COMPREHENSIVE ASSESSMENT OF FISCAL STABILITY IN UKRAINE

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Content

Part 1: Theoretical part

1.1 Definition of the subject

For the purposes of our analysis, under fiscal stability we understand a situation where the government is capable of achieving its aggregate fiscal objectives. The literature sometimes looks at the subject from another angle – that of fiscal vulnerability. It is the opposite to the notion of fiscal stability and means a situation where a government is exposed to the possibility of failure to achieve its aggregate fiscal policy objectives.[1]

The main aggregate fiscal policy objectives are:

1) maintenance of sustainable levels of public deficit and debt
2) retaining of sufficient fiscal flexibility to be able to exercise effective demand management
3) maintaining reasonable and stable level of taxation that would not hurt the economy

Fiscal vulnerability would mean the likelihood that the government will not meet these policy objectives.

The assessment of fiscal stability should be distinguished from the assessment of fiscal sustainability. Fiscal stability characterizes government's ability to service its current and upcoming obligations, while fiscal sustainability refers to the fulfillment of the government's present value budget constraint (i.e. that that the present value of liabilities is not greater than the present value of assets). The two concepts are obviously related: the recurrent failure to meet current obligations is likely to undermine the long-term sustainability; and vise-versa, the doubts about government's ability to honor its long-term obligations may cause difficulties in attracting the needed resources for financing current needs. Yet, the assessment of fiscal stability and fiscal sustainability are conceptually very different. It is fiscal stability that we are going to assess, which means that we will do fiscal sustainability assessment and will touch upon it only in as much as it is relevant for stability assessment.

The goal of this project is to develop the system of monitoring the fiscal stability (vulnerability) of Ukraine. This goal includes the establishment of methodology for fiscal stability / vulnerability assessment taking into account different types of risks and sensitivity of fiscal parameters to these risks.

1.2 Methodology design

The main parameters of the methodology that we are going to develop are the following:

1) Time horizon: the methodology will assess short-term and medium-term risks, which refer to 1-year and 5-year periods respectively.
2) Level of analysis: we are going to analyze aggregate fiscal indicators at the state level. This means that we will not touch upon local budgets level or program-specific level. It is the state budget revenues, expenditures and deficit that are our focus.
3) The methodology is going to be a combination of quantitative and qualitative indicators. Whenever possible, quantitative indicators should be offered. There will also be a linkage between different indicators, establishing a coherent framework.
4) The framework will include both conventional indicators and original ones. Derivation of original indicators will be done based on the econometric testing, in which significance of a link between the proposed indicator and a fiscal item will be tested.

[1] As defined in Hemming and Petri (2000).

1.3 Review of existing relevant studies and frameworks

To the best of our knowledge, there is no widely accepted methodology for assessment of fiscal vulnerability. There are different methodologies used by international institutions and particular countries that deal with fiscal vulnerability, yet there is no ready methodology to borrow for assessment of fiscal vulnerability in Ukraine.

At the same time, there exist different methodologies for risk assessment in the financial sector. Here we need to mention, first of all, the Handbook on the Financial Sector Assessment developed by the IMF and the World Bank (2005). There is also a substantial amount of literature and techniques on measuring fiscal sustainability. The problem is that this type of assessment focuses on the sustainable level of debt, but does not allow explicitly assessing the effect of particular risks. Yet another method is based on the assessment of unaccounted liabilities (contingent liabilities) that can pose a risk to fiscal balance when they emerge.

Another part of literature, on which we can rely in our study of fiscal stability, is forecasting of various fiscal parameters and subjecting the estimates to stress tests. De facto, the process of forecasting and its sensitivity assessments is solving exactly the same problem, namely the identification of shocks and estimation of the impact of these shocks on fiscal system. Though, if forecast need figures per se, the fiscal stability analysis needs some judgmental criteria (thresholds) allowing to spot the shocks.

Below we review all major relevant existing methodologies, as in theoretical work, so those used by different countries, and then try to come up with a proposal of a methodology that could be applied in the framework of our study for fiscal vulnerability assessment in Ukraine. Our literature review includes a limited number of studies on each methodology. There is, obviously, an extensive discussion in the literature on each of the topics. In the section "Other papers of interest" after the list of references we provide some other relevant studies that can be used for a detailed study of the issues outlined in our literature review.

1.3.1 IMF proposal for fiscal vulnerability assessment

The International Monetary Fund is currently developing a framework for fiscal risks management, yet this is a work in progress, and its details were not available to us. The major point of reference on fiscal management is the Manual on Fiscal Transparency (IMF, 2007) , which sets rules on fiscal reporting that are going to help preserve fiscal stability by promoting proper fiscal accounting and reporting. Article 202 "Assessment of Fiscal Risks" and the accompanying Box 21 in the Manual suggest that a section called "statement of fiscal risk" should be included in the budget documentation. The sensitivity of fiscal projections to varying economic assumptions and assessment of contingent liabilities are the two main parts of such a statement.

The first part should contain a description of variations in key forecasting assumptions, followed by the estimation of fiscal effects of these variations on the forecasts of revenue and expenditure. The examples of the key assumptions to test include: a 1 percentage point increase or decrease in the assumed rate of GDP growth or inflation or the level of interest rates or the exchange rate, or specific fluctuations in import and export prices, resource revenues, or the timing of relevant events such as privatization or investment projects. Also, a set of assumptions about fiscal parameters could be included: a variation in the effective tax rates, public sector wage increases, the change in the average number of claimants for social assistance (IMF, 2007: 71). Another part of the risk assessment deals with contingent liabilities and other items on the government balance sheet the value of which is not certain.

