular issues are noteworthy concerning the devaluation. The first is different values of elasticities measured over different time spans. And the second is the likely inflation consequences of nominal devaluation.

2.5 Lags

There are a number of reasons why demand elasticities rise over time, and why the quantities demanded are slow to respond even after the change in the exchange rate is passed through to import prices. Caves et al. (1996, p.362-364) indicates four time lags. First, there is a lag due to imperfect dissemination of information, during which importers recognize that relative prices have changed. Second, there is a lag in deciding to place new order. It takes months or years before inventories are depleted in case of firm's inputs, while in case of consumers changing habits takes time. Third, there may be production and delivery lag. Fourth, producers sometimes relocate their factories to the country where costs are lower because of an exchange rate advantage.

The resulting pattern of response of trade balance to devaluation is known as J-curve (see Figure 3, the curve J1). The trade balance following devaluation first worsens, because price effect dominates, then improves as quantities adjust. If it takes time before the exchange rate change is passed through to domestic prices of imports, the initial worsening of the trade balance is spread over a longer period (see Figure 3, the curve J2).

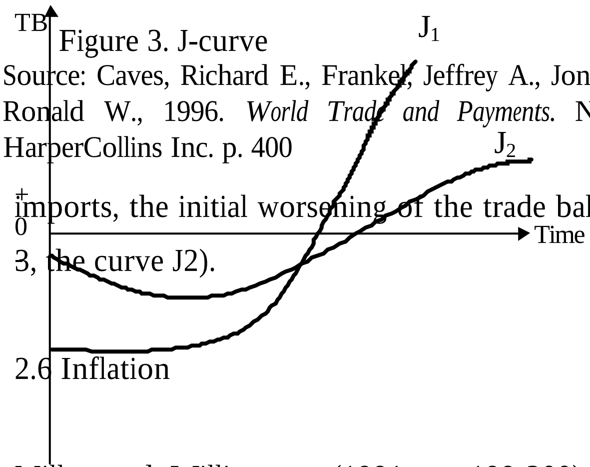

Figure 3. J-curve

Source: Caves, Richard E., Frankel, Jeffrey A., Jones, Ronald W., 1996. *World Trade and Payments*. NY: HarperCollins Inc. p. 400

2.6 Inflation

Miller and Williamson (1991, p. 199-200) state that "the fear that most or all of the devaluation will be neutralized by induced inflation is the most persuasive reason for questioning the efficacy of devaluation. There are ample theoretical reasons for this to happen, and there is ample evidence that this does happen in practice."

The domestic price effect of import price changes depends on the number of factors. Goldstein and Khan (1985, p. 1094) point to substitutability between imported and domestic goods in consumption and production, the share of imports in final expenditure or total output, the elasticity of factor prices, particularly, money wages with respect to domestic price changes, the elasticity of domestic prices with respect to changes in factor prices, notably, money wages. The higher are each of these parameters, the greater will be the elasticity of domestic prices with respect to import price changes.

The policy implication of this feedback effect is that it can diminish the real exchange rate changes that result from nominal exchange rate changes, and thereby sharply reduce the expenditure–switching effect even with reasonably high price elasticities (Goldstein and Khan, 1985, p. 1095).

Section 3

DATA AND SPECIFICATION

In this section I am trying to justify the assumptions taken in the case of Ukraine. Then I discuss main approaches to modeling structural demand equations. Finally, the data set is described, specifying the proxies for the variables.

3.1 Assumptions

The great advantage of assumption that the supply-price elasticities for import and export are infinite is that it permits satisfactory estimation of the import and export demand equations by single equation methods, since P_X and P_M are viewed as exogenous. Goldstein and Khan (1985 p.1048) argue, that "the infinite supply elasticity assumption is more defensible for a country's imports than for its exports. The rest of the world may well be able to increase its supply of exports to a single country without an increase in price, but it is less likely that even a large single country can increase its total export supply at a constant price unless there exists a large pool of unemployed resources in the export industry itself or elsewhere in the economy." Surely, there are a lot of underemployed and unemployed resources in Ukraine, notably labor, so that it can be used if sufficient demand is generated.

The second assumption is exogenous capital flows. Ukraine can be described as a country with low capital mobility. Trade flows are not dominated by capital account transactions as it is in developed countries. Most of capital flows are not directly linked to exchange rate. Exogenous capital flows such as official creditors' financing (IMF, World Bank, European Union etc.) don't endanger our model mechanics and conclusions. The assumption might not hold, however, in 1996-1997 when the government T-bills market attracted foreign investors. Still we assume it has negligible effect on the foreign exchange market.

The third assumption is aggregated goods. Each country's trade flows comprise many commodities. These are reflected in complicated linkages of complementarity and substitutability. However, we are trying to find the effects of relative price and real income changes on the overall trade balance. We cannot derive the aggregate trade equations simply by summing up demand equations for particular commodities. Therefore, even though individual goods equations may yield more significant results, for the sake of determining the macroeconomic linkages we aggregate import and export.

The intention to estimate the trade flows with ROW and with FSU requires an additional assumption. We need to disaggregate our single export good into two goods as well as import one. The cross-elasticity between two export goods is assumed to be zero as well as cross-elasticity between two import goods. This is based on the fact that commodities' structure of Ukrainian trade with ROW and FSU are relatively stable and different from each other. Another justification for disaggregating trade flows lies in the totally different patterns of hryvnya real exchange rate (RER) vs FSU and ROW last fall. Hryvnya sharply depreciated against the Western hard currencies, at the same time appreciating against Russian ruble. These movements in opposing directions led to negligible change in the RER for total export and import, which is a weighed average of the two.

3.2 Specifications

The main problem of trade flows modeling is proper dynamic form (lag specification). Goldstein and Khan (1985, p.1069), having discussed different approaches to the modeling of aggregate import and export demands, identify the main problem: ‘We do not know the length of the lags involved and we are as yet unclear on how lag patterns ought to be modeled’. We will consider 3 different forms of lag specification: autoregressive distributed lag (ADL), polynomial (Almon) lag (AL) and unrestricted lag (URL) specification which can be used to confirm the validity of the previous two.

A simple and most widely used approach to the modeling of dynamic trade behavior is to specify the equation within the framework of an infinite distributed-lag model with geometrically declining weights (Senhadji, 1998, p.9). This has come to be known as the Koyck approach to distributed-lag models. It is assumed that trade flows adjust to difference between the demand for import/export and actual import/export in previous period. Thus, the partial-adjustment model could be used for demand equation estimation (Gujarati, 1995, p.603). All variables enter the equations in logs in order the estimated coefficients to be elasticities.

Export demand

$X_t - X_{t-1} = ?(X_t^d - X_{t-1}),\ 0<?<1$

$X_t = ?? + (1-?)\ X_{t-1} + ??_0 P_t + ??_1 Y^*_t + ?u_t$

Import demand

$M_t - M_{t-1} = ?(M_t^d - M_{t-1}),\ 0<?<1$

$M_t = ?? + (1-?)M_{t-1} + ??_0 P_t + ??_1 Y_t + ?u_t.$

Where X_t - demand for export, M_t - demand for import, P_t - relative price of exports/imports, Y_t*-foreign country's real income, Y_t - domestic country's real income.

The coefficients of P and Y's are short-run[2] relative price and income elasticities. In order to get long-run elasticities of export/import demand, the coefficients of price and income (short-run multipliers) should be divided by coefficient of adjustment estimate ?. The long-run price and income elasticities are $?_0$ and $?_1$ respectively.

Goldstein and Khan (1985, p. 1067) view as the main drawback of ADL model its assumption that the largest effect of change in price or income occurs in the first period. However, this is not always true in reality, especially when other than annual observations are used. On the contrary, it could be argued that true lag effect accumulates gradually over time and declines after that, so the appropriate lag pattern could be bell-shaped. Another problem is that the lag in response to the depended variable is assumed to be the same irrespective of whether the change in flows are due to variation in prices or in the scale variables. There is no reason for the time response to be the same for all explanatory variables. Besides, as Gujarati (1995, p. 603) points out, ADL model violates some CLRM assumptions that could result in biased and inconsistent inferences.

