

DEVELOPMENT OF COMPOSITE INDICATOR OF UKRAINE'S INTERNATIONAL RESERVES ADEQUACY

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Abstract

This paper develops an indicator for estimating international reserves adequacy in Ukraine taking into account its unique characteristics. The proposed indicator was constructed based on the modification of IMF adequacy metric by changing weighting coefficients of potential balance of payments vulnerabilities based on historical data for Ukraine and by the inclusion of import as an additional component. In comparison to the IMF metric our indicator implies greater international reserves. This is due to the fact that balance of payments of Ukraine is very sensitive to current account shocks such as worsening terms of trade so our indicator except import component has increased weighting coefficient of export earnings. Also, compared to the IMF metrics our indicator provides more weighting coefficients of the other portfolio liabilities and the money supply that represents the sensitivity to financial account shocks. Reduced weighting coefficient of the short-term debt could be explained by the partial refinancing of external debt. This new indicator suggests that the accumulated levels of reserves of Ukraine have been inadequate at 1 April 2015.

Keywords: International Reserves, Reserve Adequacy, Balance of Payments

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1. Introduction

The accumulation of significant amounts of international reserves (IR), especially in emerging market economies, was the result of the balance of payments (BOP) crises, which these countries experienced during the 1990s. The sudden stop of capital flows, further outflow of foreign currency resources (FCR) and unavailability of external financing prompted the governments of emerging market economies go through active accumulation of IR to create a "safety cushion" for its use in crisis. The accumulated significant amounts of global IR increasingly attract the attention of the international community from both the academic community and economists. Despite the global financial crisis in 2008 at the end of March 2015 global IR amounted to \$11.4 trillion according to the International Monetary Fund (IMF). Of then \$7.5 trillion accumulated by emerging and developing economies (mainly due to China). But empirical studies of IMF economists found that these increase of IR exceeded adequacy level for self-insurance against sudden stops of capital flows. So today a very acute question arises regarding of IR adequacy assessment. Particularly there is an acute problem for the economy of Ukraine, whose reserves decreased by 63.2% in 2014.

2. Literature review

Detailed analysis of the evolution of approaches to determine the appropriate level of IR, which enhances the effectiveness of these assets in their role as buffers against external shocks, was done by J. Aizenman and H. Genberg (Aizenman, 2012). They showed that today a universal methodology for assessing the IR adequacy does not exist. In modern literature to determine this level there are two basic methodological approaches to deal with this issue, which are known as reserve optimality and reserve adequacy indicators.

By "optimal" level is considered the amount of IR accumulated with the purpose of self-insurance against sudden stop of capital flows based on comparison of marginal costs for reserves holding with profits derived from reserve management. So cost-benefit models describe reserve accumulation explicitly as an optimization problem: maximizing the expected income from the IR accumulation while minimizing the cost of their holding taking into account conditions on global financial markets. The main disadvantages of this approach are models, which include subjective aspects of research (for example, calibrating this parameter as the probability of a crisis). The results of these models are very

susceptible to the assumptions adopted, so these tend to be unreliable in the guidance of economic policy.

Approach assessing “adequate” level of IR is built on the research of potential outflows during the BOP crisis that is based on the research of BOP vulnerabilities. Among modern criteria and models of IR adequacy it can be distinguished the traditional metrics (import coverage, broad money coverage (typically M2), short-term debt (STD) coverage), combination metrics (which reflect a broader range of sources of risk) and econometric models to identify the main determinants of the demand for IR, that is the base of IR adequate level calculation. In the study of the IR adequacy often do not take into account the cost of holding these assets (except for econometric models where this cost can be included as one of the variables). This approach is a more popular as far as the identifying of potential BOP vulnerabilities makes it more useful for the analysis of macroeconomic policy. As well, since it focuses on variables which are available for a wide array of countries, this kind of measurements are useful for international comparisons, and serve as an indicator of the liquidity of an economy (Gómez, 2013). Therefore, our study will focus on the analysis of the adequate level of IR, not their optimal level.