The suggested approach is a useful general guide for fiscal risk assessment, yet its description is rather short and does not constitute a coherent framework. The study that does suggest a framework on fiscal vulnerability assessment is the work by Hemming and Petri (2000). The paper defines the main methodological building blocks of the fiscal vulnerability assessment and lists areas and proposes indicators that can be used for assessment. It goes along the lines of the proposal in the Manual on Fiscal Transparency, but develops it further into a comprehensive framework. The main blocks of the suggested methodology are:

(1) Assessment of the initial fiscal position (including providing information on contingent liabilities, quasi-fiscal operations and other non-transparent items), because non-accounted or non-disclosed items may pose fiscal risks.

(2) Assessment of short-term risks: the authors suggest that it should include a short-term (one year) fiscal forecast, accompanied by the fiscal risks analysis. The short-term baseline forecast should be based on the current trends and policies. In addition, a set of assumptions should be developed that would reflect possible changes in the underlying trends. The baseline scenario then should be subjected to the stress test based on these assumptions.

(3) Assessment of medium-term vulnerability and long-term fiscal sustainability. The medium-term assessment follows the same logic as short-term assessment: starting with baseline projection (for 5 years), then developing alternative scenarios and subjecting the projection to stress tests (in response to all possible shocks). In order to do the stress testing, transmission mechanisms of different shocks into the fiscal performance should be defined, as well as relations between different shocks should be established. The second part of the analysis is assessment of long-term sustainability, which involves calculation of conventional debt sustainability indicators and takes account long-term impacts of demographic trends, natural resource exhaustion and the like.

(4) Finally, the authors suggest assessing structural weaknesses. This assessment allows seeing how well the fiscal system can cope with fiscal shocks. Fr example, a large proportion of non-discretionary spending is going to reduce government's ability to adjust to shocks. High tax rates and a broad tax base also reduce the opportunities for maneuver.

Hemming and Petri (2000) propose a tentative list of fiscal vulnerability indicators (See Annex 1). Their proposal is based on the general understanding of the relationships in the fiscal sector and between the fiscal sector and the economy in general. Obviously, there is a need for a more rigorous testing of indicators to establish their validity. Moreover, the paper does not propose any techniques how the methodology can be applied in practice, in particular, how the transmission mechanisms between shocks and indicators can be established and tested. This means that if we were to decide to apply the suggested framework we would need to augment it with a study of transmission mechanisms of shocks to fiscal stability. It would also involve using a macroeconomic forecasting model that would allow stress testing of different assumptions.

1.3.2 Financial stability assessment

A very similar idea of risk assessment is already being implemented in the financial sector, as at the level of separate financial institutions, so at the level of an economy as a whole. In particular, the IMF, together with the World Bank, has developed a methodology for the financial stability assessment (FSA), a description of which can be found in the Handbook on Financial Sector Assessment.[2] The handbook defines financial stability as: "(a) an environment that would prevent a large number of financial institutions from becoming insolvent and failing and (b) conditions that would avoid significant disruptions to the provision of key financial services." This similarity in the character of objects of study means there could also be some parallels in the methods of assessment. Therefore, here we review the most relevant elements of the financial stability assessment and try to make recommendations on their possible use for fiscal stability assessment.

Financial stability assessment framework includes both quantitative and qualitative indicators that help analyze and assess financial sector soundness and its economic and institutional determinants. The main tools of the quantitative part are early warning systems (EWSs) and "macroprudential surveillance". EWSs are discussed in the next section, and here we review the macroprudential surveillance. It involves analysis of financial soundness indicators and stress testing of the system in response to diverse shocks. In addition, it involves assessment of risks that the financial sector may pose to the economy.

[2] IMF and World Bank (2005)

Macroprudential surveillance

Step 1: Compiling a set of financial soundness indicators

Financial soundness indicators (FSIs) are indicators of the financial health and soundness of the financial institutions in a country. The list of core FSIs is provided in Annex 2. In countries with well developed financial markets, the set of core FSIs is complemented with market-based indicators of financial soundness, which includes market prices of financial instruments, indicators of excess yields, market volatility, credit ratings, and sovereign yield spreads. Calculating FSIs is a first step of the macroprudential assessment. The second step is their interpretation, which involves stress testing and examining the determinants of FSIs and forecasting their future course.

Step 2: Analyzing FSIs

Analysis of FSI is based on their regressions on sets of macroeconomic and financial variables. In some cases, panel data is used, in others – time series.[3]

Step 3: Stress testing[4]

Stress test is a rough estimate of a change in the financial soundness indicators (FSIs) caused by a shock. IMF and World Bank (2005) emphasize that these tests are only rough estimates and do not give a precise measure of the magnitude of losses or gains.

The testing includes the following stages:

1) Identification of vulnerabilities or areas of concern. It is based mainly on expert assessment and understanding what is normal and what is a deviation in the circumstances of a particular country. In particular, attention should be drawn to macro and financial variables that are the most volatile, misaligned, or out of equilibrium - they are the most susceptible to major shocks or realignments.

