

Criteria for International Reserves'

Adequacy:

What level of reserves does Ukraine need?

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Abstract:

Discussion of reserves' adequacy has renewed after financial crises in Asia and Russia. It became evident that large international reserves made countries less prone to crisis. Special attention was paid to the ratio of a country's external short-term debt to reserves as a very successful marker of potential external vulnerability that generally outperforms other reserves' adequacy criteria.

This paper studies applicability of various reserves' adequacy criteria to Ukraine as a transition economy with large foreign trade turnover and relatively low external capital flows. It is argued that, despite low capital mobility, a rise of short-term public debt was a crucial factor for Ukraine's financial crisis in 1998. At the same time, historical data provide no proof for high vulnerability of current account as a source of instability. So, it is stated that debt-related criteria for reserves adequacy could be relevant for Ukraine. This paper provides calculations of the minimal necessary level of international reserves based on benchmarks proposed by Wijnholds and Kapteyn, as well as a discussion of costs of reserves' holding.

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1 Introduction

Discussion of international reserves' adequacy has renewed after a series of financial crises in the end of the 90th, in particular in Asia and Russia. Then it became evident that better reserves and debt management could reduce country's vulnerability to capital outflow (Wijnholds and Kapteyn, 2001; IMF, 2001). It appeared that countries with larger reserves had better prevented crises and cognation (Aizenman and Marion, 1999; Feldstein, 1999; Fisher, 2001).

An emphasis on importance of large reserves' holdings differs from a point of view emerged in the early 90th. The growth of capital inflows in emerging markets supported an opinion that the accessibility of international capital can offset current account imbalances, and, consequently, the need for large reserves is reduced (Fisher, 2001). However, recent events demonstrated that flows of international capital are quite uncertain and very volatile, making them an inappropriate instrument for crisis prevention. As showed by Caballero and Krishnamurthy (2001), during financial crisis the country faces so called international liquidity constraints. In other words, crisis-ridden countries cannot attract enough external capital inflows. Aizenman and Marion (1999) demonstrated that in the case of increasing reserve uncertainty foreign investors are reluctant to lend. Moreover, it is very likely that foreign investors withdraw money from the crisis-ridden country.

The availability of funds provided by international financial institutions, namely, by the IMF, in the case of financial crisis is also uncertain, if country has no prior credit arrangements. Additionally, these credits are provided under detailed conditions, widening time lag between time of need and time of disbursement and reducing a level of confidence that these funds will be actually obtained (Feldstein, 1999). In 1999 the IMF introduced a new instrument, namely Contingent Credit Lines, to protect countries from contagion effect providing extra liquidity (Bussiere and Mulder, 1999). This instrument may enhance the access to international funding in the future.

The level of international reserves is considered adequate, if it is sufficient for execution of functions, incumbent on reserves. By definition, international reserves are

"External assets that are readily available to and controlled by monetary authorities for direct financing of external payments imbalances, for indirectly regulating the magnitudes of such imbalances through intervention in exchange rate markets to affect the currency exchange rate, and / or for other purposes" (Balance of Payments Manual, 5th edition, as referred in IMF, 2000).

Thus, the level of reserves is adequate if it provides enough emergence liquidity on the market performing the role of buffer during the crisis. Also, international reserves are used to "support an exchange rate peg, to maintain confidence in the national currency, or to serve a basis for foreign borrowing" (Ouanes and Thakur, 1997). Moreover, reserves are held to maintain a confidence that country can perform its external obligations (IMF, 2001). All



these functions should be taken into account determining the necessary reserves' level.

It should be noted that reserves, sufficient to perform one task, might be inadequate with respect to another, although it is frequently the case that the targets could coincide. In addition, the central bank has additional instruments applicable for same tasks as international reserves are. For instance, sudden devaluation could be prevented not only by spending of international reserves, but also by interest rate policy or capital control (IER, 2002). Moreover, reserves' holdings are costs for the economy, and its level cannot approach infinity, even if it could be economically possible. Therefore, it is necessary to conduct a cost-benefit analysis of reserves' holdings, and identify a major task that must be achieved by reserves' holdings. All other functions of reserves should be considered as secondary. Definitely, for different countries different tasks are primary. For instance, if country has a currency board regime, the level of monetary base identifies a level of reserves, in the first place.

There are two basic approaches to identification of reserves' adequacy. On the one hand, estimation could be based on analysis of demand functions for reserves. On the other, one or many benchmarks, or adequacy criteria could be applied. Estimations of adequacy of international reserves on the basis of demand analysis have a long history. For instance, Kelly (1970), Iyoha (1976), Frenkel and Jovanovic (1981), etc. estimated a demand function for international reserves on the basis of actual data in attempt to identify an optimal level of holdings. One of the drawbacks of this approach is a reliance of a derived level of reserves as optimal. If, by any reason, estimated demand function does not correspond with real, results will be misleading (Edwards, 1981). Edwards (1981) emphasises the role of country-specific demand functions in determining the adequacy of reserves for better tuning. However, that does not always solve the problem, because even country-specific demand function could be incorrectly specified, if conditions change or if previous holdings of reserves were constantly inadequate. The latter is especially important for countries that have very turbulent or short-term economic history.

Alternative approach is to rely on adequacy criteria. Although these criteria are based on conventional benchmarks with no country-specific adjustments, and claimed to be naïve (Berg and Pattillo, 1998) and completely theoretically justified (Wijnholds and Kapteyn, 2001), they are easy in application and widely used, providing good basis for comparisons. Extensive use of these indicators by international investors' community makes them an important factor for formation of the country's credibility. And current financial flows are, to the large extent, are determined by confidence in the country's soundness, and not by the soundness itself. Moreover, they performed fairly well in predicting financial crisis (IMF, 2000).

There are several types of reserves adequacy criteria, namely monetary-based, import-based, and debt-based indices. The most traditional measure, the ratio of international reserves to months of imports, has recently lost the most of its relevance (Wijnholds and Kapteyn, 2001; Fisher, 2001). That



happened due to increase in importance of capital account vis-à-vis current account volatility as a source of financial instability.