[2] By short run elasticity I mean the one showing the effect of RER change on the export or import in the same quarter.

These problems could be avoided using polynomial distributed-lag models to estimate export/import demand equations. Polynomial distributed-lag models assume that the response of export/import to changes in price and income could be expressed as some degree polynomial function of the length of lag (Goldstein and Khan, 1985, p. 1068). This lead us to the following specification of demand equations (all variables enter the equations in logs):

Export demand

$$X_t = ? + ?_0P_t + ?_1P_{t-1} + ?_2P_{t-2} + ?_3P_{t-3} + \ldots + ?_kP_{t-k} + ?_0Y^*_t + u_t$$

Import demand

$$M_t = ? + ?_0P_t + ?_1P_{t-1} + ?_2P_{t-2} + ?_3P_{t-3} + \ldots + ?_kP_{t-k} + ?_0Y_t + u_t$$

Where slope coefficients are approximated by an m^{th}-degree polynomial in the length of lag -

$?_i(i) = a_0 + a_1i + a_2i^2 + \ldots + a_mi^m, (m<k).$

In order to obtain estimable demand equation so called 'Almon' variables should be constructed out of lagged original explanatory variables. The a_j's coefficients are estimated using conventional OLS procedure and the original $?_i$'s are computed using the formula for polynomial restriction. The $?_i$'s are short-run elasticities of demand, while long-run (medium-run) elasticities could be obtained by summing up the $?_i$'s of all lagged explanatory variables.

Although the polynomial distributed-lag model satisfies all assumptions of classical linear regression model it has some undesirable practical problems. Gujarati (1995, p. 615) notes that prior to estimating procedure the order of polynomial and maximum length of lag is to be specified. In fact, the length of lag could be determined on the basis of Schwarz criterion. One might find the degree of polynomial while performing a number of preliminary tests with the selection based on some criteria of goodness-of-fit or one might have some prior expectations regarding the number of turning points in the curve relating $?_i$ to i.

The unrestricted approach to estimation distributed-lag models suggests that it may proceed by sequential search for the lag length until the sign or the value of the lagged explanatory variables start becoming difficult to explain theoretically or appears to be insignificant. When URL coefficients resemble those of ADL or AL it gives additional support to specification under consideration.

The usual problem is the choice of the corresponding proxies for the variables entering the model. The quantity of export/import demanded is proxied as real exports/imports of goods expressed in foreign currency (USD) terms. The real exchange rate is used as a proxy for relative price of exports/imports. The income variable is domestic GDP in import demand and GDP of trading partners for export demand.

3.3 Data Description

For the estimation of import and export demand equations for Ukraine the national account data for Ukraine and its trading partners are used. The period analyzed in this paper is 1994-1998, for the period before 1994 no reliable data are available. Starting 1994 NBU began to publish balance of payment data calculated according to IMF methodology that is compatible with techniques used around the world[3]. The sample includes 20 observations of quarterly data on Ukrainian trade with non-former Soviet Union countries (rest of the world or ROW) and with former soviet union (FSU) countries, during selected period.

The Ukrainian data on trade flows (million of USD), exchange rates (UAH/USD) and gross domestic product (million of UAH) were taken from Ukrainian Economic Trends monthly issues. Two measures of Ukrainian GDP are used. One is official data, the other the UEPLAC[4] estimates. The foreign data on real GDP of main trading partners of Ukraine, their exchange rates come from International Financial Statistics. Since foreign income enters export demand equation as one variable the corresponding index should be constructed to accounts for GDP of all trading partners of Ukraine. All trading partners of Ukraine are divided into two groups (ROW and FSU), and two different income indices were computed using weighting scheme. GDP of ROW trading partners was computed as the weighted average of their GDP; weights account for percentage of Ukrainian exports to the particular trading partner in total Ukrainian exports. We restrict ourselves to those countries that have weights over 2%. Thus, USA, Germany, Turkey, China, Poland and Hungary (ROW) and Russia, Belarus, Turkmenistan, Moldova (FSU) are considered to be main trading partners of

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[3] A note of caution is needed on trade statistics' reliability. For example, there has been a major discrepancy so far between the 1997 current account data produced by the State Statistics Committee and that produced by the NBU. SSC showed a surplus of $424m on the combined goods and services balance, while NBU presented a deficit of $1.54bn. So the difference comprises almost $2bn. The NBU includes an estimate of informal trade, while SSC does not.

[4] UEPLAC - Ukrainian-European Policy and Legal Advice Center.

Ukraine on the basis of this criterion (Khymych et al., 1999, p.11). In fact, since the most significant part of trade with FSU countries belongs to Russia and quarterly data of real GDP's for countries other than Russia are not available, Russian GDP serves as a proxy for GDP of FSU countries. Ukrainian real income is proxied by nominal income in hryvnas divided by nominal UAH/USD exchange rate.

Real exchange rate (RER) for the ROW region is the nominal UAH/USD exchange rate corrected for inflation difference in Ukraine and the USA. RER for the FSU region is the nominal cross-rate of UAH/RUR corrected for inflation difference in Ukraine and Russia. Inflation indices are CPI. RER for total export and import demands is constructed as a weighted average of RER for ROW and RER for FSU with equal weights, reflecting almost equal shares of Ukrainian trade with these regions.

All data we use are time series. These are often found to be nonstationary, containing unit root. Thus, if variables that enter the demand equation contain a unit root, ignoring this fact may result in incorrect statistical inference (Senhadji, 1998, p.237). Our time series data on trade flows, exchange rates and incomes in the form they enter the demand equations were tested for the existence of a unit root. The unit root hypothesis was tested using the Augmented Dickey-Fuller (ADF) test. The lag length (k) in the ADF regression is defined using the Schwarz criterion (Senhadji and Montenegro, 1998, p.11). The results of the test are presented in the Table 2 in Appendix 2. The unit root could be rejected at 5% or less significance level for logs of total exports, total exports with FSU, total imports with FSU, total imports with ROW, real exchange rate (UAH/USD), real exchange rate FSU (UAH/RUR), estimated real GDP. For other series a unit root cannot be rejected. This doesn't mean that the valid estimation couldn't be performed. In order to avoid problems dealing with nonstationarity in data each estimated equation residuals were tested for the existence of unit root. The rejection of unit root in residuals signifies that the linear combination of time series in particular equation is stationary or that time series are cointegrated (Gujarati, 1995, p.726). The residuals ADF test statistic is presented along with OLS estimation output (Tables in Appendices).All series are cointegrated at 10% significance level.

Section 4

RESULTS DISCUSSION

Ukrainian trade flows were influenced by a variety of factors. It is virtually impossible to take all of them into account. Szyrmer (1998, p.1-2) points out such features of transition economies, which are peculiar to Ukraine and distinguish it from developed market-based economies. First, the Ukrainian economy has been undergoing fundamental systemic transformation. Second, the shadow sector is even bigger than its official counterpart. Third, the government is highly involved in micromanaging the economy. All these features often lead to unpredictable consequences of policy decisions. Mentioned above general complications with respect to export and import show up in changing composition and directions of trade, under- and overinvoicing of trade contracts, and often changing regulation of the trade sector.

In this study only pure market signals are considered: substitution effect and income effect. Econometric OLS estimates presented in Appendices 5-10 suggest that these effects do play a role in determining Ukrainian export and import. However, some estimates from various specifications differ a lot, implying that no strong conclusion could be made about the value of elasticities.

Appendices 5 and 6 show estimates for total export and import demands. ADL specification appears to be invalid because lagged dependent variables lie outside the range [0,1], while AL and URL give us some plausible results. Up to fourth RER lag seems to be significant in import demand. Therefore, our medium-run elasticity measures the effect of relative price change over a year, though RER lagged one and two quarters appear to be less significant. Both linear and quadratic structure of AL are used. It turned out that the resulting elasticities are very dependent on which measure of Ukrainian GDP is used. When YREALEST is employed estimates are close to -1.4, while with YREAL these tend to lie in range -0.1 to 0.4. In order to avoid possible bias due to unreliable data, the income was also supposed not to change. Thus, import was regressed on RER variables only. The resulting elasticity is -0.2, which is closer to one produced with official income data. None of specifications seems to be superior, and without any theoretical ground for the choice, I calculated average elasticities. Average marginal and cumulative elasticities are shown in Appendix 11. Surprisingly, import elasticity falls over time from 2.17 to 1.03, though we expected it to rise.