2) Construction of scenarios. The scenarios are developed with help of macro-econometric models. These are conventional macro-models that are used for economic forecasts. The objective of the modeling is to link a particular set of shocks to key macroeconomic and financial variables in a consistent and forward-looking framework. The result of the modeling should be a forecast of a set of macro and financial variables that are the most volatile, misaligned, or likely to have the greatest effect on the financial system. In addition to this risk factors, it is also necessary to make projections for the common variables that influence the balance sheet of the financial institutions, such as interest rate, exchange rate etc.

3) The results of the modeling are mapped into the balance sheets and income statements of financial institutions. This mapping exercise is done with help of econometric models that establish the links between macro indicators and balance sheets of financial institutions. The effects of a shock are normally expressed as a percentage of capital (or assets or profits).

The methodology of stress testing is an example of how a methodology for any vulnerability assessment can be shaped. In case of fiscal vulnerability assessment it would mean the following:

1) compile the list of risk factors;

2) with help of a macro model, make projection that would show the effect of risk factors on key macro variables and specific indicators that are used for fiscal planning;

3) insert the resulting values into the model used for fiscal planning.

Such an approach assumes that there is a ready model used for fiscal planning, i.e. the model that allows forecasting budget items based on a given set of parameters. If such a model is absent, then the assessment may be done in one step, i.e. with establishing direct links between risk factors and budget items. But such an approach would have an important limitation, namely, it would take into account only direct effect of risks on the state budget, but

[3] See examples in IMF and World Bank (2005).
[4] The discussion in this section draws on Appendix D in IMF and World Bank (2005).

would not account for indirect effects that emerge due to the economy-wide response to the risk.

In addition to suggesting a general framework, the Handbook also suggests the methods on how links between macro-parameters and financial institution balance sheet items can be calculated. The applicability of such techniques for fiscal assessment is questionable, as financial sector assessment is based on the net worth (or capital) approach, and application of the concept of the net worth in public finances is complicated due to often unclear value of state assets and liabilities. For example, the Handbook suggests indicators for measurement of the effect of exchange rate and interest rate risk on capital of a financial institution (See Section 7: Examples of vulnerability indicators). It is clear that we would need to modify these indicators to make them usable in the context of public finances, yet the general approach to their construction is worth studying.

1.3.3 Early warning systems (or leading indicators)

Early Warning Systems (EWS) are widely used in the empirical literature to predict currency, debt and bank crises. It is also a part of the financial stability assessment by the IMF.

The main idea of this approach is to identify leading indicators whose movements tend to occur ahead of movements of general economic activity. Normally, EWSs combine a number of indicators into a single measure of the risk of a crisis. IMF and World Bank (2005, Ch 3: 36-38) review different approaches to constructing EWS models for predicting currency crises. The two main approaches are:

1) the indicators approach, developed by Kaminsky et al (1998), and Kaminsky (1999), and
2) limited dependent variable probit–logit models, proposed in Berg and Pattillo (1999).

Indicators approach

The "indicators approach", suggested by Kaminsky et al (1998), is borrowed from the literature on forecasting turning points in business cycles. The approach is based on testing different macroeconomic indicators on the past instances of currency crises. The authors start with a review of empirical studies on currency crises in order to define "candidates" for early warning indicators. Then they look how often a deviation of the indicator from its normal value was followed by a currency crisis. A crucial point of the analysis is defining the threshold beyond which the value of the indicator can be considered abnormal. The technique for the threshold calculation is explained in detail in the later work by Kaminsky (1999); its essence is to minimize Type I and Type II errors. Then the authors look how often a particular indicator provided the right signal (i.e. its value was beyond the threshold before the crisis) and how often it provided the wrong signal (i.e. it was beyond threshold, but a crisis did not happen). Then they calculate the noise ratio, which is a proportion of false signal to right signals. Based on this ratio, they choose indicators that performed the best and suggest them as early warning indicators of currency crises. In particular, they find that output, exports, deviations of real exchange rate from trend, equity prices and the ratio of broad money to gross international reserves are good indicators of approaching currency crises.

One could try to use such an approach for predicting fiscal distress. The challenge would be then to define what fiscal distress is on the macro level and also to select "candidate" leading indicators (it is a challenge because the literature on fiscal distress is not as developed as literature on currency crises). Otherwise, the approach is quite straightforward, as it does not involve use of any models or complicated techniques.

Another good summary on early warning indicators of debt crises is also provided in the IMF (2000). The authors run simple regressions of different indicators against the crisis index calculated for the past instances of debt crises in various countries.

Probit–logit models

Another approach that is used for predicting crises uses probit or logit models. It is used not only for prediction of currency crises, but also of sovereign debt crises. A review of such studies can be found in Manasse et al (2003). The essence of these works is in testing conventional indicators of solvency with regard to the past instances of crises with help of

probit/logit regressions. The study by Manasse et al (2003) is an example of application of a logit model. The authors start with selection of "candidate" indicators, which they do based on common sense, results of other studies and also graphical analysis (an abnormal deviation of an indicator before the crisis makes it a candidate for an early warning system). Then the authors run the logit model on the past instances of debt crises. The explanatory variables with significant coefficients are selected as good predictors of sovereign debt crises. Manasse et al (2003) found that external debt ratios measuring solvency and debt sustainability (in particular, the ratio of short-term debt to international reserves), measures of illiquidity or refinancing risk, measures of external imbalance and debt-servicing pressures, and some other macrovariables provide a good measure of the probability of entering into a debt crisis. These findings are in line with those of other studies (other studies name the following indicators as good early warning indicators of sovereign debt crises: measures of solvency (debt-to-GDP ratio), measures of liquidity (short-term debt to reserves, exports and debt service to reserves or exports), as well as such macroeconomic variables such as real growth, inflation, exchange rate overvaluation, and the fiscal balance). In one of the models[5] the authors get very good results by using volatility of major macro indicators as explanatory variables (terms of trade volatility, fiscal policy volatility, monetary policy volatility, and exchange rate policy volatility).