Analysis of using the various metrics of IR adequacy by credit rating agencies and investment banks was showed that most of them use traditional metrics (Antal, 2011). In preparing country reports the IMF uses traditional metrics and also own combination metric. The new IMF metric (IMF, 2011; IMF, 2013; IMF, 2015a) is the most popular today for use of combined indicators. Although the IMF also uses other combination metrics, such as the Wijnholds-Kapteyn metric and Lipschitz, Messmacher, and Mourmouras metric.

As noted by IMF experts, it is impossible to develop a simple universal metric that will be suitable for use by all countries, because each country has its own features. Therefore metric developed by the IMF is the starting point from which each country can begin its analysis and adapt this metric in the own features. The IMF's new metric became widely used, first of all, because of its simplicity and its ability to correction for its adaptation to the characteristics of individual countries by changing the weighting coefficients and the inclusion or exclusion of additional types of vulnerabilities.

A lot of papers of Ukrainian economists are devoted to the research of adequacy of Ukraine's IR. But most of them use traditional metrics for determining adequate level of reserve assets and IMF metrics. Also of note is the paper of Bogdan T. (Богдан, 2011), which modified the IMF metric by increasing the weight coefficient of money supply M2 (for a fixed exchange rate), that explains the growth of a foreign cash outside the banking system.

In our previous paper (Makarenko, 2015) we conducted an econometric analysis of the main

determinants of the demand for IR of Ukraine. We concluded that the main factors that reduce reserves in the long term were the growing propensity to import, increased demand for money and the amount of short-term debt by residual maturity. It was proved that external shocks associated with the BOP financial account is more dangerous for Ukrainian economy than the current account shocks. As a result it was decided to develop a combination metric of IR adequacy that will reflect the individual features of Ukrainian economy. Using IMF combination metric (IMF, 2011) for assessing IR adequacy for Ukraine with the proposed components and its weights will lead to inaccuracies. But this indicator provides a very complete benchmark to measure reserve adequacy as it considers the major potential risks for an economy in the eventuality of a shock to the balance of payments. Therefore, the indicator proposed by the IMF was adopted to find the adequate level that this country should hold by calibrating it with historical data for Ukraine. This specific indicator for IR adequacy, based on the analysis of BOP, must also consider the presence of critical import in the BOP structure because increase of import price increases the demand for IR. Similarly, for example, based on modifications of IMF metric a combination metrics for Small Island countries (Mwase, 2012) and for Colombia (Gómez, 2013) were developed.

3. Methods

We would like to develop the own IR adequacy indicator based on the approach proposed by the IMF (IMF, 2011). The metric is based on an analysis of change in stocks of main external liabilities and internal assets in periods of pressure on the foreign exchange market. Algorithm of IMF metric development and other combination metrics development with the specific characteristics of individual countries is the following:

1. Establishing the period of the research data;
2. Estimation of an index of exchange market pressures (EMP), following Eichengreen, Rose, and Wyplosz (Eichengreen et al., 1995), in order to identify the periods in which the hryvnia faced unusual depreciation pressures, as these are the moments in which the international reserves would be required to provide liquidity to the market;
3. Determination of the main sources of potential BOP vulnerabilities;
4. Determination of weighting coefficients of the main potential risks separately for fixed and floating exchange rates.

Then based on constructed indicator, traditional metrics of adequacy and IMF metric we shall calculate the adequate level of Ukraine's IR.