In export demand equation up to third RER lag is significant. Ukrainian export seems to be less elastic than import. Though short-run elasticity is positive, the long-run one is slightly negative and lies in range -0.14 - -0.81. As for the income effect, the third lagged variable coefficient is most significant and positive. This implies that only after half a year demand for Ukrainian goods rises following the world economy enters boom. The medium-run relative price export elasticity falls from 0.30 in the same quarter to -0.38 a year later implying that devaluation leads to decline in export revenues.

The estimations results for Ukrainian trade with ROW region are presented in Appendixes 9 and 10. Short-run import demand elasticity is surprisingly positive, what might be explained by higher purchases in expectation of further devaluation. Export elasticity estimates appeared to be more dispersed. Short-run elasticity is higher than medium-run one. The average marginal and cumulative elasticities are shown in Appendix 13. The import one rises from -1,98 in the same quarter to 0,45 after half a year. The export one falls from 1,32 in the same quarter to 0,05 after two quarters.

Estimates of trade equations with FSU (see Appendixes 7 and 8) are more dispersed than those of ROW, and two important features are to be highlighted. First, lag lengths are bigger than those for ROW region (up to 7 quarters for FSU vs. two for ROW). Second, elasticities appeared to be higher. The range of short run export elasticities is 2.0-4.4, while long run estimates are 2.4-6.0. Import elasticities turned out to be positive, but of lower magnitude than export ones. The average marginal and cumulative elasticities are presented in Appendix 12. The import and export elasticities fluctuate over times, intensifying the doubts about their validity. The medium-run (7 quarters) import elasticity is 1.82, while export one equals 4.36. The high value of export elasticity could be influenced by the sharp export revenue decline after Russian devaluation in August 1998. However, the effect may be nonsymetric; that is, Ukrainian devaluation would not lead to large increase in export revenues. The reason is that Russia is major market for Ukrainian export, while Ukraine is not the largest Russian goods importer.

As expected, the demand equations' coefficients are more plausible and significant for ROW region than for FSU. The meaningful estimations are those come from AL and URL specifications, while ADL fails probably because of usage of quarterly, not yearly, data.

Simulating the exchange rate effect on the current CA we assume that government is able transform the nominal devaluation into the real one. Simulations 50% real devaluation of the hryvnya shows improvement of the TB with FSU and worsening of the TB with ROW. Total TB seems to worsen one year after the devaluation. The results of simulations are presented in Appendixes 11-13 and are based on the following assumptions related to Marshall-Lerner condition. The first is ceteris paribus, that is no exogenous changes in real incomes and price level in Ukraine and abroad. The second assume no Laursen-Metzler-Harberger effect. It means that foreign and Ukrainian real income do not change after devaluation. Thus, the Marshall-Lerner condition become simplified to the following

$$\frac{P_X}{E} X ? (e_X^* ? \frac{EP_M^* M}{P_X X} e_M ? 1) \overset{?}{E} ?$$

The simulation implies that Marshall-Lerner does not hold in trade with ROW while it may hold in trade with FSU. In my opinion, the latter could be explained by higher degree of substitutability between Ukrainian and FSU goods.

The simulation suggests J-curve pattern of TB response for ROW region as the theory predicts, while for FSU it is very unlikely. The total TB response to devaluation implies inverse J-curve pattern, which can be justified by non-market logic of trade with FSU elasticities.

Section 5

CONCLUSIONS

Despite the fact that Ukraine is undergoing a transition from an administrative economy to a market one and has been subject to a number of external and internal shocks, price and income effects do play a role in determining its trade flows. In this work I am especially interested in whether and how does relative price, proxied by real exchange rate, affect trade balance.

Estimated RER elasticities appeared to be significant. However, export to and import from ROW seem to be more market-based, than those with FSU. The time profile of TB with ROW following the devaluation is very much like the well-documented one for developed countries, that is J-curve. But responce of TB to devaluation versus FSU implies very different time profile. The sharp improvement is followed by some worsening of TB, still the weighted sum of elasticities far exceed unity, needed for the Marshall-Lerner condition to hold. On the contrary, the sum of elasticities for ROW region is small to satisfy the Marshall-Lerner condition.

The estimated time lag of export and import quantities response to RER changes is longer for FSU (7 quarters) than for ROW (2 quarters). Up to fourth lagged coefficients of total export and import demands are significant.

Simulated 50% real devaluation of the hryvnya leads to improvement of the TB with FSU and worsening of the TB with ROW. Total TB, which is the result of interactions between the previous two seems to worsen one year after the devaluation.

The main reason for Marshall-Lerner condition not to hold for total and ROW demand equations is low export elasticities. Ukrainian enterprises are very slow to respond to relative price changes. In my opinion, factors both internal and external to a firm play a role in this relative unresponsiveness. Management of a firm still bases its decisions on only on market signals. However, what makes these internal obstacles binding and reinforces them is counterproductive institutional environment. Exporters are still subject to much restrictive regulations that discourage incentives and restricts profits. As Porter (1998, p.xviii-xix, 128) highlights:

> at the government level, discussions on competitiveness are still too focused on macroeconomic policy, when microeconomic are often the real constraints to progress. Governments mistake devaluation and currency policies as a means to increase 'competitiveness' rather than see currency as the tail, not the dog, and recognize that the need for devaluation is the reflection of failed policies…undervaluation can slow the upgrading of competitive advantage and direct firms to less sustainable, price-sensitive market segments. The result is a long-term loss of competitive advantage. Government “help” that removes the pressures on firm to improve and upgrade is counterproductive.

Thus, although market signals do play a role in determination of Ukrainian trade they are weak enough. A macroeconomic tool to improve TB (CA), devaluation fails to work nowadays in the case of Ukraine. In order to make this tool more powerful the economic environment is to be changed toward market-friendly. Only after that, the imperfect and even counterproductive but often useful expenditure switching instrument, devaluation, will become available for Ukrainian policy makers.

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APPENDIX 1

Derivation of Marshall-Lerner Condition

In order to derive Marshall-Lerner condition let us define that trade balance expressed in foreign currency as:

$$TB ? \frac{P_X}{E} X ? P_M^* M ,$$

where P_X is the home currency price of the home (export) good, X is the quantity demanded by foreign consumers, P^*_M is the foreign currency price of the foreign (import) good, *M* is the quantity demanded by domestic consumers, *E* is the exchange rate in units of home currency per unit of foreign currency.

The change in trade balance is

$$dTB ? \frac{P_X}{E} X(\overset{?}{P}_X ? \overset{?}{X} ? \overset{?}{E}) ? P_M^* M(\overset{?}{P_M^*} ? \overset{?}{M})$$

The foreign demand for the home good depends on the prices of home and foreign goods and on foreign income, all expressed in foreign currency. The domestic demand for the foreign good depends on the same prices and on domestic income, all expressed in home currency. Formally

$$X ? g(P_X^*, P_M^*, Y^*)$$
$$M ? f(P_X, P_M, Y)$$

where $P_X^* ? \frac{P_X}{E}$ and $P_M ? EP_M^*$

The change in X is

$$dX ? g_X dP_X^* ? g_M dP_M^* ? g_Y dY^*$$

Quantity demanded falls when the price of a good rises, but rises when income rise, so $g_X<0$, $g_Y>0$. The sign of g_M is uncertain. Let e^*_X be the own-price elasticity of the foreign demand for the home good, let e^*_M be its cross-price elasticity, and e^*_Y - its income elasticity:

$$e_X^* ? ?g_X \frac{P_X^*}{X} ? 0$$

$$e^{*}_{M} ? \, g_{M} \frac{P^{*}_{M}}{X} ?? \, 0$$

$$e^{*}_{Y} ? \, g_{Y} \frac{Y^{*}}{X} ? \, 0$$

It follows, that growth rate of X can be expressed as:

$$\overset{?}{X} \; ? \; ? \, e^{*}_{X} \overset{?}{P}{}^{*}_{X} ? \, e_{M} \overset{?}{P}{}^{*}_{M} ? \, e_{Y} \overset{?}{Y}{}^{*}$$