We could possibly employ a methodology similar to those described above in order to derive indicators of fiscal vulnerability, but substituting the instances of debt crises by instances of high fiscal deficit or other indicators of fiscal distress. Also, the results of the above studies could be used to introduce a range of indicators for predicting problems with debt servicing and repayment. It is also a good idea to use volatility of some economic variables as an indicator of fiscal risk.

1.3.4 Value at Risk

Barnhill and Kopits (2003) propose to use VAR (Value at Risk) model for estimating the effect of risks on fiscal performance. VAR is normally used in simulations of down-side risks in the financial portfolios. The authors suggest how it can be applied in public finances. The distinctive feature of this method is that it uses net worth approach to government finances. The analysis starts with estimation of the present value of major components of the government balance sheet. The core element of the analysis is a variance-covariance matrix of different risk factors (the authors include interest rates, foreign exchange rates, market equity returns, oil prices, output growth as main risk factors). The calculated net worth is adjusted for the value of VAR to get an adjusted (for risk) net worth. The advantage of this approach is that it allows accounting for interaction of different risk factors. The disadvantages, however, make its use for our purposes questionable. First of all, this method is quite demanding technically, in particular, calculation of variances and covariances of different risk factors is quite a challenging task. Second, it assesses only direct effects of risks on the government finances, but does not take into account economy-wide effects. Finally, as the authors of IMF (2000, Annex IV) note, VAR assumes random walk of the variables (in the financial models these are prices of assets), which can hardly be assumed about the majority of macro variables.

1.3.5 Contingent liabilities

Accounting for contingent liabilities and their possible effect on government finances has been the most frequently applied method to measure risks to fiscal stability, both in theory and in practice.

Schick (1999), distinguishes four basic approaches to budgeting for contingent liabilities:

1) to present background information on contingent liabilities and other financial risks in the budget, but to make budget decisions only for direct expenditures and for payments pursuant to existing commitments.

[5] Catão and Sutton (2002)

2) to devise a separate budget for contingent liabilities and risks;

3) to integrate direct and contingent liabilities on a cash basis (the Netherland and Hungary – see the section on country experiences);

4) to integrate direct and contingent liabilities on a cost basis.

There is a debate in the literature on whether to put contingent liabilities on the government balance sheet. Schick (1999) argues that due to lack of precision in their measurement, it is better to list them in the notes to the government financial statements, but not in the statements themselves.

1.3.6 Cyclically-adjusted balance

In order to capture the effect of the economic cycles on the government fiscal stance, the literature suggests using a cyclically-adjusted balance (CAB). CAB is obtained by removing the cyclical component (captured by the output gap) from the observed balance. CAB shows the part of the fiscal balance that emerges due to discretionary measures of the fiscal policy, as opposed to the influences of the economic cycle. CAB is used by many government and international organizations in their fiscal assessment.

Here we briefly describe the methodology used by the UK Treasury, which goes along the lines of commonly used approach to CAB calculation.[6] To obtain CAB, spending and revenues expressed as ratios of GDP over the past 30 years are regressed against contemporaneous and lagged estimates of the output gap. Revenues and expenditures are regressed separately. Total revenues and different components of revenues (income taxes, corporate taxes, VAT and excise duties) are regressed against the output gap and trend GDP. The data is adjusted in order to separate the effect of factors other than cyclical component, such as discretionary tax measures. As a result, cyclically-adjusted receipts increase slightly as a share of GDP when output is above trend. Then the elasticity of the ratio of expenditures to GDP with relation to output gap is determined (it is assumed to be equal the ratio of expenditures to GDP). Finally, cyclically-adjusted net borrowing (an indicator of the fiscal stance) is calculated as net borrowing adjusted for current output gap and the output gap of the previous year with coefficients estimated in the course of the exercise.

It is definitely advisable to use CAB for fiscal assessment in Ukraine in order to have a better understanding of the government fiscal stance. Yet, it is not clear how useful it is going to be for assessment of risks to fiscal stability. One possible route to follow would be to make projections of CAB based on its past levels and the projections of potential output and the output gap. In such a way, the potential impact of the business cycles on the fiscal balance could be estimated.

1.3.7 Disaggregated framework for fiscal policy analysis

Similarly to CAB approach Kremer et al. (2006) proposed to disaggregate the impact of factors on the budget performance. Separate analysis of each factor improves quality of fiscal policy assessment since it gives clear answer what was the source of the observed changes. In terms of the fiscal stability assessment the desegregation framework could be used as a part of notification system. Understanding of the acting factors gives insight on the current tendency at fiscal area.

The essence of the framework suggests estimating cyclical and structural components of the deficit using a two-step procedure of detrending the GDP series and applying relevant elasticities of the fiscal variables to the output trend gap series.

The main interest of the analysis is paid to structural aggregates. Structural components (revenues, expenditures and deficit) are the budget categories independent of GDP fluctuation (reflecting only long-run trend). In contrast the cyclical components consider the gap between actual GDP and trend GDP.