4. Results

Before starting with the construction of IR adequacy indicator we will analyze the exchange rate system in Ukraine. Fixed exchange rate (ER) in Ukraine was introduced in 1994 as a means of the opposition to the inflation. Since 2000 the National Bank of Ukraine (NBU) announced a gradual transition to a flexible exchange rate (the exchange rate band implemented). But during 2000-2004 the NBU actually held at fixed ER level, allowing only small fluctuations. Since 2005 the NBU actually provides greater flexibility of hryvnia (the official ER is near to the market ER). But because there was pressure on the ER, in the same year the NBU conducts administrative revaluation of the hryvnia. Deployment of the global financial crisis led to a jumpy devaluation in 2008, and then in the following years there was the fixed ER. Since 2014 the NBU introduces the transition to a flexible ER that together with the political, economic and social instability caused instability in the foreign exchange market. But the NBU have undertaken the foreign exchange market interventions. During 2014 in Ukraine there were several ER: official (defined daily by the NBU), interbank (mounted on the results of cashless trading), cash (calculated independently by each bank, and its value is not limited by applicable law) and "black market" ER. This situation primarily was caused by insufficient supply of currency in the foreign exchange market. Since September 2014 the NBU started to set the indicative ER (determined every evening on the basis of actual transactions on the interbank market the day before). But the indicative ER was still lower than the real. Therefore, to eliminate the multiplicity of ER and establish real market rate of February 2015 the NBU refused to establish the indicative ER. Such the intermediate ER regime operates today, as the Chairman of the NBU Valery Gontareva noted "now we do not have a floating exchange rate, as far as we do not yet reject the administrative measures of the foreign exchange market regulation» (NBU, 2015a).

Establishing the period of the data of the research

We used quarterly data between I quarter 1998 and IV quarter 2013 for construction of IR adequacy indicator for a fixed ER. Earlier period was not used because of the lack of official statistics on most indicators. To construct the IR adequacy indicator for a flexible ER we used the statistics available for the period between I quarter 2014 and I quarter 2015.

Estimation of an exchange market pressure index

The EMP index used to identify the currency crisis. Although to determine the index in the IMF uses the methodology of Eichengreen, Rose and Wyplosz (ERW) (Eichengreen et al., 1995) today there are several different methods. Extensive review of methods for determining the EMP index was held by Angkinand (Angkinand, 2006). For a more precise

identification of the crisis period is recommended to use several methods simultaneously. Despite the rich heritage in defining the EMP index today there are often used two methods: Eichengreen, Rose and Wyplosz method and Kaminsky, Lizondo and Reinhart (KLR) method (Kaminsky et al., 1998).

According to the ERW methodology the EMP index is a weighted average of the depreciation of the national currency against the base currency (usually the US dollar in nominal or real terms), changes in the monthly volume of IR (in percentage terms) and changes in a monthly interest rate. Eichengreen et al. (1996) uses Germany (and the Deutschmark) as the comparison reference as he argues that it is a country with a strong institutional framework. In the later works of different authors often in determining the EMP index for the Eurozone the Deutschmark was substituted by the Euro, for other countries – by the US dollar. In calculating the IR adequacy metric for Colombia in determining the EMP index there were chosen the Special Drawing Rights as the benchmark, since these capture the behavior of the most important reserve currencies (US dollar, euro, British pound and yen), but still gives a significant weight to the behavior of the indicators of United States, which is Colombia's main trading partner. (Gómez, 2013). In our case, the calculation of the EMP index for Ukrainian case should adopt a basis of comparison the US dollar, as the Ukrainian economy has a significant level of dollarization and the US dollar has the greatest proportion in the IR structure.

By the KLR method in calculating the EMP index uses only its own macroeconomic indicators. The EMP index increased with depreciation of the national currency, reduction in international reserves and the growth of nominal interest rates.

EMP event occurs whenever the index is several standard deviations (depending on the method from 1 to 3) over the mean of the EMP during the sample.