Similarly, for the domestic demand for foreign good:

$$e_{X} \; ? \; ? \, f_{X} \frac{P_{X}}{X} ? \, 0$$

$$e_{M} \; ? \; f_{M} \frac{P_{M}}{M} ?? \, 0$$

$$e_{Y} \; ? \; f_{Y} \frac{Y}{X} ? \, 0$$

Growth rate of M can be expressed as

$$\overset{?}{M} \; ? \, e_{X} \overset{?}{P}_{X} ? \, e_{M} \overset{?}{P}_{M} ? \, e_{Y} \overset{?}{Y}$$

Substituting equations for growth rates of X and M into *dTB* equation, we have

$$dTB \; ? \; \frac{P_{X}}{E} X (\overset{?}{P}_{X} \; ? \; \overset{?}{E} ? \, e^{*}_{X} \overset{?}{P}{}^{*}_{X} ? \, e^{*}_{M} \overset{?}{P}{}^{*}_{M} \; ? \; e^{*}_{Y} \overset{?}{Y}{}^{*}) \; ? \; P^{*}_{M} M (\overset{?}{P}{}^{*}_{M} ? \, e_{X} \overset{?}{P}_{X} \; ? \; e_{M} \overset{?}{P}_{M} ? \, e_{Y} \overset{?}{Y})$$

By the change-in-product rule we have

$$\overset{?}{P}{}^{*}_{X} \; ? \; \overset{?}{P}_{X} ? \; \overset{?}{E} \qquad\qquad \overset{?}{P}_{M} \; ? \; \overset{?}{P}{}^{*}_{M} ? \; \overset{?}{E} \, .$$

Substituting these into previous equation, we get

$$dTB \; ? \; \frac{P_{X}}{E} X (\overset{?}{P}_{X} \; ? \; \overset{?}{E} \; ? \; e^{*}_{X} (\overset{?}{P}_{X} \; ? \; \overset{?}{E}) \; ? \; e^{*}_{M} \overset{?}{P}{}^{*}_{M} ? \; e^{*}_{Y} \overset{?}{Y}{}^{*}) \; ? \; P^{*}_{M} M (\overset{?}{P}{}^{*}_{M} ? \; e_{X} \overset{?}{P}_{X} \; ? \; e_{M} (\overset{?}{P}{}^{*}_{M} ? \; \overset{?}{E}) \; ? \; e_{Y} \overset{?}{Y})$$

Quantities demanded depend fundamentally on relative prices and real incomes, so uniform changes in $P*_X$, $P*_M$, $Y*$ should not change X, because they do not affect relative prices or foreign income

$$X \; ? \; g(?P_X^*, ?P_M^*, ?Y^*) \; ? \; e_M^* \; ? \; e_X^* \; ? \; e_Y^*$$

Similarly, uniform changes in P_X, P_M, Y should not affect X. Therefore,

$$M \; ? \; f(?P_X, ?P_M, ?Y) \; ? \; e_X \; ? \; e_M \; ? \; e_Y$$

Substituting expressions for e^*_M and e_X into dTB, we get

$$dTB \; ? \; \frac{P_X}{E} X ? \overset{?}{P}_X ? \overset{?}{E} ? e_X^* (\overset{?}{P}_X ? \overset{?}{E}) ? (e_X^* ? e_Y^*) \overset{?}{P}_M^* ? e_Y^* \overset{?}{Y}^* ? ? P_M^* M ? \overset{?}{P}_M^* ? (e_M ? e_Y) \overset{?}{P}_X ? e_M (\overset{?}{P}_M^* ? \overset{?}{E}) ? e_Y \overset{?}{Y} ?$$

$$dTB \; ? \; \frac{P_X}{E} X ? \overset{?}{P}_X ? \overset{?}{E} ? e_X^* \overset{?}{P}_X ? e_X^* \overset{?}{E} ? e_X^* \overset{?}{P}_M^* ? e_Y^* \overset{?}{P}_M^* ? e_Y^* \overset{?}{Y}^* ? ? P_M^* M ? \overset{?}{P}_M^* ? e_M \overset{?}{P}_X ? e_Y \overset{?}{P}_X ? e_M \overset{?}{P}_M^* ? e_M \overset{?}{E} ? e_Y \overset{?}{Y} ?$$

$$dTB \; ? \; \frac{P_X}{E} X ? \overset{?}{P}_X ? \overset{?}{E} ? e_X^* (\overset{?}{P}_M^* ? \overset{?}{P}_X ? \overset{?}{E}) ? e_Y^* (\overset{?}{Y}^* ? \overset{?}{P}_M^*) ? \frac{EP_M^* M}{P_X X} \overset{?}{P}_M^* ? e_M (\overset{?}{P}_M^* ? \overset{?}{E} ? \overset{?}{P}_X) \frac{EP_M^* M}{P_X X} ? \frac{EP_M^* M}{P_X X} e_Y (\overset{?}{Y} ? \overset{?}{P}_X) ?$$

Lets adds and subtract the term $\frac{EP_M^* M}{P_X X} \overset{?}{P}_M^*$ on the right-hand side:

$$dTB \; ? \; \frac{P_X}{E} X ? \overset{?}{P}_X ? \overset{?}{E} ? e_X^* (\overset{?}{P}_M^* ? \overset{?}{P}_X ? \overset{?}{E}) ? e_Y^* (\overset{?}{Y}^* ? \overset{?}{P}_M^*) ? \frac{EP_M^* M}{P_X X} \overset{?}{P}_M^* ? e_M (\overset{?}{P}_M^* ? \overset{?}{E} ? \overset{?}{P}_X) \frac{EP_M^* M}{P_X X} ? \frac{EP_M^* M}{P_X X} e_Y (\overset{?}{Y} ? \overset{?}{P}_X) ? \frac{EP_M^* M}{P_X X} \overset{?}{P}_M^* ? \frac{EP_M^* M}{P_X X} \overset{?}{P}_M^* ?$$

Rearranging the terms we get

$$dTB \; ? \; \frac{P_X}{E} X ?(e_X^* ? \frac{EP_M^* M}{P_X X} e_M ? 1)(\overset{?}{P}_M^* ? \overset{?}{P}_X ? \overset{?}{E}) ? \frac{EP_M^* M}{P_X X} \overset{?}{P}_M^* ? e_Y^* (\overset{?}{Y}^* ? \overset{?}{P}_M^*) ? \frac{EP_M^* M}{P_X X} e_Y (\overset{?}{Y} ? \overset{?}{P}_X) ?$$

The Marshall-Lerner condition says that the expression on the RHS should be positive.

4

APPENDIX 2

Table 1. Summary Statistics for the Data Set

Time series	Mean	Standard Deviation
total exports	3640.10	433.23
total imports	4329.00	823.53
total exports fsu	2247.60	1800.32
total imports fsu	3044.90	1035.65
total exports row	2077.45	1394.35
total imports row	1969.05	1494.78
real GDP	11001.08	2329.46
real GDP (estimated)	10526.43	1876.98
GDP fsu	48.78	24.07
GDP row	603.01	31.97
total income	325.90	25.48
real exchange rate	23.22	11.03
real exchange rate fsu	15.23	3.47
real exchange rate total	19.22	5.07

Table 2. Augmented-Dickey Fuller Test for Variables Entering Demand Equations

Variable	ADF-statistic	# of obs	k	test equation specification
total exports	-3.136916*	20	1	c
total imports	-1.141651	20	1	none
total exports fsu	-2.848586*	20	2	c
total imports fsu	-3.838694*	20	1	c
total exports row	-2.454981	20	2	tc
total imports row	-3.535182*	20	2	tc
real GDP	-3.108501	20	1	c
real GDP (estimated)	-4.786531*	20	1	tc
GDP fsu	-2.911687	20	2	tc
GDP row	-2.075485	20	2	tc
total income	-2.154422	20	2	tc
real exchange rate	-3.726416*	20	3	c
real exchange rate fsu	-4.357877*	20	1	c
real exchange rate total***	-3.745795*	20	3	c

Note to table: All variables are in logs as they enter the demand equations, GDP fsu is a log of real GDP of Russia, GDP row is a log of weighted average of GDP of non-former Soviet Union trading partners of Ukraine. The optimal lag in the ADF regression is given by k; t, c denote the presence of trend and intercept in the ADF regression. Significance levels at 5 percent and less are indicated by *.