The structural component in turn is decomposed into dynamic internal effects and policy effects. Under dynamic inertial effects the authors mean the changes in structural

[6] Source: Woods (2006), see also UK (2003) Annex A for details.

components which will take place without changes in fiscal policy. The dynamic inertial effects include fiscal drag and differential growth in trend tax base.

Fiscal drag usually refers to increase in average tax rates as a consequence of increase in nominal income over time (given progressive income tax scheme). The component named 'differentiation growth in trend tax base' considers deviations in the growth of trend tax base from the trend GDP.

All other factors are piled at residual factor. Basically researchers in perspective can separate additional structural components; however, Kramer et al (2006) attribute to residual such factors as improved tax administration, lagged effect of tax revenues, structural changes in the tax base, etc.

1.3.8 Assessing the capability of the fiscal system to cope with shocks

There is a group of methodologies on fiscal vulnerability assessment that focus on the assessment of the capability of the fiscal system to cope with shocks. Such an assessment also enters the framework suggested by Hemming and Petri (2000) as a part of general fiscal vulnerability assessment. We will not dwell on the details of such an approach, as it is not the focus of our study; but it is necessary to give at least a brief note of it, as it is a part of a broader fiscal vulnerability assessment.

The main indicators of government's vulnerability are the size of the fiscal deficit and debt: the higher they are, the more difficult it will be for the government to cope with shocks.[7] Other indicators relate to the flexibility of the revenue and expenditure arrangement. For example, on the revenue side, low tax rates allow the government mode flexibility for their raising in case of distress. On the expenditure side, the major indicator is the share of non-discretionary expenditures: the higher they are, the less flexibility the government has.

An example of a methodology that assesses fiscal vulnerability n this way is Stanfard&Poor's uses Fiscal Flexibility Index. A brief explanation of the methodology can be found in S&P (2007). The index consists of two parts – a revenue flexibility index and an expenditure flexibility index. The index measures how much revenue and expenditure flexibility the government has to respond to adverse external conditions. S&P considers that low tax rates and narrow tax base are the two main determinants of revenue flexibility. On the expenditure side, the flexibility is higher where large proportion of spending categories can be compressed with discretion at short notice (investment spending, for example).

This methodology does not allow assessing potential impacts of shocks, but rather helps to predict how well the government is going to cope with such shocks. As our task to assess the impact of possible shocks, we are not going to adopt this methodology, unless there is an interest on the part of the client (Ministry of Finance) to include some assessment of stress resistance into our assessment.

1.3.9 Intergenerational fairness indicators

The criteria of fairness, declared at the Code of Fiscal Stability, especially concentrates on intergenerational fairness i.e. it should prevent future generations to pay off debts (or social liabilities) built up by earlier generations. One of the approaches for evaluation of the generational fairness was proposed by Auerbach et al (1992). They evaluated net tax payments (revenues minus transfers) faced by newborns in different years. If the share of the present value net taxes (versus lifetime earnings) is equal through all assessed generations then the fiscal stance is considered generationally fair. The indication on fair (or unfair) inter-generational balance should stipulate for revision of current (future) taxes or liabilities.

Researchers also propose many other approaches to evaluation of generational accounts. For instance, Hills (2004) attempts to identify "welfare generations" in other words he adds to the traditional analysis other factors like quality of education, healthcare and social security system. Another approach considers returns on public investments, it views generational accounts as a "portfolio" of assets i.e. it estimates returns on education, technological

[7] See discussion in Giammarioli et al (2006: 664)

advancements etc. Finally, Musgrave (1988) stated that future richer generations could bear a higher tax burden; moreover, he considered that generational accounts are unable to evaluate improvement physical and human capital and that is why it is impossible incorporate them for estimation of generational fairness.

With respect to the current study the intergenerational fairness indicators could be an effective instrument for identification of inefficient long-run fiscal policy of the government. Specifically for Ukraine the topic is very hot since politicians put on the first place social (current) fairness while do not consider hazard of future periods. The indicator also could be included to the notification system since it signals on dangerous tendencies.

1.4 Institutional framework of fiscal stability

The [country] experience considers fiscal stability framework as a set of rules and principles, which should be adhered by Finance Ministry and Government in long-run for achieving safe fiscal policy. It is a usual practice to define some criteria of sustainable/stable/solvent policy in advance. The criteria or rules include thresholds for macroindicators, financial or fiscal requirements etc. In contrast to the leading indicators or notification system, the fiscal policy framework does not aim to know the moment when the threshold was (or will be) broken. In practice the framework intends to warn that a broken threshold or incompliance with a requirement will lead to difficulties in fiscal policy.

Apart from giving signals on approaching problems at fiscal sector, the enforcement mechanisms are much more important for practical needs. In reality every country has its specific, more or less advanced framework for budgetary surveillance and mechanism of fiscal rules enforcement. In literature particular attention is paid to the fiscal stability frameworks applied at the European Union and the UK. The EU and the UK achievements in this field are among the most advanced suggesting valuable experience of surveillance and enforcement mechanisms.

Stability and Convergence Program (European Union)

The EU budget monitoring and regulation procedures are complex in implementation; however, very simple in their basic idea. The Commission requests the Member States to keep moderate deficit (3% of GDP), debt (60% of GDP) and ensure strong budgetary position, which will allow resisting economic shocks (with no more than 3% deficit). Important, while the vast majority of member states have their own framework, national authorities concentrate on the annual budget cycle. In contrast, the EU budgetary policy imposes medium-term fiscal planning for local governments thus improving to overall fiscal stability at the Union.