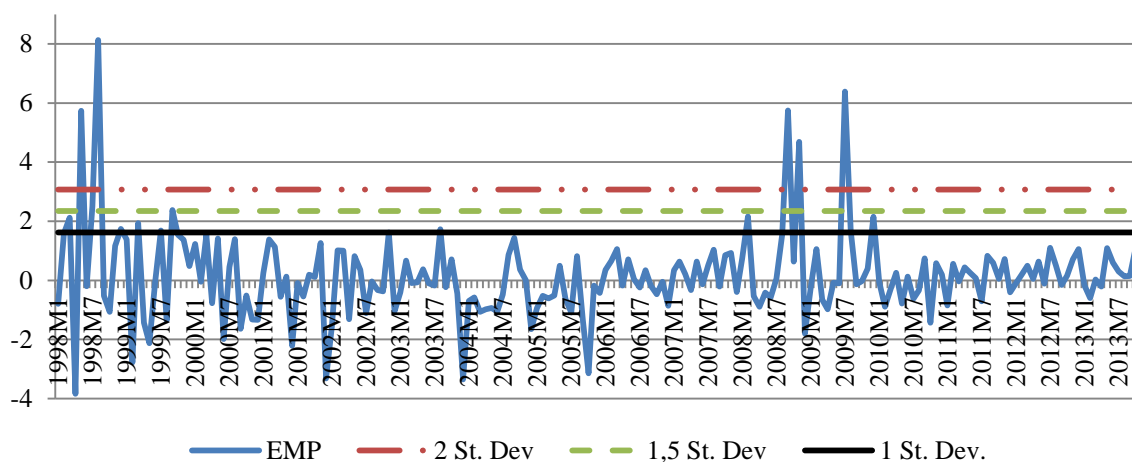
In the Eichengreen's (Eichengreen et al., 1995) and the IMF's (IMF, 2011) works the EMP events occurs if the value of an EMP index for a country exceeds its mean by more than 1.5 times its standard deviation. Kaminsky et al. (Kaminsky et al., 1998) pool all events for a country as a crisis event if the standard deviation from the EMP mean exceeds a threshold of 3 standard deviations. In the case of Small Island countries and the Colombian economy this threshold was set to 1, because of the short sample needed a weaker criteria in order to obtain a greater sample of periods of EMP to have a better defined distribution when analyzing the potential BOP outflows. The estimation of the EMP index for Ukrainian case by the KLR method by Homjak (Хом'як, 2014) with a threshold of 2 standard deviations clearly identified only two episodes of crisis: the crisis in 1998 and 2008. Therefore, in this paper as the threshold we use one standard deviation of an EMP index.

In the Ukrainian case we evaluated the EMP

index by both the most popular methods (see Fig. 1, 2). The information base for the evaluation of the EMP index was the IMF International Financial Statistics. We used the following data: the nominal exchange rate of the national currency against the US

dollar (line rf), international reserves (excluding gold) (line 1L.D) as a percentage of the money supply M1, the rate of the interbank money market in foreign currency (line 60b), rate for 3-month treasury bills (line 60c).

Figure 1. EMP index (ERW method)



Source: created by the authors

Figure 2. EMP index (KLR method)



Source: created by the authors

We see that from the on the figures clearly determined periods of crisis in 1998 and 2008. Other periods of increased pressure on the currency market are different depending on the EMP index evaluation method. To our mind, more reliable evaluations by the KLR method, as evidenced by the NBU analysis of the currency market (NBU, 2015b). According to this method we have 20 crisis episodes. As BOP statistics is available only with quarterly and annual frequency, the crisis will assume the following periods: III quarter 1998 – I quarter 1999, III quarter 1999 – I quarter 2000, IV quarter 2004, IV quarter 2008, III quarter 2009, I quarter 2010, IV quarter 2011, III quarter 2012.

The inconsistency between evaluated crisis episodes by the ERW method and real crisis period can be explained by incorrect choice of the base country for comparison. Although the US dollar is the

main currency in the structure of IR and in the structure of payments and receipts for goods and services, the US part as a trading partner is negligible (according to BOP the US part in the total turnover is 2.3% in 2013).

Determination of the main sources of BOP potential vulnerabilities

For consideration of BOP current account shocks we propose using both export and import components. Since the main source of FCR on the foreign exchange market is export earnings reflected the potential loss that could arise from a drop in external demand or a terms of trade shock. In Ukraine the current account depends on the dynamics of prices for ferrous metals and their products as the main

commodity groups of Ukrainian exports. Therefore, the reduction of metal price or reduction of export volume in this commodity group decreases currency inflow to the domestic foreign exchange market. Proof of this was a significant reduction in steel exports in 2014 because of military operations in the Donbas, which significantly affected the FCR supply.