APPENDIX 3

Chart 1 Quarterly Dynamics of Real and Nominal Exchange rates during 1994-1998, UAH/USD (in logarithmic scale)

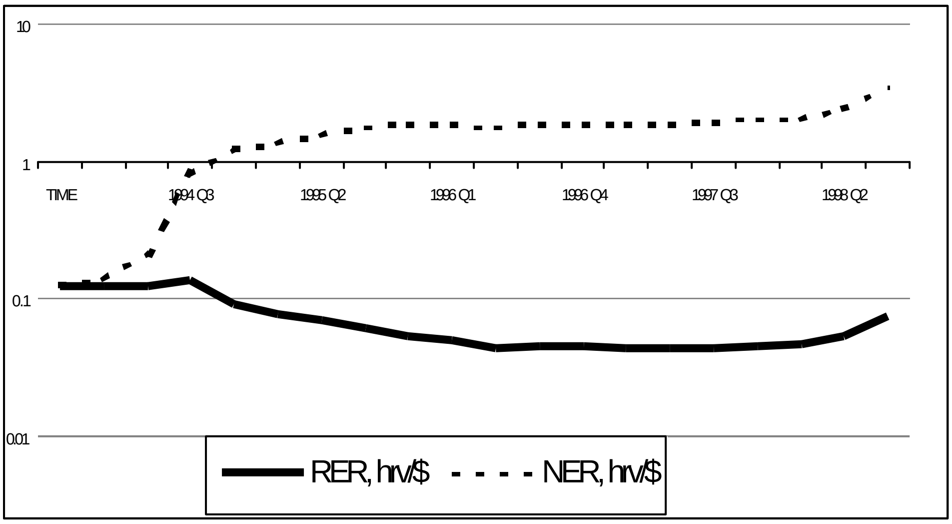
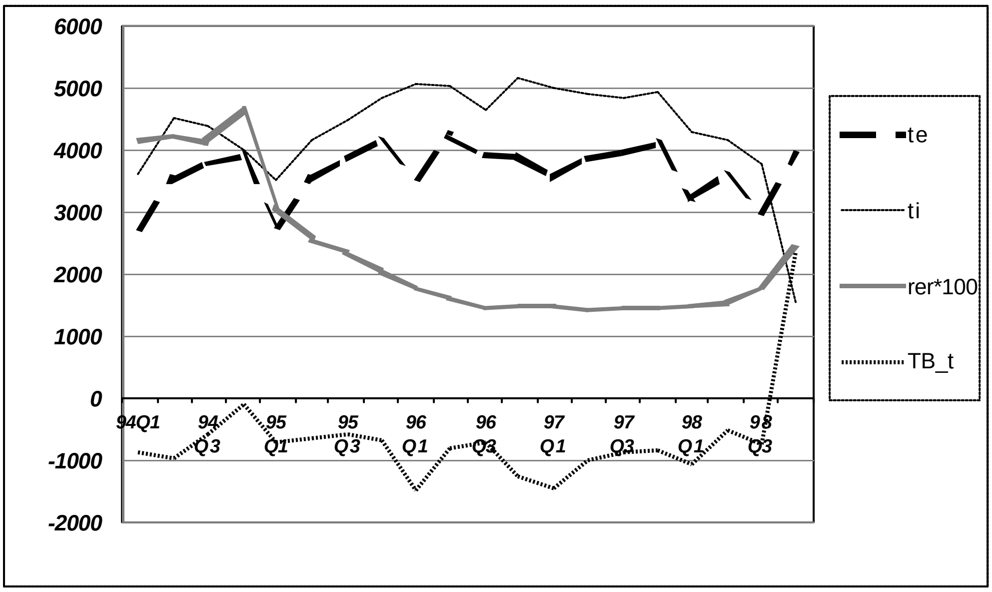


Chart 2 Volumes of Total Foreign Trade (millions of $) and Changes in Real Exchange Rate (UAH/USD*100) during 1994-1998



APPENDIX 4

Chart 1 Volumes of Foreign Trade with ROW Region (millions of $) and Changes in Real Exchange Rate (UAH/USD*100) during 1994-1998

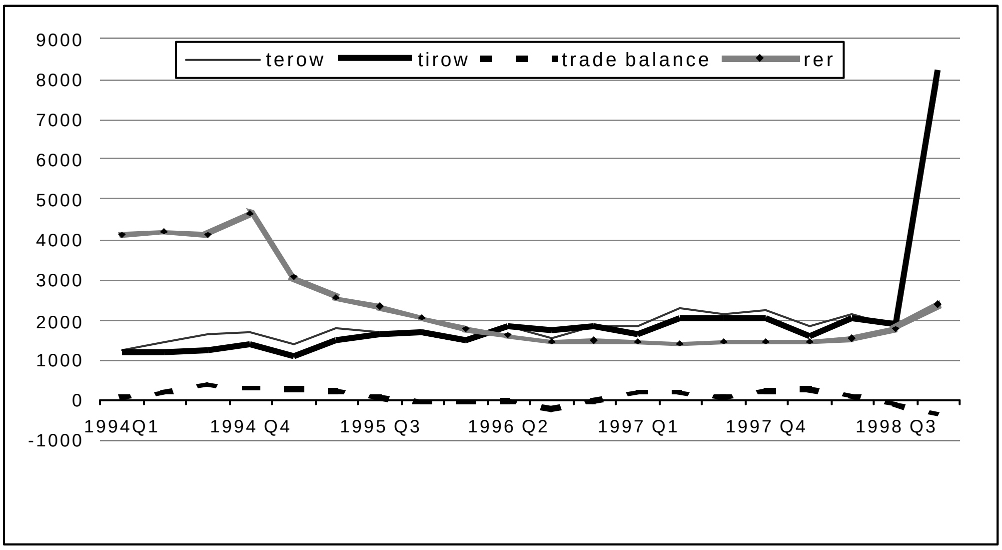
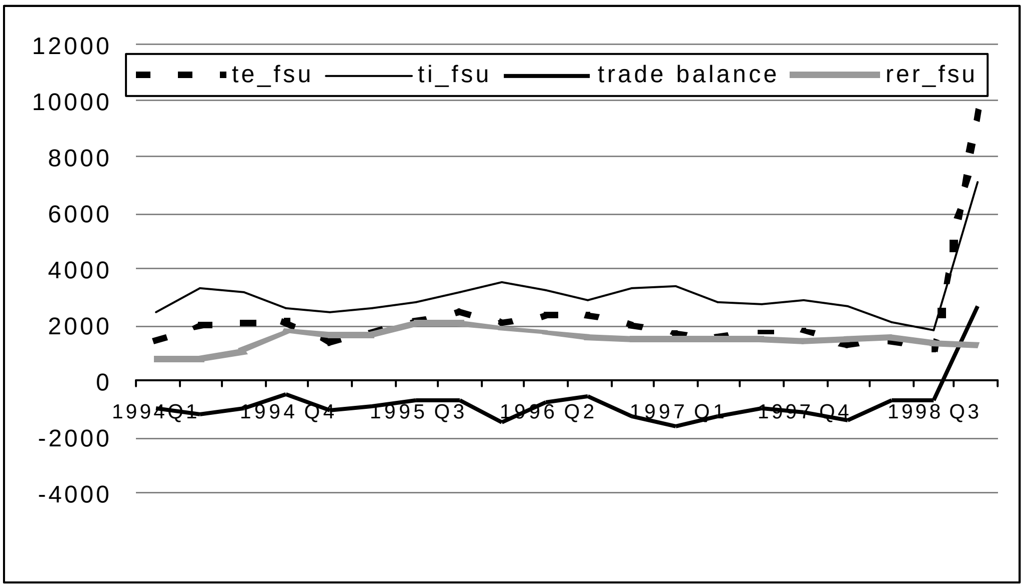