The enforcement of the simple rules is underpinned with a set of instructions and complex procedures. The basic regulations are suggested at (i) the Excessive Deficit Procedure; (ii) the Stability and Growth Pact; (iii) the Broad Guidelines of the Economic Policies. As regards to institutional interaction, the EC monitors and evaluates fiscal performance of the Member States while the decisions, recommendations and sanctions are on the side of Ecofin (Council of Finance or Economic ministers).

The key instrument of the EU budgetary surveillance and fiscal policy framework is the stability and convergence program. The Member States regularly submit the program (in package with fiscal reporting) to the Commission. The program should contain comprehensive analysis of the medium-term fiscal policy objectives (balance, debt etc.). Also the document should explain the main economic assumptions underlying the fiscal policy as well as an analysis of how changes in the economic assumption could affect the fiscal aggregates.

The official status of strategic planning activities creates a solid framework for a stable country development in the fiscal area. Although the requirements (indicators) are not sophisticated they clearly restrain national governments from dubious or even risky decisions. Moreover, possibility that Ecofin could apply sanctions stimulate for reasonable and prudent medium-term fiscal planning.

The Code of Fiscal Stability (United Kingdom)

The fiscal policy framework at the UK is designed by the Code of Fiscal Stability, which was approved as a statutory document in 1998 by the UK parliament. Later the framework was adopted by New Zealand and Australia. The Code was developed in compliance with the EU rules; however, the UK framework differs from the European.

The Code of Fiscal Stability requires the government to comply with principles of transparency, stability, responsibility, fairness and efficiency. Although the principles are very general they already suggest framework for the fiscal authorities' behavior. Legislatively approved they create grounds for development of detailed rules and requirements, which should guide the Finance Ministry to pursue transparent, stable, responsible, fair and efficient fiscal policy. It is important that the responsibility principle includes fiscal prudence, which is often violated during elections. In addition, governments often sacrifice fairness principle, which includes not only equal distribution of incomes but also intergenerational fairness.

The Code pays particular attention to the planning activities. The document requests publication of the next year plan (Pre-Budget Report), short-term plans (Financial Statement and Budget Report) and long term goals (Economic and Fiscal Strategy Report). Moreover, the projections of economic indicators used for the planning should be revealed in details. And the assumptions underpinning the projections should be audited in case of changes.

The comprehensive planning mechanism and almost perfect transparency of the projection and planning process [strongly] reduce chances for unpredictable fiscal outcome i.e. decrease the level of fiscal risks. In addition the economic and fiscal risks specifically are requested to be analyzed and assessed separately. HM Treasury is obliged to estimate possible contingent liabilities, analyze past forecast errors for aggregates and quantify (were possible) consequences of the expected government decisions.[8]

A separate reporting is expected on debt management. An absolute transparency and efficiency is requested in debt policy. The declared primary objective is minimizing costs related to borrowings and debt servicing. Given the statutory status of the requests, the government could not abuse the instrument of fiscal policy. The 'golden rule' also tightens debt management: no borrowings to fund current expenditures; loans could be allocated only on investment projects. A separate Debt Management Report should be delivered to public every year. In addition the Code requests reporting on the plans of gilt issuance (including calendar), maturity, structure and other details on current debt and it perspectives.

[8] See more detail on this in the section "Country Experiences"

1.5 Country Experiences

We did not find any evidence of practical use of early warning systems for fiscal risk assessment. Yet, countries use different techniques to evaluate risks to fiscal stability, including calculation of cyclically adjusted deficit, proper accounting of contingent liabilities and some other techniques described below.

United Kingdom[9]

The United Kingdom Treasury, according to the Code on Fiscal Stability[10], is supposed to quantify and disclose all decisions and circumstances that can have a material impact on macroeconomic and fiscal outlook. In particular, The UK Treasury uses several tools for taking into account uncertainty associated with budget planning. The three main tolls, as described in Woods (2006), are:

1) cautious projections: fiscal projections use an economic growth estimate that is ¼ points lower than official growth forecast,
2) stress test: fiscal projection is accompanied by a stress test that shows fiscal outcomes under assumption of the economic growth lower by 1% than in the main projection. This allows to better plan spare capacity in the budget.
3) sensitivity analysis: fiscal projections also include sensitivity analysis on particular variables, such as trend growth, interest rates, equity prices and alternative demographic assumptions.

In addition, the Treasury makes a detailed analysis of fiscal forecast errors in its "End of Year Fiscal Report". For the debt sustainability analysis, the Treasury makes long-term macro projections and then calculates a range of conventional fiscal sustainability indicators, such as intertemporal budget constraint/gap and fiscal gap. An important part of the UK fiscal management and planning is calculation of the Cyclically Adjusted Balance (CAB), described in the previous section.

The example of the UK shows that one can use a combination of different tools and frameworks to assess risks to fiscal stability, by combining, for example, cautious projections, stress testing and sensitivity analysis.

Government balance sheet management – Australia

The approach developed by the Australian Treasury comes quite close to the risk assessment we are looking for. Economists from the Australian Treasury (Yeung et al., 2006) developed a framework for optimal government balance sheet management that would mitigate the risk to government finances from macroeconomic shocks that affect the budget. The essence of their proposal is to define the types of assets in which the government can invest that would mitigate the effect of risks. This approach does not assess the effect of risks per se, and so is not of direct relevance to our question; yet, it is interesting as a next step after risk assessment, i.e. risk mitigation.