Also, to our mind, as the current account shock should be considered not only export but also import. In the structure of Ukrainian imports there is a significant proportion of critical imports such as imports of gas and petroleum industry products, so higher prices for it has a significant negative pressure on the domestic currency market and IR.

As potential financial account vulnerabilities we propose using STD and other portfolio liabilities (OPL). Econometric analysis (Makarenko, 2015) confirmed the negative long-term relationship between IR and STD. However, we note that there are trade credits (about 1/3) in the STD structure and that during the crisis of 2008-2009 STD was refinanced. Therefore, we can assume that the weight of this component will not be so significant as the IMF metric. Although the impact of OPL on the demand for IR was not researched in our econometric analysis, structural and dynamic analysis of BOP component allows to include this component as one of the potential financial account vulnerabilities.

The negative long-term impact of money on IR which is also slowly eliminated follows from carried out econometric analysis. Ukrainian economy is also characterized by significant amount of foreign cash outside the banking system. So in crises periods (political or economical), which provoked inflation and devaluation expectations, the pressure on the foreign exchange market is increasing significantly due to increasing demand for FCR from the people and legal entities. Therefore we can assume that this component of our indicator may be the most significant.

Although also the remittances of migrant workers are the source of a significant amount of foreign currency inflow in Ukraine, we will not add this component in our metric. BOP analysis showed that even in times of crisis for this channel significant FCR were received.

Data sources for the construction of the IR adequacy indicator are external sector statistics (NBU, 2015c), namely BOP data for exports and imports of goods and services, STD data by remaining maturity, international investment position (IIP) data for the calculation of OPL, and monetary aggregates data (NBU, 2015d). Since the NBU calculated STD by remaining maturity only since IV quarter 2004, for the period I quarter 2000-III quarter 2004 we used the calculations of the Institute for Economic Research and Policy Consulting (Movchan et al., 2009).

Determination of the weighting coefficients of the main potential outflows of IR adequacy indicator for a fixed ER regime

Weighting coefficients for each potential source of capital outflow are calculated on the basis of research of capital outflows from the country under periods of EMP event. That weight is calculated as the percentage change of each of these variables in periods of EMP with respect to their 12-quarter average before the crisis event (equivalent to 3 years in (IMF, 2011)). Then, for each variable we find the tenth percentile of these changes, which reflects the potential outflows under periods of high stress.

Calculate weighting coefficients for each component metrics:

- *Export earnings.* This will be the tenth percentile of export percentage change relative to the average earnings for 12 quarters before the crisis event. However, it should be noted that, as in the Colombian case (IMF, 2014) EMP events, calculated by the KLR method, do not coincide with periods of terms of trade worsening. According to the EMP index evaluation I, II and IV quarter 2009 is not defined as crisis period, but during this period there was a dramatic decline in export earnings. This was due primarily to a decrease in world prices of primary commodity exports, exports of metallurgy industry products decreased by 55.4% in 2009 (NBU, 2015c). Steel prices reached their peak in August 2008, and during 2009 decreased by 2 times, so in the calculation of export percentage change we have included these periods additionally. According to our calculations the 10th percentile loss by the previous year's export earnings was 25.9%;

- *Import.* Ukraine is most dependent on imported gas and petroleum products. So IR adequacy indicator should include additional buffer, calculating on the basis of the price gap between current prices and a cautious forecast of future prices. Today it is impossible to calculate the expected long-term prices for this type of import, as prices for Ukraine depends not so much on economic factors, but on political relations between Ukraine and Russia. These relations are poorly predictable, despite the assistance of the EU in solving the gas problems between the two countries. To calculate the price gap IMF has proposed to take a future price at the 68 percent confidence interval (equivalent to one standard deviation if the future distribution is normal) (IMF, 2015a). For the calculation of energy imports volume we will use the moving average of import weight part (commodity code and title by Ukrainian Classification of Commodities in Foreign Trade "27 mineral fuel, petroleum and petroleum distillation products" according to the State Statistics Service of Ukraine) for the last 3 years. During 2011-2013 the part of imports of this commodity group was 31% of total imports;