This paper studies applicability of various reserves' adequacy criteria to Ukraine. At the present the country is very open to foreign trade with exports and imports, each covering more than 50% of the GDP in 2001. Quite oppositely, international capital mobility is not very significant in the country. For instance, foreign direct investments inflow since 1991 up to present accounts to approximately USD 4.7 bn, i.e. the level of domestic investments during the year 2001. Portfolio investments that reached their pick in 1997 constitute USD 1.6 bn, or nearly 4% of the GDP. In situation like this, researches usually recommend considering import-based criteria of reserves' adequacy (Wijnholds and Kapteyn, 2001; IMF, 2000).

However, financial crisis of the year 1998 demonstrated that debt-based criteria of reserves' adequacy perform better for Ukraine. Moreover, the crisis of 1998 could be prevented if Ukraine held more international reserves and, thus, international confidence in the country's financial soundness was higher.

The rest of the paper is organised as follows. Section II discusses an evolution of international reserves' adequacy criteria. Section III is devoted to analysis of comparative performance of various criteria during the financial crisis in 1998. Next, minimal necessary level of international reserves is estimated in Section IV, and costs of reserves' holdings are discussed in Section V. Finally, Section VI presents some conclusions and policy implications.

2 International Reserves' Adequacy Criteria: an Overview

Literature on international reserves provides several criteria of their adequacy, including comparisons of reserves with monetary aggregates, imports, and debt. One of the earliest adequacy criteria was a ratio of international reserves to monetary base, dominated prior to the World War II (Wijnholds and Kapteyn, 2001). Nowadays this ratio is important for countries with a currency board (Ouanes and Thakur, 1997).

Until recently a key criterion of reserves adequacy was international reserves in months of imports. The basic idea is straightforward: it is a number of months that country can support its imports at a current level without any other inflow or outflow of foreign currency (IMF, 2000). The criterion is especially important for countries with rather limited access to international financial resources. For instance, Wijnholds and Kapteyn (2001) propose to apply import-based measure of reserves adequacy to low-income developing countries, where involvement into international capital flows is fairly low.

One of the mostly debated questions regarding the import-based reserves adequacy criteria is the benchmark. The rule of thumb, frequently used by the IMF (Ouanes and Thakur, 1997), is a three months of imports. There are other possible benchmarks proposed by various authors. For example, Triffin (1960) suggested establishing at least 35 percent reserves/import coverage (i.e. 4.2 months of imports). The 1958 study conducted by the IMF supports a



30% to 50% reserves/imports ratio, or 4 – 6 months of imports (Williamson, 1973).

Import-based criteria were developed when vulnerability of a current account was a major source of instability. Recent financial crises, tightly connected to increase in world's capital mobility, pushed forward new criteria of adequacy, namely debt-based measures. Pablo Guidotti, the Deputy Finance Minister of Argentina, proposed a simple guideline for determination of adequate level of international reserves (Greenspan, 1999). In particular, he suggested keeping a level of usable reserves higher than a one-year scheduled amount of foreign currency debt amortisation (assuming no rollovers). In other words, a ratio of reserves to short-term foreign debt by remaining maturity should be equal or more than one. That would allow country to pay its one-year due obligations even if all other inflows or outflows cease.

Studies of the IMF experts (IMF 2000) showed that a smaller level of reserves to a short-term debt ratio is positively associated with a frequency and depth of crisis. In particular, Bussiere and Mulder (1999) claimed that the one-year benchmark in reserves – debt ratio “appears an advisable target for countries with broadly balanced exchange rate and modest current account deficit”.

There are several possible components of a short-term debt that could be included into the ratio. According to the IMF (2000), in general all categories of short-term (by remaining maturity) debts like loans, securities, trade credits, and debt component of foreign direct investments should be included. That covers all debt instruments held by non-residents disregarding currency of denomination. Alternatively, all debt to residents in foreign currency should be excluded. The line of reasoning is based on assumption that, in aggregate, foreign currency relations between residents are mutually cancelled, and transfers of foreign currency within country does not cause an external outflow and, consequently, does not increase a risk exposure.

There are no doubts about inclusion of a public debt (issued or guaranteed) into the debt-based indicator. However, the inclusion of private debt remains questionable (IMF 2000). On the one hand, liquidity problem in one sector of the economy could cause self-fulfilling expectations and affect the economy as a whole. Thus, private debt should be attended. On the other hand, there are also private “reserve” assets that, in principle, should be added to denominator of a debt-based ratio. In general, these two components – private debt and private “reserves” – could balance out each other, leaving the ratio unchanged.

Other additional component in the short-term debt formula may be a current account deficit (IMF 2000). The idea is simple. If reserve adequacy is considered on the basis of how long country can survive without external borrowing, it implies that other obligations should be considered, in particular a current account deficit. The resulted index was called augmented short-term debt criterion. However, some studies show (IMF, 2000) that general and augmented debt-based ratios perform broadly the same.

Greenspan (1999) extended Guidotti's suggestion proposing two additional adequacy criteria. The first is that average maturity of a country's external



debt exceeds a pre-specified threshold, for instance, three years. The second, later called "liquidity-at-risk" standard, recommends to calculate a country's liquidity position under a range of possible outcomes, attaching a probability to these outcomes. In this case, international reserves could be considered adequate if country can sustain one year without new borrowings with a certain *ex ante* probability, e.g. 95%.

The considered debt-based measures of reserve adequacy, according to Wijnholds and Kapteyn (2001), monitor one of two important risk factors, namely an "external drain". The other factor is "internal drain", or capital flight by residents. One of the most conventional measures of capital flight exposure of the country is a money-based indicator of reserves' adequacy. As it was mentioned before, reserve to monetary base ratio was one of most antique adequacy criteria, but it yielded to reserve/imports ratio in wideness of use due to low crisis predictability power. Among the reasons that diverted modern researchers from a wide exploitation of money-based indicators was that it indicates a potential flight, but says nothing about its probability.

However, recently Calvo (1996) revived attention to money-based measures, initiating a discussion on another money-based instrument, namely reserves to broad money (M2) ratio, as one of indicators of financial vulnerability.