Chart 2 Volumes of Foreign Trade with FSU Region (millions of $) and Changes in Real Exchange Rate (UAH/USD) during 1994-1998



APPENDIX 5

Table 1 - OLS Estimates of Total Import Demand Equation

No of regression equation	2	3	16	17	18	27	28	29	30	31	MEAN[1]
TI(-1)	1.3619	1.375042									
	*2.5382**	*2.370369**									
RERT	0.3368	0.097936	-2.007244	-1.552937	-1.49578	-0.866477	-0.790233	-2.734895	-2.621039	-2.633047	-2.17416
	1.1985	*0.290861*	*-3.81781**[2]	-	*-2.851597**[2]	*-1.608369*	*-1.469724*	*-3.177668**	*-3.145157**	*-5.269661**	
RERT(-1)			-0.741046	-0.077184	-0.883065	1.016447	0.422284	1.18685	0.048939		-0.0931012
			2.031574[2]	-	*2.845066**[2]	*1.855253*	*0.569169*	*1.623339*	*0.058686*		
RERT(-2)			0.11929	0.687943	-0.27035		0.745514	0.197246	-0.149594		0.116907
			-1.20585[2]	-			*1.351135*	*0.302075*	*-0.258009*		
RERT(-3)			0.573764	0.742444	0.342365			0.799823	0.739301	0.655213	0.642151667
				-				*1.203359*	*1.156744*	*1.364914*	
RERT(-4)			0.622376	0.086319	0.95508			0.110438	0.544698	0.550518	0.478238167
				-				*0.20403*	*1.145713*	*1.375874*	
YREAL	0.3765			0.646363		0.615822	0.815341	0.634928			
	1.4570			*1.32302*		*2.099272**	*2.332203**	*1.399749*			
YREALEST		-0.170522	-1.309612		-1.334943				-1.023972	-1.002399	
		-0.48435	*-2.660055**		*-2.347271**				*-1.720637*	*-2.452212**	
Ep	**na**	**na**	**-1.43286**	**-0.113415**	**-1.35175**	**0.14997**	**0.377565**	**-0.440538**	**-1.437695**	**-1.427316**	**-1.033929**
Ey	**na**	**na**	**-1.309612**	**0.646363**	**-1.334943**	**0.615822**	**0.815341**	**0.634928**	**-1.023972**	**-1.002399**	
R-squared	0.4028	0.328748	0.728451	0.615032	0.726326	0.305612	0.41324	0.73246	0.754858	0.752967	
DW	1.1206	1.186312	1.087597	1.208312	1.591196	1.219784	1.294631	1.302636	1.090031	1.093045	
ser	0.2264	0.240024	0.177741	0.211629	0.184236	0.244125	0.240775	0.195044	0.186701	0.169528	
residual ADF-statistic	-1.62	-2.14	-2.19	-2.88*	-2.199	-1.388	-1.92	-3.13*	-2.161	-2.174	
#of observations	19	19	16	16	16	19	18	16	16	16	
type of distributed lag	ADL	ADL	AL	AL	AL	URL	URL	URL	URL	URL	

Notes: the dependent variable is total imports; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 16,17,18,29,30,31.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

APPENDIX 6

Table 2 - OLS Estimates of Total Export Demand Equation

# of regression equation	1	19	20	21	22	23	24	25	26	MEAN[1]
TE(-1)	-0.0213									
	-0.0913									
RERT	-0.0951	-0.3258	0.17505	0.32921	0.3667	0.27299	0.30538	0.30634	0.36688	0.30322
	-0.4619	*-0.9342*[2]	*0.78744*[2]	*1.3913*[2]	*1.68519*[2]	*1.15571*	*1.23113*	*1.2393*	*1.75514*	
RERT(-1)		-0.2174	-0.4226	-0.7543	-0.8384	-0.6513	-0.7712	-0.7526	-0.8326	-0.7176
		0.16542[2]	*-1.9167*[2]	*-2.0284**[2]	*-2.3812**[2]	*-2.4774**	*-2.3496**	*-2.5204**	*-3.4913**	
RERT(-2)		-0.0581	-0.3343	-0.0433	0.01027	0	0.12699	0	0	-0.0343
		0.22704[2]	*2.14355**[2]	*1.65967*[2]	*2.38124**[2]		*0.41226*			
RERT(-3)		0.15211	0.43994	0	0	0	0	0	0	0.06285
		0.41319[2]								
RERT(-4)										
YT	0.20954	-0.6926	0.43547	0.9556		0.80613	0.69875	0.77238		
	0.32294	*-0.507*	*0.37101*	*1.1193*		*0.93931*	*0.69023*	*0.83204*		
YT(-1)						0.36622	0.46379	0.30212		
						0.42785	*0.5116*	*0.3052*		
YT(-2)								0.46663		
								0.48287		
YT(-3)					1.62156				1.6366	
					*2.37121**				*2.98234**	
Ep	**na**	**-0.036**	**-0.1419**	**-0.4683**	**-0.4615**	**-0.3783**	**-0.3389**	**-0.4463**	**-0.4658**	**-0.3859**
Ey	**na**	**-0.6926**	**0.43547**	**0.9556**	**1.62156**	**1.17236**	**1.16254**	**1.54113**	**1.6366**	
R-squared	0.015	0.394	0.342	0.346	0.514	0.3146	0.36	0.3633	0.5135	
DW	2.181	2.346	2.510	2.097	2.110	1.9888	2.10	2.1962	2.1030	
ser	0.121	0.109	0.109	0.105	0.094	0.1040	0.11	0.1078	0.0903	
residuals ADFstatistic	-2.82*	-2.73*	-2.07	-2.14	-2.56*	-2.33	-2.38	-2.301	-2.562*	
# of obs	19	16	17	18	17	19	18	18	17	
type of distributed lag	ADL	AL	AL	AL	AL	URL	URL	URL	URL	

Notes: the dependent variable is total exports; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 20,21,22,23,24,25,26.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

APPENDIX 7

Table 3 - OLS Estimates of FSU Import Demand Equation

# of regression equation	2	3	6	7	22	14	17	19	20	21	23	25	MEAN
TIFSU(-1)	-0.3028	-0.0779											
	-0.7297	-0.2055											
RERFSU	0.02616	0.18603	-0.1406	0.42701	-2.4249	0.21674		0.26103	0.49969	2.13513	-1.13	-2.6137	-0.7068
	0.14445	1.12311	1.11824[2]	1.50653[2]	-2.0745*[2]	0.19958		0.73163	0.44281	2.18355		-3.4505*[2]	
RERFSU(-1)			-0.8231	-0.3836	-0.1795	-0.0831	-1.2904		-2.5459	-6.6181	-0.3539	-0.1879	-1.9771
			-0.7048[2]	-0.5623[2]	1.8037[2]	-0.0675	-1.3257		-1.8616	-3.6038		2.63279*[2]	
RERFSU(-2)			0.79275	0.15948	0.38999					5.25102	0.1705	0.44693	1.56461
			0.56249[2]	0.22088[2]	-1.6785[2]					2.53572		-2.2118*[2]	
RERFSU(-3)					0	-0.0576	-0.2305		0.21849	-4.5628	0.44327	-0.7092	-0.9221
						-0.0873	-0.239		0.18222	-2.2357			
RERFSU(-4)					0	0.28413	0.61888		1.3309	4.74277	0.46437	0	1.30761
						0.41686	0.66909		1.12834	3.06107			
RERFSU(-5)					0		-0.0554		-0.2636	-2.8617	0.2338	0	-0.5783
							-0.062		-0.3675	-2.5413			
RERFSU(-6)					0		0.27224		0.48079	2.15563	-0.2484	0	0.4776
							0.34094		0.56557	2.50114			
RERFSU(-7)					0				-1.7622	-2.1924	-0.9823	0	-0.9874
									-2.8137*	-4.9626			
YREAL	-0.0226		-0.4039										
	-0.0736		-1.2055										
YREALEST		0.71623		0.66986	0.17081	1.894	-1.0227	0.99652	2.90668	2.18339	2.5317		
		2.12032*		1.1049	0.22062	2.08714*	-1.6763	2.07147*	3.78665*	3.79332	3.60925		
YREALEST(-1)					-0.7762	-1.4565	-0.9807					-0.7485	
					-1.1275	-1.6634	-1.7497					-1.1625	
YREALEST(-2)					1.06143							1.09626	
					1.64899							1.84679	
YREALEST(-3)					-2.5674							-2.6618	
					-2.8612*							-3.5478*	
Ep			**-0.1709**	**0.20292**	**-2.2144**	**0.36014**	**-0.6852**	**0.26103**	**-2.0418**	**-1.9504**	**-1.4028**	**-3.0639**	**-2.1347**
Ey			**-0.4039**	**0.66986**	**-2.1113**	**0.43745**	**-2.0034**	**0.99652**	**2.90668**	**2.18339**	**2.5317**	**-2.314**	
R-squared	0.04174	0.26245	0.22394	0.21126	0.61896	0.44996	0.61503	0.2029	0.87585	0.9605	0.73692	0.6169	
DW	1.62122	1.54795	1.76	1.509	2.45055	2.1	1.49	1.5258	3.07441	3.65303	2.33811	2.49307	
ser	0.28376	0.24895	0.27332	0.27555	0.2298	0.27452	0.27446	0.24691	0.19058	0.12412	0.19617	0.21859	
residual ADFstatistic	-3.339*	-3.3169*	-2.924	-3.838*	-3.04*	-3.525*	-3.3016*	-3.3114*	-4.7406*	-3*	-4.3781*	-3.1464*	
# of obs	19	19	18	18	17	14	14	20	13	13	13	17	
type of distributed lag	ADL	ADL	AL	AL	AL	URL	URL	URL	URL	URL	URL	AL	