- *Short-term debt.* Unfortunately, due to lack of official statistics on STD on a remaining maturity basis over the period to 2000 and the inability of its calculation based on official statistics, calculations were done for the period 2000 Q1-2013 Q4. Calculations have showed that during this period there was no outflow of capital for this item. This fact could be explained by the STD structure during this period. Even during the crisis parent companies finance their affiliated enterprise was not stopped. A similar situation was observed during the global financial crisis in countries such as Estonia, Latvia, Lithuania, Bulgaria, which with high STD level lost IR equivalent only 10% of STD (IMF, 2011). Thus, the 10% percentile of STD percentage change (but not the outflow and inflow) amounted to 4.4%;

- *Money Supply.* The estimated loss of money supply (percentage change of M2) is calculated removing valuation effects resulting from exchange rate changes during the crisis. As a result of the devaluation the foreign currency deposits in the hryvnia equivalent was increased significantly and the money supply in national currency was increased. Since most of the deposits in foreign currency are the deposits in US dollars, to simplify the calculation of valuation effect was thought that all deposits denominated in US dollars. Valuation effect has been calculated according to the NBU methodology (NBU, 2015e). According to calculated data 10% percentile of M2 change equal to 20.1%;

- *Other portfolio liabilities.* According to IMF methodology (IMF, 2011) OPL are a medium-term portfolio liabilities (debt and equity) and medium-term bank debt. Other liabilities are defined as the difference between sum of total portfolio investment and other investment liabilities less the measure of short-term debt described above. The flow (stock) measures of non-short-term debt liabilities are based on BOP (IIP) data, but we can not use the IMF methodology to calculate the weighting coefficient of OPL for Ukrainian economy. This is because:

- foreign portfolio investment inflow in Ukraine has been begun just before the crisis 1990s (in 1996-October 1997) and has been focused on the domestic government bond market. Since November 1997 there was a significant outflow of non-residents capital from this market. Therefore, for the calculation of capital outflows under this BOP item during crisis 1998-1999 years the previous period (12 quarters) could not be used;

- it is necessary to take into account the change in the portfolio liabilities structure. There is small part of equity securities in their structure (on average 2000-2013 they were 15% of total portfolio liabilities). Debt securities, namely domestic sovereign bonds, were the main source of attraction of FCR in 1990s, and in 2000s the main source of attraction of FCR were become Eurobonds. As at 01.04.2015 the accumulated amount of liabilities in the form of bonds were \$27,6 billion, while at

01.01.2001 was only \$2.4 billion (NBU, 2015c). On the domestic sovereign bonds market part of non-residents has been decreased (at the end of 2006 it was 34.7%, 2007 – 23.6%, 2008 – 2.9%, 2009 – 0.7%, 2014 –4,7% (NBU, 2015d)). At the same time on the Eurobond market during the 2000s also the portfolio liabilities structure has been changed. If the government issues Eurobonds since 1999, then in 2002 Ukrainian company "Kyivstar" has issued Eurobonds, and in 2003 – the Ukrainian bank (Privatbank). Peak of FCR attraction through the issuance of Eurobonds by the banking sector was in 2007. As at 1 January 2008 the following structure of debt securities was observed: general government and monetary authorities – 44.8%, banks – 42.3%, the other sector – 12.9%. In subsequent years, the part of the banking sector has been declined, but the state and real sectors has been grown. As at 1 April 2015 the part of general government and monetary authorities equaled to 68.9%, banks – 14.6%, other sectors – 16.5%.