Wijnholds and Kapteyn (2001) proposed a new criterion of international reserves' adequacy for emerging countries that could be considered as an extension of money-based and debt-based criteria, hereinafter referred as W-K criterion. It consists of three components. First, it is a short-term debt by remaining maturity. It allows capturing "external drain". Next, it is a fraction of M2 considered as an indicator of potential for capital flight in the country. That allows capturing "internal drain". Authors distinguish between three groups of countries choosing an appropriate level of M2: "those with independently floating exchange rates, those with managed floats or fixed rates, and those with a currency boards". For countries with a managed float or fixed regime the share of broad to be covered by reserves is proposed between 10 and 20 percent. For floating exchange rate regime and currency board it is proposed to share between 5 and 10 percent.

Finally, the third component of the W-K criterion is a capital flight probability indicator. It is presumed that not all of emerging countries are equally exposed to risk of capital flight due to different economic fundamentals. In order to capture the difference in fundamentals and to adjust criteria for country-specific conditions, authors adjusted the share of M2 on index of country risk published by *The Economist*. Higher index means higher risk. Thus, the W-K criterion of international reserves' optimality is equal to sum of a short-term debt and an adjusted share of M2.

A shift from import-based to debt-based criteria in evaluation of international reserves adequacy is attributed to access to international financial markets and, respectively, borrowing capacities of different countries. Wijnholds and Kapteyn (2001) even differentiated between less developed and emerging countries that need different level of reserves and, consequently, different adequacy criteria. However, there are countries like Ukraine that stay somewhere in middle. On the one hand, these countries vary in their access



to financial markets; on the other, they accumulated high external debts that make them more prone to crisis. Moreover, their level of foreign trade openness is much higher than their financial openness making import-based or current account-based indicators still potentially important. One of possible solutions is to use augmented short-term debt index. However, it misses internal drain. Therefore, it may be advisable to combine augmented short-term debt indicator and W-K criterion for better measurement of countries vulnerability of the crisis. Let's call it here augmented W-K criterion.

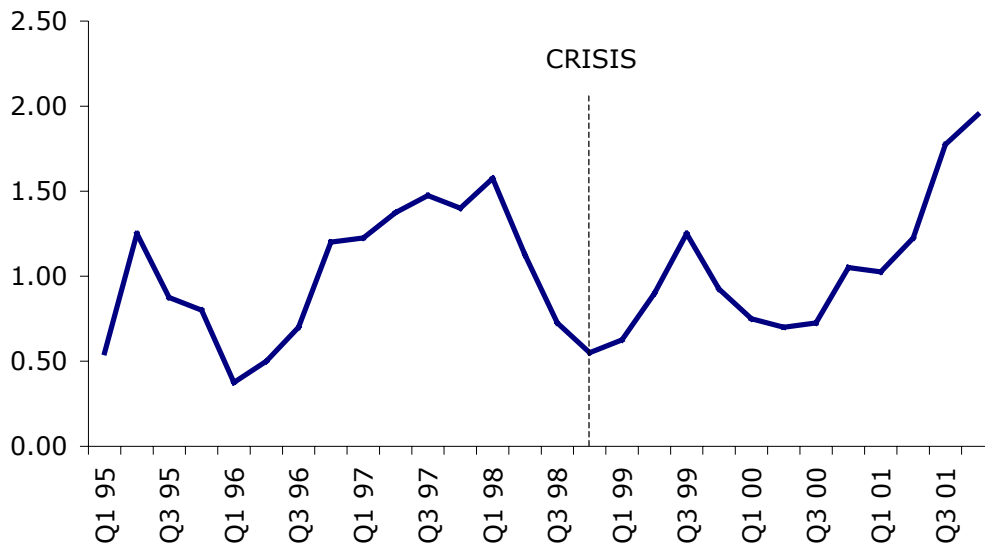
3 Performance of Reserves' Adequacy Criteria in Ukraine in 1998

In August 1998 Ukraine went through a financial crises. Sharp devaluation of national currency and a quick depletion of international reserves pushed the government to restructure its debt obligations. Here I would like to consider what adequacy criteria were the most appropriate for identification of this crisis.

First, let's take a ratio of international reserves to months of imports, the most conventional measure of reserves' adequacy for countries with developed trade relations and low access to capital markets. It was below three months of imports throughout all period of economic history of independent Ukraine before the crisis (Figure 1).

Figure 1.

Gross International Reserves Over Months of Imports, months of imports



Source: NBU

That means Ukraine had insufficient level of reserves (according to this particular criterion) well before the crisis of 1998, indicating potential



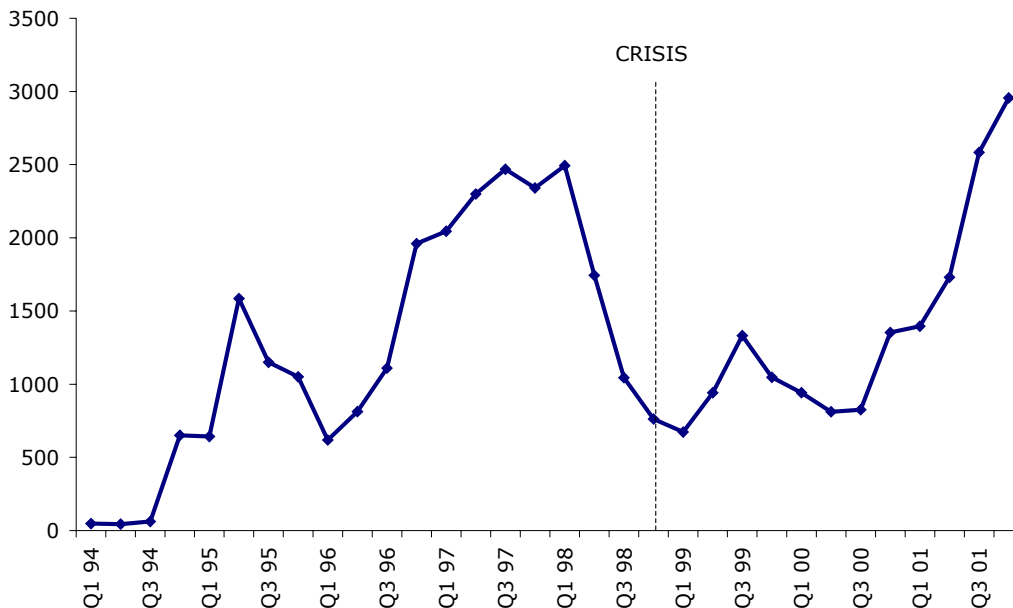
vulnerability of the economy. But the pure benchmark said almost nothing about timing of forthcoming crisis, and could not be used as an early warning system. Moreover, in the first two quarters of 1998 imports reduced, i.e. gross reserves in months of imports should increase, *ceteris paribus*. Overall trade balance of goods in the first two quarters of 1998 was even a little bit better (i.e. deficit was lower), than in the respective quarters of the previous year. Thus, the crisis did not come from pressure on exchange rate, caused by the increase in importers demand for foreign currency.