Notes: the dependent variable is imports to FSU region; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 20,21,22,23,25.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

APPENDIX 8

Table 4 - OLS Estimates of FSU Export Demand Equation

# of regression equation	1	4	5	8	9	10	11	MEAN
Variable								
TEFSU(-1)	-0.0091							
	-0.0135							
RERFSU	-0.2325	3.12947	1.99772	2.75795	4.42526	4.13782	4.60188	3.50835
	-0.4035	*2.39253**[2]	*1.5787*[2]	*1.93801*[2]	*1.94773*	*2.01384**	*2.30166**	
RERFSU(-1)		-0.3809	0.11312	-1.1118	-5.1993	-4.3162	-4.9875	-2.6471
		*-2.0383**[2]	*-1.5082*[2]	*-0.9246*[2]	*-1.5834*	*-1.6714*	*-2.0026*	
RERFSU(-2)		1.12198	-0.3279	0.80995	7.13518	6.18932	5.85939	3.46466
		1.80688[2]	*1.45545*[2]	*0.72554*[2]	*2.50383**	*3.12018**	*2.99849**	
RERFSU(-3)		0	0.67468	0.18089	-2.066	-1.7078	-1.9242	-0.8071
				0.25546[2]	*-1.2097*	*-1.1795*	*-1.3454*	
RERFSU(-4)		0	0	0	3.25414	2.90574	3.00755	1.52791
					1.9575	*2.06133**	*2.14094**	
RERFSU(-5)		0	0	0	-1.5141	-1.3097	-1.275	-0.6831
					-1.6826	*-1.7497*	*-1.7065*	
YFSU	-0.3115	-1.853	-1.7673	-1.8657	-1.4593	-1.4379	-1.8413	
	-1.024	*-2.9935**	*-2.529**	*-2.6791**	*-2.2745**	*-2.4019**	*-4.1856**	
YFSU(-1)			0.98112	1.051	-0.6614	-0.9502		
			1.29393	*1.39727*	*-0.5627*	*-0.9943*		
YFSU(-2)					-0.4727			
					-0.497			
Ep		**3.87053**	**2.45763**	**2.63696**	**6.0352**	**5.89915**	**5.28206**	**4.36359**
Ey		**-1.853**	**-0.7862**	**-0.8147**	**-2.5934**	**-2.3881**	**-1.8413**	
R-squared	0.20572	0.49978	0.41965	0.4844	0.83154	0.82322	0.79408	
DW	1.78136	2.01876	2.17242	2.1204	2.84229	2.85121	2.5599	
ser	0.45873	0.39554	0.42605	0.42118	0.3329	0.31131	0.31106	
residuals ADF statistic	-2.1707	-2.74*	-12.47*	-3.34*	-2.96	-2.8442*	-2.751*	
# of obs	19	18	18	17	15	15	15	
type of distributed lag	ADL	AL	AL	AL	URL	URL	URL	

Notes: the dependent variable is exports to FSU region; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 4,5,8,9,10,11.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

APPENDIX 9

Table 4 - OLS Estimates of ROW Import Demand Equation

# of regression equation	2	6	7	8	10	11	12	15	16	MEAN
TIROW(-1)	1.46917									
	1.96024									
RER	0.22685	1.74025	1.59537	2.17267	1.59537	2.21919	2.38008	2.1379	2.16788	1.98154
	0.61957	*3.30191**	*2.67506**	*3.54949**	*2.67506**[2]	*3.76993**[2]	*4.26371**[2]	*7.62861**[2]	*3.56148**	
RER(-1)		-2.1346	-1.5328	-2.5535	-1.5328	-1.3405	-1.9346	-1.6682	-1.4356	-1.7806
		*-4.1573**	*-1.5708**	*-4.289**	*-1.7886*[2]	*-2.1191**[2]	*-2.8328**[2]	*-3.7183**[2]	*-2.1153**	
RER(-2)			-0.4665	0	-0.4665	-1.1476	-0.7781	-0.3912	-1.0839	-0.6571
			-0.7404		*1.43035*[2]	*1.46465*[2]	*2.23461**[2]	*2.95138**[2]	*1.49528*	
YREALEST								1.51687		
								*3.23947**		
YREALEST(-1)							-1.372	-1.6411		
							*-3.0846**	*-4.7125**		
YREAL	-0.2596	-0.6146	-0.6221	-0.4393	-0.6221				-0.2673	
	-0.6082	*-1.7903*	*-1.4295*	*-1.216*	*-1.4295*				*-0.6212*	
YREAL(-1)				-0.5305		-1.0234			-0.9075	
				-1.3072		*-2.5389**			*-2.0027*	
Ep	**na**	**-0.3943**	**-0.4039**	**-0.3808**	**-0.4039**	**-0.2689**	**-0.3326**	**0.07851**	**-0.3516**	**-0.3623**
Ey	**na**	**-0.6146**	**-0.6221**	**-0.9698**	**-0.6221**	**-1.0234**	**-1.372**	**-0.1242**	**-1.1748**	
R-squared	0.27054	0.57425	0.57162	0.62056	0.57162	0.66861	0.71378	0.94748	0.67893	
DW	1.82376	2.00779	1.85313	2.18554	1.85313	1.92691	2.0802	1.84025	1.94307	
ser	0.38596	0.29486	0.31025	0.28814	0.31025	0.27288	0.2536	0.1181	0.27956	
residuals ADFstatistic	-2.5087	-2.979	-2.7799	-3.8009*	-2.7799	-3.609*	-3.23*	-3.1151*	-3.3487*	
# of obs	19	19	18	19	18	18	18	18	18	
type of distributed lag	ADL	URL	URL	URL	AL	AL	AL	AL	AL	

Notes: the dependent variable is imports to ROW region; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 6,7,8,10,11,12,15,16.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