Since the our indicator will be used in the current economic realities, in our opinion, the crises period of 1990s should not be used as an example of portfolio liabilities outflow for the calculation of the weighting coefficient of OPL. If in the 2000s we consider as crises period only the periods specified using the EMP index, then such periods will be around 6, and OPL outflow was observed in only 4 of them. Therefore, in our opinion, the calculation of the weight coefficient must should take into account all periods in which there was an outflow of OPL, namely 2008 Q3 – 2009 Q3, 2010 Q1, 2011 Q3 and Q4, 2012 Q2. Also we propose to use as the previous period not 12 quarters and 8 quarters in this case. As quarterly dynamics of IIP was available only since 1 January 2010, the data for the previous period was calculated by the author based on the BOP data. In this case the 10% percentile was 15%.

Determination of the weighting coefficients of the main potential outflows of IR adequacy indicator for a floating ER regime

Since 2014 the NBU moved from a fixed to a floating ER regime, so the construction of integral indicator of IR adequacy using retrospective data of the Ukrainian economy is impossible. It was difficult to make the country sample available for comparison among the emerging markets economies, using a flexible ER system (for panel sample). This is due, above all, the difficult economic, political and social situation in which Ukraine finds itself. So we have decided to construct a new indicator by modifying the above indicator for a fixed ER system with the recommendations of the IMF (IMF, 2013; IMF, 2015a).

Export earnings. We will analyze statistics of exports (excluding the temporarily occupied territories, the Autonomous Republic of Crimea and the city of Sevastopol in 2014 and 2015 Q1) to

calibrate the weighting coefficient of export earnings. During the period there was a decrease in export earnings due to the delay of production facilities and the destruction of transport infrastructure in the east of the country, lower prices on world commodity markets and deteriorating trade relations with Russia. Average change relative to the average earning for the past 8 quarters was 20.6% and relative to the average earning for the past 4 quarters – 16.9%. It should take into account the change in the export structure, namely increasing the part of agricultural products and reducing the part of ferrous metals (in 2008 the part of agricultural products was 16%, and ferrous metals – 40.8%, and in 2014 the part of agricultural products – 30.2 % and ferrous metals – 27.6% (NBU, 2015c)). Although export of agricultural products is not yet able to replace exports of ferrous metals. This fact somewhat reduces dependence on export earnings only prices for products of one commodity group, as it was before 2008. Therefore, in our opinion, the weight of export earnings can be reduced to 15%.

Import. The part of mineral products import since 2013 has been reduced, in 2014 it has been amounted to 25.7%. Also it should be noted that to stabilize the foreign exchange market by the IMF recommendations the NBU conducts direct foreign exchange intervention to meet the needs of "Naftogaz Ukraine", to the largest Ukrainian importer did not enter the interbank foreign exchange market. It should be taken into account the increase of gas tariffs for all categories of users to reasonable market since April 2015, which aims to reduce the "Naftogaz Ukraine" deficit. Therefore, we suggest reducing the weighting coefficient of import volume to 20%.

Short-term debt. In the period of the fixed ER even in crisis period STD has been not threatening for the BOP of Ukraine and basically has been refinanced. But today, because of the deteriorating investment climate and from inflation-devaluation risks, in the near future probability of investment and credit capital inflow is very small. According to the

NBU refinancing corporate sector on foreign obligations in 2014 decreased to 86% from 97% in 2013 and 112% in 2012, and in 2015 it is expected to further decline to 82%. Therefore, in the future under this BOP items will be more capital outflows. Successful restructuring external debt by Government, of course, will reduce the pressure on the IR and the probability of significant outflows as STD, because the restructuring aims to delay debt payments. So, we propose to take as a basis the IMF metric coefficient and to reduce it from 30% to 15%.

Money supply. In our view, the money supply is even under flexible ER regime one of the most potential sources of capital outflow to Ukraine, that the current banking crisis has been confirmed. Today the NBU uses administrative restrictions on long-term withdrawal of deposits that is aimed at reducing the demand for currency on the foreign exchange market. But these actions disturb confidence of people to the national currency and banking system as a whole. Therefore, in our view, "escape" from a national currency has been prorogued. Moreover, according to IIP at 1 April 2015 stocks of cash foreign currency outside the banking system were amounted to \$92.2 billion. Therefore, we propose reducing the weighting coefficient from 20% to 10%.