In the first half of 1998 a steady growth of this ratio reverted to a sharp decline, indicating potential crisis. However, in the first quarter of 1996 this ratio also dropped significantly, but there were no financial crisis followed this decline. This case also emphasizes non-optimality of the import-based criterion.

The sharp decline in reserves – imports ratio occurred due to reduction of international reserves (Figure 2): during March to July 1998 they dropped from USD 2.5 bn to 1.6 USD m. The fall in reserves was caused by the National Bank of Ukraine (NBU) attempts to sustain an announced level of exchange rate corridor in the situation of increasing pressure on domestic currency. The pressure occurred due to capital market movements, and not due to changes in current account dynamics.

Figure 2.

Gross International Reserves less Gold, USD m



Source: NBU, IFS

The major factor that determined a financial crisis of August 1998 was a state debt. In the first years of independence budget deficit was financed by direct credits of the central bank causing hyperinflation, but since the middle of 1995 government started to employ alternative sources of deficit financing, in particular internal and external borrowing. In 1995 the NBU financed almost 73% of the deficit, and in 1997 72% came from internal borrowing, mainly state domestic bonds market (Dekhtiarchuk, 1999). The peculiarity was that



internal borrowings became *de facto* external because of high participation of foreigners on this market.

Ukraine's Treasury bills (T-bills) were introduced in 1995 as discount securities with maturities of 1-, 2-, 3-, 6-, 9-, 12-, and 18-months. However, till the end of 1998, there were only about 50 auctions that sold T-bills with 18 months to maturity (out of total 1440 auctions, organised in 1995-1998). Thus, all other t-bills could be considered as a short-term debt instruments. Initially the dynamics of this market was very positive: effective rate of return had been steadily reducing making this borrowing cheaper, while volumes had grown up. Between June 1995 and June 1997 the volume of funds raised at the T-bills market grew by more than 400 times in nominal terms, and reached a UAH 2.3 bn level. According to experts' estimates, a share of T-bills purchased by foreigners reached almost 60% as of the end of 1997 (Chaban, 1999).

Problems started in the fall of 1997. In August-September the rate of return reached its minimum making this market much less attractive in "risk-return" coordinate space. Ukraine had quite low credit ranking signalling high speculative nature of its securities. Moreover, government's difficulties in implementing the IMF requirements and parliamentary elections of March 1998 increased a risk perception. All these factors deteriorated a demand for T-bills, including the foreign demand.

Moreover, government, intending to pay back wage arrears, used for this purpose a loan from the Bank of Luxemburg, consequently, increasing a supply of money (Dekhtiarchuk, 1999). These two factors, namely lower demand for national currency from participants of bonds market and higher supply of money, stimulated a pressure on domestic currency to devaluate. In its turn, a drop in hryvnia exchange rate accelerated an outflow of funds from the country. In 1998, the NBU had to purchase almost 60% of newly issued government bonds, but that did not change a structure of already existing indebtedness.

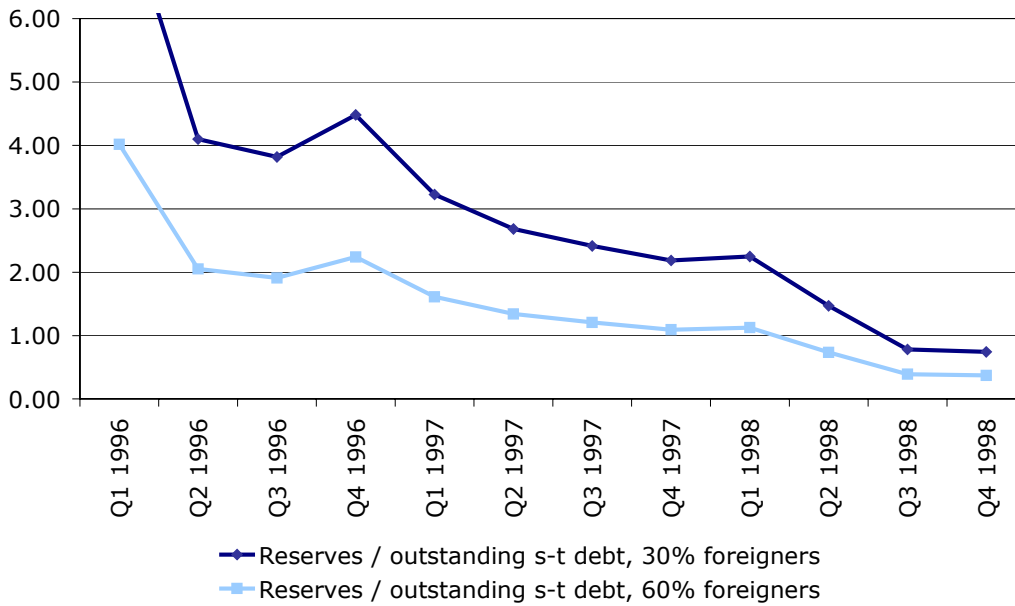
As can be seen, the nature of domestic T-bills market makes necessary to take it into account in the analysis of reserves' adequacy criteria. Indeed, various T-bills debt-based ratios confirm their usefulness in predicting Ukraine's financial crisis of the year 1998.