APPENDIX 10

Table 4 - OLS Estimates of ROW Export Demand Equation

# of regression equation	1	3	4	5	9	14	MEAN
TEROW(-1)	-0.1422						
	_-0.2109_						
RER	0.33512	1.5275	1.23438	1.37536	1.45385	1.01715	1.32165
	_1.20305_	_2.96828*_	_2.05352*_	_2.18768*_	_2.43933*_[2]	_2.34497*_[2]	-
RER(-1)		-1.6421	-1.1146	-1.0193	-1.0043	-0.0069	-0.9574
		_-3.4304*_	_-1.5528_	_-1.0475_	_-1.4076_[2]	_-2.1467*_[2]	-
RER(-2)		0	0	-0.1628	-0.3607	-1.0309	-0.3109
				_-0.1756_	_1.06291_[2]	-	-
YROW	-5.5007	-2.0086	-1.1773	-1.0494	-1.2504	-0.459	
	_-2.4203*_	_-0.8061_	_-0.4181_	_-0.2958_	_-0.3641_	_-0.1363_	
YROW(-1)			-1.6624	-1.5034			
			_-0.6812_	_-0.5545_			
Ep	**na**	**-0.1146**	**0.11982**	**0.19327**	**0.0889**	**-0.0207**	**0.05334**
Ey	**na**	**-2.0086**	**-2.8398**	**-2.5528**	**-1.2504**	**-0.459**	
R-squared	0.33094	0.45968	0.47701	0.51151	0.499	0.45546	
DW	1.62546	1.74161	1.72136	1.83225	1.82621	1.775	
ser	0.33235	0.29867	0.30416	0.31183	0.30341	0.30481	
residuals ADFstatistic	-2.815*	-2.8306*	-2.6187	-3.0861*			
# of obs	19	19	19	18	18	18	
type of distributed lag	ADL	URL	URL	URL	AL	AL	

Notes: the dependent variable is exports to ROW region; all variables enter equations in logs; t-statistics are italicized; ser is standard error of regression; DW is Durbin-Watson statistic; significance levels at 5% are indicated by asterisk. Ep and Ey are long-run price and income elasticities respectively, computed as a sum of corresponding short-run estimates.

[1]Mean values of elasticities estimates are calculated based on equations 3,4,5,9,14.

[2]t-statistics of transformed independent variables according to polynomial restriction (Almon variables)

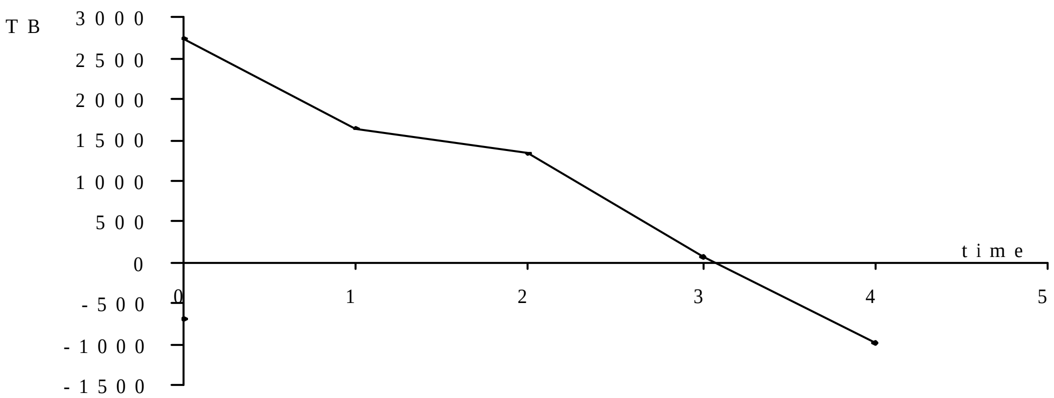
APPENDIX 11

Table 1- Simulation of Total Trade Balance Dynamics After 50% Real Devaluation

	Import		Export		M / X	ML	0.5*ML*X	TB_0+0.5*ML*
	point elasticity	Cumulative elasticity	point elasticity	Cumulative elasticity				
								-688.
RERT	2.17416	2.174157	0.303221	0.303221	1.189253	1.8888437	3437.7899	2748.88
RERT(-1)	0.0931	2.267258	-0.71758	-0.41436	1.189253	1.2819816	2333.2706	1644.37
RERT(-2)	-0.1169	2.150351	-0.03434	-0.4487	1.189253	1.1086136	2017.7321	1328.83
RERT(-3)	-0.6422	1.5082	0.062848	-0.38585	1.189253	0.4077806	742.18108	53.2810
RERT(-4)	-0.4782	1.029961	0	-0.38585	1.189253	-0.1609656	-292.96543	-981.86
Ep	1.03393		-0.38585					

Notes: M and X -average total imports and exports over the period investigated respectively; ML - Marshall-Lerner condition,
* the trade balance at the initial period calculated using mean values of M and X.

Graph 1 Simulation of Total Trade Balance Dynamics After 50% Real Devaluation



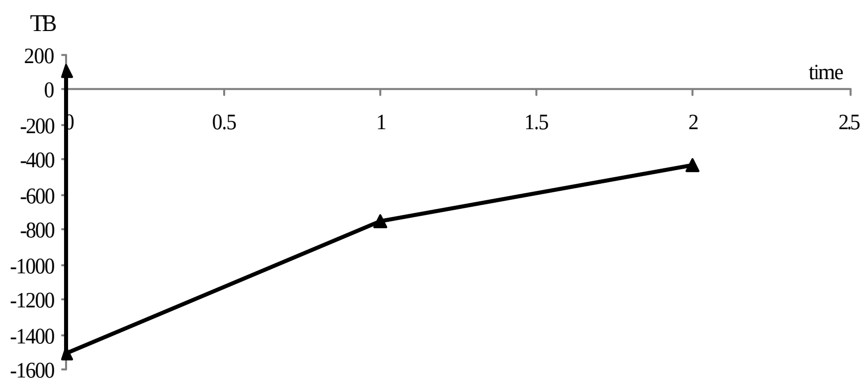
APPENDIX 12

Table 1 Simulation of ROW Trade Balance Dynamics After 50% Real Devaluation

	import		Export		M / X	ML	0.5*ML*X	TB_0+0.5*ML*X
	point elasticity	cumulative elasticity	point elasticity	Cumulative elasticity				
								108.4
RER	-1.98154	-1.98154	1.321648	1.321648	0.947821	-1.5565	-1616.77	-1508.37
RER(-1)	1.78062	-0.20092	-0.95744	0.364208	0.947821	-0.82623	-858.226	-749.826
RER(-2)	0.657106	0.456184	-0.31087	0.053337	0.947821	-0.51428	-534.198	-425.798
Ep	0.362311		0.053337					

Notes: M and X -average total imports and exports over the period investigated respectively; ML - Marshall-Lerner condition,
* the trade balance at the initial period calculated using mean values of M and X.

Graph 1 Simulation of ROW Trade Balance Dynamics After 50% Real Devaluation



APPENDIX 13

Table 1 Simulation of FSU Trade Balance Dynamics After 50% Real Devaluation

	import		Export		M / X	ML	0.5ML*X	TB_0+0.5*ML*X
	point elasticity	cumulative elasticity	point elasticity	Cumulative elasticity				
								-797.3
RERFSU	0.706762	0.706762	3.508347	3.508347	1.354734	3.465821	3894.89	3097.59
RERFSU(-1)	1.977057	2.683819	-2.64712	0.861228	1.354734	3.497089	3930.028	3132.728
RERFSU(-2)	-1.56461	1.11921	3.464657	4.325884	1.354734	4.842116	5441.57	4644.27
RERFSU(-3)	0.922059	2.041268	-0.80707	3.518813	1.354734	5.284189	5938.372	5141.072
RERFSU(-4)	-1.30761	0.733662	1.527906	5.04672	1.354734	5.040636	5664.667	4867.367
RERFSU(-5)	0.578296	1.311958	-0.68313	4.363588	1.354734	5.140942	5777.39	4980.09
RERFSU(-6)	-0.4776	0.834361	0	4.363588	1.354734	4.493925	5050.273	4252.973
RERFSU(-7)	0.987379	1.82174	0	4.363588	1.354734	5.83156	6553.508	5756.208
Ep	2.134662		4.363588					

Notes: M and X -average total imports and exports over the period investigated respectively; ML - Marshall-Lerner condition,
* the trade balance at the initial period calculated using mean values of M and X.

Graph 1 Simulation of FSU Trade Balance Dynamics After 50% Real Devaluation