Contingent liabilities

The most widespread practice of accounting for fiscal risks is related to assessment of contingent liabilities. Schick (1999) describes approaches adopted by different countries. Below are examples of New Zealand and the Netherlands. New Zealand is a pioneer in accounting for the risks involved in contingent liabilities. To account for these liabilities, they adopted an accrual method in the fiscal accounting and budgeting. All government entities apply commercial accounting principles and publish audited financial statements. The

[9] A good summary of the UK fiscal practices can be found in Woods (2006), on which this sub-section is based.
[10] UK (1998).

statements reflect both quantifiable and non-quantifiable contingent liabilities. The Netherlands include contingent liabilities directly into the budget by making provisions equal to the estimated payouts. Thus, the provisions for contingent liabilities reduce the amount available for direct budget expenditures.

Early waning systems for local budgets

In the United States, an early warning system was developed and is used for identifying likely fiscal distress (which is defined as large fiscal deficit) in local budgets. Each state has it own system, and the one for Michigan is described in Kleine et al (2002). The 30 early warning indicators are legally incorporated into two public acts and are regularly monitored. The system monitors such things as late submission of budget reports and other technical violations. Overall, the system focuses more on the mechanics of the local finance, and not enough on the risk warning. In their work, Kleine et al (2002) suggest how this system can be improved. They propose nine indicators an early warning of fiscal distress by applying it to historical data for a sample of Michigan local governments.

Interesting for our study could be a system of criteria for indicators: at the outset, the authors define the criteria to which the proposed indicators should adhere. These include: the theoretical validity, the power of prediction, availability of data etc. In our study, we could also define a set of criteria to which indicators should adhere – this will make them uniform and make the whole framework more coherent.

Below are a couple of indicators suggested by Kleine et al (2002):

- Population Growth: low population growth is a sign of the weakening of the local economy; the latter is likely to lead to fall in government revenues.
- Real Taxable Value Growth (Or the growth of tax base): for local budgets, the main source of revenue is property tax. Reduction in the real (adjusted for inflation) value of property is going to lead to reduction in government revenue.

The authors calculate the historical data for these indicators for each municipality and see how it correlates with past instances of fiscal distress.

The authors stress that any single indicator is not enough for defining the approach of the fiscal distress, and suggest making assessment based on several indicators simultaneously using a 10-point scale. For each indicator, a local budget receives either 0 or 1 depending on whether the indicator passes a threshold value; then all marks are summed. The sum of marks on all risk factors serves as an indicator of possible fiscal distress. St the end, the authors apply their system to the past data and find that it is a reasonably good predictor of fiscal distress.

The approach, described above, could be applied to design a simple early warning system for the Ukrainian public finance. Of course, indicators will be different, but the idea of scaling risks according to their passing the threshold level and then and summing the scores looks interesting.

1.6 Conclusions of theoretical part

Based on the review of the theoretical studies and country experiences, we would like to make the following conclusions.

The methodology for the comprehensive assessment of fiscal vulnerability has not been developed yet. There are, however, studies on the subject that suggest how this framework could look like (for example, Hemming and Petri, 2000). Also, there exist methodologies for vulnerability assessment in other sectors, in particular, financial and external sectors. On top of this, there are useful country experiences of fiscal risk assessment.

Based on the review of these approaches, we can suggest that the comprehensive system of fiscal stability assessment in Ukraine can consist of the following components:

- assessment of the initial fiscal position, including contingent liabilities and cyclically-adjusted balance;
- early warning system;
- stress testing;
- assessment of the ability of the fiscal system to cope with shocks;
- disaggregated framework for fiscal policy analysis
- intergenerational fairness indicators
- fiscal sustainability assessment (focusing on long-term effects).

The proposed system should be coupled with the proper budget surveillance. Also, it is worthwhile to introduce the practice of the UK “End of Year Fiscal Report” that includes a detailed analysis of fiscal forecast errors.

The focus of our work, as we understand based on the communication with the Ministry of Finance, is to develop an early warning system. Therefore, in our empirical work in Part 2 we concentrate on the development of a EWS for fiscal risks.

Apart from developing the EWS, we would like to give some recommendations on other components of the fiscal vulnerability assessment. In particular, we suggest that the Ministry of Finance does stress testing while preparing the budget forecast. Here, one can use the experience of the United Kingdom, as well as approaches applied in the financial sector.

In its “Manual on fiscal transparency” IMF suggests that fiscal forecasts should be subjected to stress tests in order to get a better idea of effects of possible shocks. The IMF, however, does not give any detailed prescriptions of how stress testing should be done. At the same time, there is an analogue used for assessment of financial stability, described in IMF and World Bank (2005). The stress testing has two sages: first, is running a macro model based on different assumptions; and second, mapping the results of modeling into financial sector balance sheet (for which a separate model can be used relating macro variables to the items of the balance sheet). A similar approach is widely used in the private financial sector for assessment of impact of risks on the net worth of financial institutions. Although the example of stress testing in the financial sector can not be directly transferred for application in the fiscal sector, it can still be used as a reference for the development of methodology of stress testing in the fiscal sector.