In order to take into account that not only non-residents, but also residents participated in the government bonds market, as a measure of the short-term debt by one-year remaining maturity it applied a share of outstanding net debt. As benchmark cases, it is taken 30% and 60% shares capturing non-residents participation in different periods of time.

Both ratios of international reserves to short-term debts to non-residents have a downward-sloping trend during 1996-1998 and approach to one (a threshold). In the first half of 1998 they crossed the threshold (Figure 3). Obviously, higher participation of foreigners in domestic T-bills market (referred as 60% non-residents share in outstanding debt) means lower reserve to debt ratio that became below one in the beginning of the year.

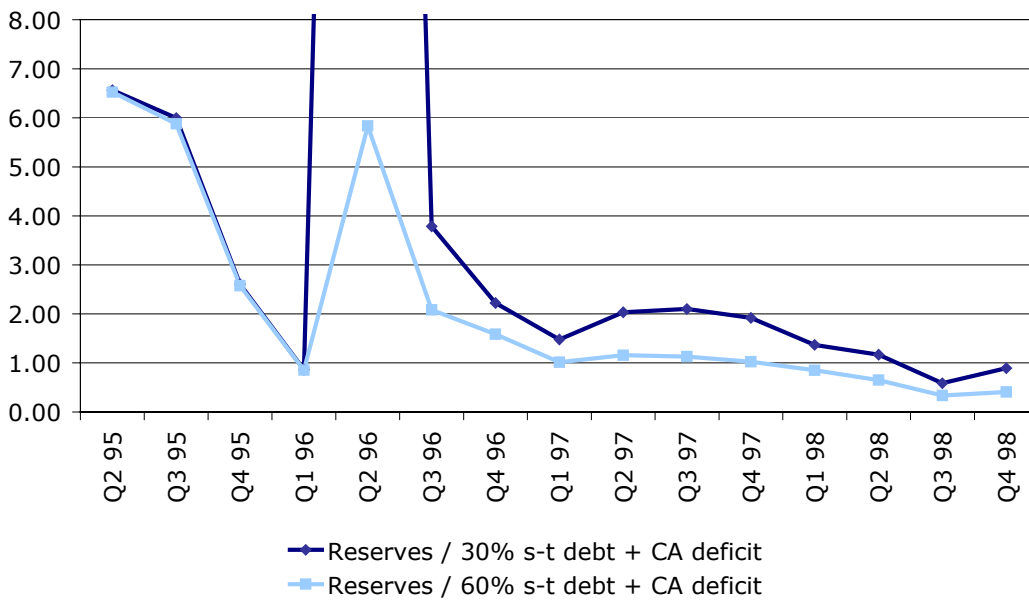


Figure 3.
Gross International Reserves over Short-Term Debt (T-Bills Market)



Source: NBU, UEPLAC, own calculations

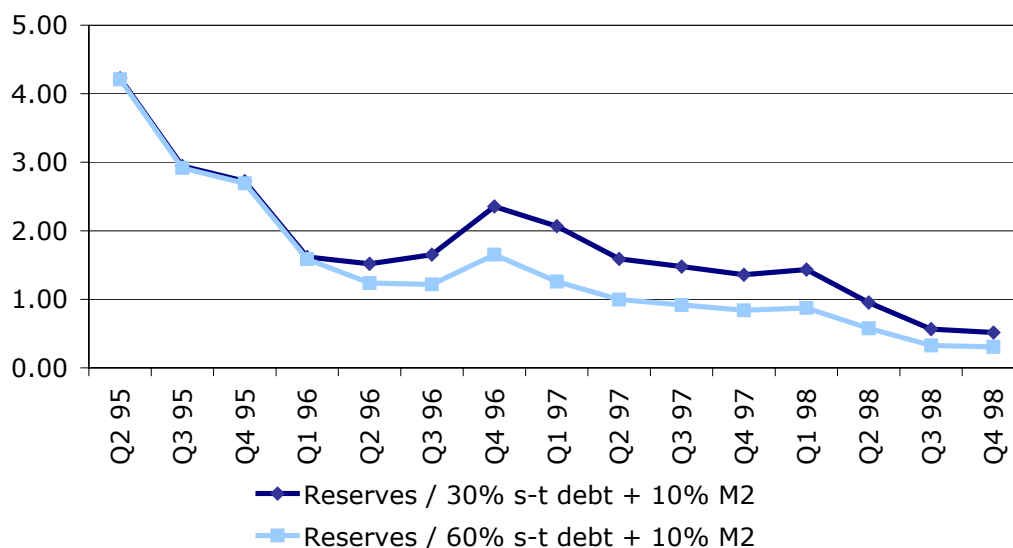
Figure 4.
Gross International Reserves over Short-Term Debt (T-Bills Market) and Current Account Deficit