Other portfolio liabilities. According to (IMF, 2013) it is necessary to increase weighting coefficient from 10% to 15% for this component. This logic is confirmed by the outflow of debt securities of the real sector of economy. While the government sector continues to attract FCR through the Eurobonds issue. Also increasing capital outflows for this BOP item has been projected by the IMF for 2016-2017 years (IMF, 2015b). Therefore, we kept the weighting coefficient as 15% as well as for a fixed ER regime.

Our metric is constructed as the simple sum of the potential changes taking into account Ukrainian experiences and crisis events (Table 1).

Table 1. International reserve adequacy indicator for Ukrainian case

	Export	Import	STD	Money supply	OPL
For fixed exchange rate regime					
IMF metric (IMF, 2011)	10%	-	30%	10%	15%
Authors' metric	25.9%	31%*68%	4.4%	20.1%	15%
Authors' metric (rounded coefficients)	25%	30%*68%	5%	20%	15%
For floating exchange rate regime					
IMF metric (IMF, 2011)	5%	-	30%	5%	10%
Authors' metric	15%	20%*68%	15%	10%	15%

Source: Authors' calculations

Calculation of adequate level of Ukraine's IR

We will now calculate the adequacy level of Ukraine's IR by constructed indicator and compare

this estimated level to the traditional adequacy metrics and IMF metrics (for a fixed and floating ER because Ukraine uses an intermediate ER) at the 1 April 2015. This is shown in table 2.

Table 2. Calculation of adequate level of Ukraine’s international reserves at 1 April 2015, Billion US Dollars

Actual IR	Authors’ metric	IMF metric for floating ER / fixed ER	import cover metric	Short-term external debt metric	Broad money metric
9.97	32.2	30.4 / 24.1	29.9	55.5	8.2

Thus we see that the actual IR level is inadequacy by all metrics except the broad money cover metric, but it could be explained by the reduction of the money supply in dollar terms.

In comparison to traditional metrics of adequacy our indicator takes into account a greater number of potential risks of the BOP. This provides a more reliable assessment of BOP outflows than any of the traditional indicators of adequacy.

In comparison to the IMF metric (IMF, 2011), which consists of the same variables except import, our indicator implies greater IR. This is due to the fact that BOP of Ukraine is very sensitive to current account shocks such as worsening terms of trade. Therefore, unlike the IMF metric our indicator includes import as an additional component and has increased weighting coefficient of export earnings. Also, compared to the IMF metrics our indicator provides more weighting coefficients of the OPL and the money supply, that represents the sensitivity to financial account shocks. Reduced weighting coefficient of the STD could be explained by the partial refinancing of external debt.

5. Conclusion

Unlike calculating the optimal level of IR, depending on the subjective assumptions, that limits their use for political decision-making, we decided to construct an composite indicator of IR adequacy. The use of specific indicator of adequacy will give an opportunity for Central Bank to take into account key vulnerabilities of BOP of Ukraine that can help developing the adequate macroeconomic policy. The proposed indicator was constructed based on the modification of IMF adequacy metric by changing weighting coefficients of potential BOP vulnerabilities based on historical data of the Ukrainian economy and by the inclusion of imports as an additional component. Consideration imported component due to a high part of energy import and oil products in total import structure.

Increasing IR to \$32.2 billion should reduce the vulnerability of Ukraine to external shocks of the BOP. The NBU based on the measurement of IR adequacy should consider this level as medium-term targets of monetary policy. However, this level should be adjusted depending on the BOP and IIP.

Today the program of cooperation between Ukraine and the IMF would increase the IR of Ukraine to \$18.3 billion at the end of 2015 and to \$35.2 billion at the end of 2018 (IMF, 2015b). Because of the inability of Ukraine to attract the FCR on the foreign capital markets and worsening

investment climate, the main source of increasing IR will become financial assistance of the IMF and other official creditors, that provided by program of cooperation with the IMF.

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