Source: NBU, UEPLAC, own calculations

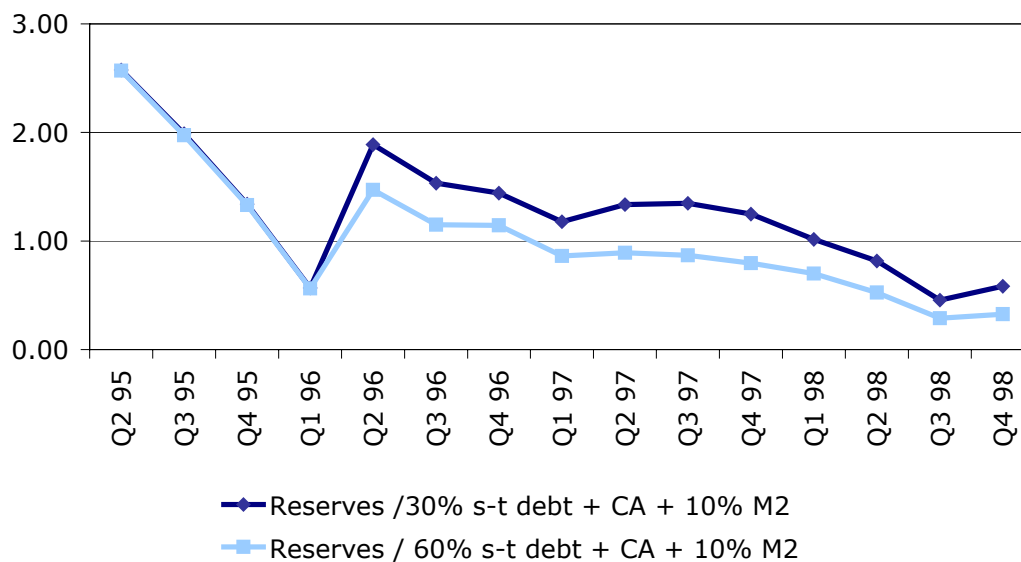


Figure 5.
W-K criterion of Reserves' Adequacy



Source: NBU, UEPLAC, own calculations

Figure 6.
Augmented W-K criterion of Reserves' Adequacy



Source: NBU, UEPLAC, own calculations



Utilisation of other debt-based criteria like augmented short-term debt or W-K indices does not change the picture. Augmented index, that includes both T-bills short-term debt and a current account deficit, also dropped below one in 1998 (Figure 4). W-K criterion, which identifies both external drain through a short-term debt and internal drain through capital flight, has even more strongly market downward sloping trend (Figure 5). In the case if nearly 60% of outstanding short-term debt on governments bond market belonged to non-residents, this index became below the benchmark level as early as the second quarter of 1997. In that period volumes of total reserves had been increasing, and no other explicit signs of future crisis appeared. Augmented W-K criterion confirms the conclusion that reserves became inadequate early before August 1998 (Figure 6).

In this paper the W-K criterion does not include an explicit adjustment on probability of capital flight in the country, as initially proposed by Wijnholds and Kapteyn (2001). It means that probability of this flight is presumed to be equal to unity. Indeed, Ukraine is internationally considered as a quite risky country. In Institutional Investors' ranking of countries creditworthiness Ukraine possesses a 117 place out of 145 countries in September 2001. Therefore, non-inclusion of adjustment index should not significantly distort the results. Here the W-K criterion is calculated on the basis of 10% value of M2, the minimal level for countries with pegged exchange rate like Ukraine. It is obvious that application of 20% M2 as the second part of the W-K criterion reduces the total ratio, showing even more pessimistic picture for reserves' adequacy criteria in Ukraine.

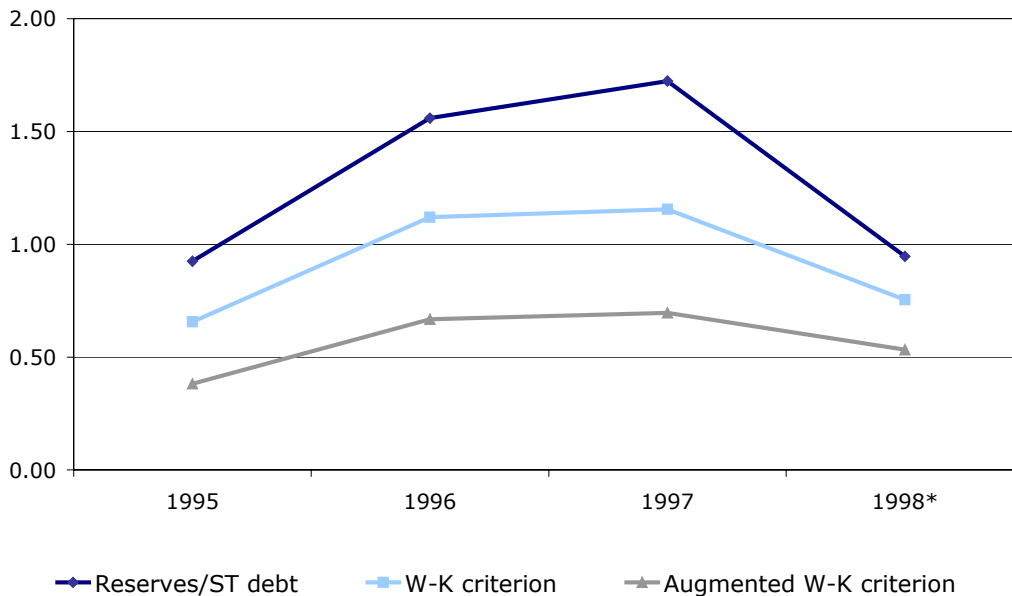
In addition to internal borrowing that actually appeared to be externally financed, Ukraine started to actively borrow abroad. Between 1994 and 1997 public and publicly guaranteed external debt reached USD 7.0 bn, or 21.9% of the GDP. Among the largest payments of this period it is necessary to mention Nomura credit that was due on August 11, 1998 and that was successfully paid; and the payments to Chase Manhattan and to Merrill Lynch that were due in the autumn – winter of 1998.

According to the World Bank data, in 1997 the ratio of total reserves to debt burden (both interest and principal payments) was 1.72, i.e. above the benchmark (Figure 7). However, in 1998 this ratio dropped below one (0.95) even when the level of international reserves is assumed constant on a 1997 level. The W-K and the augmented W-K criteria were also below one in 1998 under above assumption, indicating that the country became prone to crisis even in the case of no quick drop in reserves occurred in the first half of 1998.

If we combine both T-bills market obligations to non-residents and other external debt, in 1997 the ratio of gross international reserves to the whole short-term debt by remaining maturity is equal to 0.65, i.e. stayed far below a desired level. That signalled that country was very vulnerable to financial crisis.

**Figure 7.**

Criteria of Reserves' Adequacy for Official External Short-Term Debt



Source: World Bank, own calculations

Note: * - The 1997 level of gross international reserves is taken.

As we saw, Ukraine did not have enough international reserves to sustain a financial crisis of August 1998. The country could not service its merchandise trade payments, conduct debt servicing and keep exchange rate stable with actually available level of reserves. Moreover, it became clear that debt-based criteria of reserves' adequacy were very important for Ukraine. They provided much earlier warning signals than import-based criteria or dynamics of international reserves. I believe that the best performers were the W-K and augmented W-K criteria that allowed capturing both evolution of the short-term debt by remaining maturity, current account deficit, and potential capital flight.

4 Calculation of the minimal necessary level of reserves for Ukraine in 2002-2005

As demonstrated, the optimal level of international reserves in Ukraine could be determined on the basis of both current account and debt payments, in other words the W-K and the augmented W-K criteria. Here I present an estimation of minimal necessary level of international reserves that Ukraine needs under these criteria.

Information on the forecasted level of external debt by remaining one-years maturing is obtained from the Ministry of Finance publications. This debt represents annual due-payments of Ukraine, covering both principal amount and interest payments. Data on current account deficit and imports are obtained from the NBU's forecast, distributed at the macroeconomic



forecasting seminar held by the Ministry of Economy and European Integration of Ukraine in March 2002. Forecast of dynamics of M2 is calculated assuming that in 2002 its growth rate will be 35%, in 2003 – 25%, in 2004-05 – 20%. For calculations below are based on implicit assumption that forecasted values will realise. It is obvious that this assumption is too strong, and an actual dynamics could be quite different. Therefore, the provided estimations should be considered as baseline estimations.

Results provided in Table 1 show that in 2002 Ukraine needs at least USD 2.7 bn in international reserves to be able conduct all public and publicly guaranteed one-year of remaining maturing external debt payments, as well as to sustain internal drain in the form of capital flight. That is based on assumption that Ukraine needs 10% of M2 to account to internal drain, i.e. capital flight. According to Wijnholds and Kapteyn (2001), 10% of M2 are required for countries that have fixed or pegged exchange rate regime (minimal level) or countries that have floating exchange rate regime (maximum level). Officially, since 1999 Ukraine has a floating exchange rate regime, but in fact it is managed by the NBU. Therefore, it is also calculated the W-K criterion for 20% M2 (the maximum level for pegged exchange rates). According to the second estimation procedure, Ukraine needs USD 3.8 bn in 2002.

Table 1. Minimal Necessary Level of International Reserves for Ukraine in 2002 – 05, USD m

		2002	2003	2004	2005
Forecast of external debt	(1)	1529	1646	1657	1532
Forecast of M2	(2)	11775	15166	19715	25630
Forecast of CA deficit	(3)	-993	-819	-761	-628
Forecast of imports	(4)	21835	23362	24773	26333
Minimal necessary level of international reserves (10% of M2)	(1) + 0.1 * (2)	2706	3162	3628	4095
Minimal necessary level of international reserves (20% of M2)	(1) + 0.2 * (2)	3800	4458	5031	5582
Augmented minimal necessary level of international reserves (10% of M2)	(1) + 0.1 * (2) + (3)	1713	2343	2867	3467
Augmented minimal necessary level of international reserves (20% of M2)	(1) + 0.2 * (2) + (3)	2807	3639	4280	4954
Three months of imports	0.25 * (4)	5459	5841	6193	6583

The level of reserves that is considered necessary in line with the W-K index in 2003-05 steadily goes up from USD 3.1 – 4.5 bn to USD 4.1 – 5.6 bn. Augmented W-K criterion in 2002-05 is lower than the W-K index due to



persistent current account surplus expected in Ukraine during this period. In August Ukraine held approximately USD 3.8 bn of reserves, i.e. the amount required by both the W-K criteria with 10% or 20% of M2, as well as the augmented W-K criteria.

It is interesting to note that still the three months of imports, the most conventional criterion of international reserves' adequacy, has not been met in Ukraine (Figure 1), and will not be met if we keep the level of reserves, necessary by the W-K criterion. The question is whether Ukraine should attempt to reach also the three-months of imports level. As it was shown in the previous discussion, debt-related criteria of reserves' adequacy performed well in the case of 1998 financial crisis. Moreover, the augmented W-K criterion captures a volatility of current account, i.e. a potential problems with imports payments.

The only reason why the NBU might to approach import-based criteria is a wide recognition of this criterion by international community. For instance, the IMF incorporated this criterion into the set of requirements under the Extended Fund Facility Program. However, reserves' holdings have not only benefits, but also costs. Thus, it is necessary to evaluate the costs of holding additional reserves over the W-K criterion. It might be better to publicise the fact that Ukraine performs well by other reserves' adequacy criteria, but does not divert extra funds from the economy.

The final solution regarding the desired level of gross international reserves depends both on costs of reserves' holdings and on goodness-of-fit of forecasts, on which estimation of necessary reserves are made. If forecasts are very poor, it is better to hold more reserves just for pre-cautionary reasons.

Another question is a role of government bonds market and participation of non-residents. In 1998 this debt market has a leading role in determining the sufficiency of international reserves. Currently non-residents cannot purchase the Ukrainian domestic T-bills, which are sold only to country residents. Thus, this market lost its importance in discussion of the necessary level of reserves.

To summarise, presently Ukraine has a minimal necessary amount of international reserves to cover its short-term external debts by remaining maturity and to at least partially sustain the internal drain. However, the question remains how costly is to hold excess reserves. This issue will be discussed in the next chapter.

5 Costs and Benefits of Reserves' Holdings

Holding of international reserves brings both benefits and costs. Benefits of reserves' holding are attributed to insurance function of international reserves. Countries that have fixed exchange rate or currency board need international reserves to preserve a value of exchange rate. However, even countries with floating exchange rate keep large amounts of international reserves to decrease a risk of rapid currency depreciation (Feldstein, 1998).



Moreover, holding of international reserves perform important psychological function providing a signal for a rest of the world that a country has sufficient resources to sustain a desired level of exchange rate or to fulfil its obligations.

Although it is possible to estimate a necessary level of reserves under different adequacy criteria, it is quite difficult to quantify benefits associated with reserves' holdings. One approach is to measure a reduction in probability of financial crisis associated with reserves' holdings (Feldstein, 1999). Another approach could be a measurement of potential losses that associated with a crisis and that could be avoided if reserves were adequate. For instance, the financial crisis of 1998 in Ukraine led to slowdown of economic recovery. In the second quarter of 1998 the real GDP became positive for the first time since independence, but the crisis destabilised a situation, and a -1.9% drop on the real GDP was registered in the end of the year. In dollar value, Ukraine's GDP reduced by USD 8 bn between 1997 and 1998. However, it should be noted that not only inadequate reserves could be blamed for a crisis, thus benefits from holding reserves could not be equalized to entire amount of GDP losses that could be potentially avoided. That is just an approximation.

In line with benefits, there are several types of costs associated with reserves' holdings. As one type of costs, Feldstein (1999) considers a higher level of exports vis-à-vis imports in the country, entailing lower domestic consumption and investments than otherwise prevail. However, this claim is correct only in the case, if domestic market can absorb extra products that are currently directed to foreign markets. It is not always the case, and it is a possibility that lower exports would finally imply lower both domestic production and consumption. Thus, this type of costs is very dubious.

Other costs include costs of obtaining reserves. If reserves were borrowed, that would be a yield paid for these funds. One of the sources of international reserves in Ukraine is the IMF crediting. Currently a total amount of charges and interest that Ukraine has to pay to the IMF during 2002-06 is USD 201 m (IMF, 2002).

If reserves are financed by surplus of exports receipts, costs include foregone investments into national economy, both state and public, that could be made out of export earnings keeping as reserves, and, consequently, a missed rate of return (see Clark, 1970; Kelly, 1970; Frenkel and Jovanovic, 1981; Feldstein, 1999). In Ukraine a August level of international reserves was USD 3.6 bn. Average interest rate on deposits in foreign currency for legal entities was 6.0% p.a., and interest rate on credits was 12.8% p.a. Thus, keeping international reserves away from the banking system means returns' losses at an approximately USD 216-461 m level per year, or 0.5 – 1% of the GDP in 2001. It remains questionable whether export earnings, if not kept as reserves, would be directed to investments.

Costs of holdings of estimated levels of reserves are presented in Table 2. The foregone interest rate is assumed on the level of 12% throughout the whole period from 2002 and 2005. As could be seen, costs vary from 0.5% to 2% of the GDP in 2001. It is obvious that costs of the reserves that could cover three months of imports are higher, than for other criteria. One percentage of



the GDP is the level accepted in other countries (Feldstein, 1999), and it could be used as a benchmark for the case of Ukraine. At the moment, Ukraine does not exceed this benchmark. It also advocated a usage of debt-based criteria, and no import-based.

Table 2.

Estimation of Costs of Gross International Reserves' Holdings, USD m per year

	2002	2003	2004	2005
Interest rate (assumption)	12%	12%	12%	12%
Costs of holding minimal necessary level of international reserves (10% of M2)	325	379	435	491
Costs of holding minimal necessary level of international reserves (20% of M2)	456	535	604	670
Costs of holding augmented minimal necessary level of international reserves (10% of M2)	206	281	344	416
Costs of holding augmented minimal necessary level of international reserves (20% of M2)	337	437	514	594
Costs of holding three months of imports	655	701	743	790

It should be said that international reserves are managed by central banks, thus these funds are invested, but into low-risk and high-liquidity assets ensuring that reserves could be quickly withdrawn and used for intervention in the case of needs (Wijnholds and Kapteyn, 2001). Thus, actual costs of holding reserves should be estimated as costs of foregone opportunities of investments in national economy (in the case of export earnings) and borrowing costs associated with acquisition of reserves minus the yield obtained on reserve assets.

Other potential costs of holding large reserves are an effect of moral hazard (Brussiere and Mulder, 1999). Countries that keep very large international liquidity tend to behave riskier and do not solve problems in fundamentals (a main source of crisis, according to the first generation of crisis models).

6 Conclusions and Policy Implications

The study of reserves' adequacy criteria during the 1998 financial crisis demonstrated that debt-based criteria provide earlier warning signals than import-based indices. This result contradicts *ex-ante* expectations regarding relevancy of various adequacy criteria for Ukraine. Despite the fact that



Ukraine is more open to merchandise trade, than to capital mobility, the last financial crisis had a debt-related nature. That places Ukraine, alongside with other emerging economies, in a group of countries that has to pay a special attention to the ratio of reserves to short-term debt by remaining maturity.

Calculations of the minimal necessary level of international reserves on the basis of debt-based criteria demonstrated that in 2002 Ukraine needs at least USD 2.7 – 3.8 bn in gross reserves by the W-K criterion and USD 1.7 – 2.8 bn by the augmented W-K criterion. That is almost equal to the level of international reserves that Ukraine possesses at the moment. In other word, in terms of debt-based criteria of reserves' adequacy, Ukraine's level of reserves is adequate. Still, it is recommended to keep higher level of reserves than it is minimally necessary by provided estimations, taking into account a possibility of forecast errors.

However Ukraine still does not perform well in terms of import-based criterion, namely three months of imports. For this criterion, Ukraine remains behind the majority of Eastern European countries (IER, 2002). In this case, the question arises whether Ukraine has to approach also the import-based criteria. From the point of view of previous Ukraine's experience and the fact that reserves' holdings are costly, the achievement of three months of imports coverage is not justified.

It could be justified from a perspective of confidence in soundness of Ukraine's exchange rate regime or obligations. Nowadays import-based criterion is still widely used by investors and international institutions like the IMF or European Bank for Reconstruction and Developments. And Ukraine looks worse than other countries, if this criterion is considered. Therefore, the NBU may want to approach this level after a more careful assessment of additional costs of reserves' holdings. But it should not be taken as a primary goal of the NBU.

International reserves are not only instrument that could and should be used approaching exchange rate and financial stability of the economy. Reforms that address fundamentals of the economy are very important for decrease a country's vulnerability to shocks, including financial crises. This idea is applied in the W-K criterion that assumes lower internal drain and, consequently, less necessary reserves for countries that has better ranking in *The Economists* index. Therefore, successful structural reforms may reduce a need for international reserves in the future.



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