In fact, stress testing in the fiscal domain is done by some countries. In particular, the United Kingdom Treasury does stress tests as a part of its budget planning. The conduct of the stress test requires the use of a macroeconomic model. Possible shocks enter the model as assumptions, and based on this assumptions simulations are conducted. Then, based on the results of the simulations, alternative fiscal forecasts are made. The UK treasury also compliments stress testing with sensitivity analysis that shows how budget performance is sensitive to changes in assumptions.

In addition to stress-testing the fiscal stability assessment framework would be strengthened if we use disaggregation and intergenerational fairness indicators. Decomposition of the changes in fiscal sector will give more information on source of the impact and the contribution of the sources to budget aggregates changes. Although the decomposition methodology suggested by Kremer et al. (2006) is not ideal and does not advise on

constructing of comprehensive picture it gives valuable experience on how contribution of some factors could be separated and analyzed as an independent risk.

Important role could be attributed to intergeneration fairness indicators. The Ministry of Finance could use indicators as a part of the notification system. The approach requires more sophisticated analysis; however, the index tells if the current policy is fair enough with respect to future generations. Importantly, intergenerational fairness is the issue that particularly lacks attention in Ukraine. We consider it indispensable part of fiscal stability assessment but it should go in conjunction with institutional enforcement.

For efficient functioning of fiscal stability framework its enforcement is essential. If the Ukrainian authorities are not obliged to react to the signals, the suggested framework could remain just of theoretical and scientific interest. Legislatively approved indicators will become a practical instrument of risk management in fiscal sector. Experience of EU and UK could be considered for effective implementation of the assessment mechanisms in Ukraine.

Part 2: Empirical part

The section was a part of interim report and contains many important details and findings; however, at first reading of the report it could be omitted.

2.1. Introduction to empirical part

As we discussed in literature review (Part 1), the comprehensive system of fiscal vulnerability assessment in Ukraine should include several components (see Conclusions of theoretical part).

The first component, assessment of the initial fiscal position, allows identifying the current problems embedded in the budget, including the assessment of riskiness of existing contingent liabilities. Also, such a system should include the monitoring of budget performance and the trends of key fiscal indicators like the debt to GDP ratio, deficit to GDP ratio, etc.

The next part of the framework, early warning indicators, allows conducting monitoring of macro indicators to identify forthcoming shocks that could affect the fiscal stability in the short and medium run. It is a complimentary system (prerequisite) for stress testing and assessment of the ability of the fiscal system to cope with shocks, as it points on these shocks.

We suggest that early warning system for macro shocks is accompanied with monitoring of fiscal policy changes. It is obvious that these changes depend on the policy decisions taken by the government and the parliament, and thus cannot be considered as pure shocks. Though, their impact on fiscal stability is tremendous. Thus, they are to be timely identified and incorporated in the further analysis of stress testing and assessment of the ability of the fiscal system to cope with shocks.

Particular attention should be paid to stress testing and assessment of the ability of the fiscal system to cope with shocks. The instruments allow quantifying the impact and measure the bounds for resilience. There are several methods to estimate the exact impact of any shock. First, the computable general equilibrium (CGE) model could be used. It allows comprehensive assessment of the transmission of shocks on the economy, including sectoral impacts. The major drawback of this model is its reliance on several very specific behavioral assumptions that may not fully reflect the actual economic situation in the country. It is usually used to assess the direction of the impact of the shock, rather than for the budget forecast and corrections within the budgeting year.

The second option is the large econometric model that is usually more flexible than the CGE model in terms of incorporating the ongoing shocks, but still may produce misleading results as it relies on the past experience. Any structural shifts in the country (including the shifts of activity between shadow and official economies, changes in administrative pressures, etc.) could preclude the precise estimates of the macro and fiscal policy shocks on the economy.

The third option is to rely on partial equilibrium estimates of each budget item impact, including the econometric and statistical methods, as well as expert estimates. This could produce more reliable assessment, but it could miss the reflection of economic interlinks, and thus the comprehensive representation of the shock effects.

To ensure the adequate understanding of the shocks impact, we would recommend developing of the assessment system that includes all three components.

In addition to the above mentioned components of the stability assessment framework a list of other important sophisticated approaches could be applied for the needs of the current work. So far we identified such useful instruments of analysis as decomposition of the fiscal performance changes on the impact factors. Also we consider indicators of intergenerational fairness as good index of stable long-run fiscal policy. At the later stages of research the list of instruments will be expanded to give comprehensive picture on available tools that could be potentially included to the fiscal stability assessment framework.

The objective of the project empirical part as it was stipulated during the meeting with the representatives of the Ministry of Finance of Ukraine is to develop the first component of the fiscal stability assessment, that is to develop of the system of early warning indicators

(notification system). The goal was to provide the comprehensive monitoring framework that allows quick and timely response of the Ministry of Finance to the shocks. To fulfill the goal, the following steps are required:

Step 1. To compile the lists of major risks in macro and fiscal policy spheres that could affects the State Budget of Ukraine.

Step 2. To identify the key State Budget items that could be affected by these risks, including the detection of primary transmission mechanisms of these risks into the budget items. Wherever possible, empirical studies on relation between shocks and fiscal variables are used, such as the paper by Barnhill and Kopits (2003)

Step 3. To detect what indicators could be used to monitor these risks, including the formulas to calculate them, and the sources of these indicators.

Step 4. To develop the system of thresholds[11] that allows identifying the situation in which the probability of shock is increasing (that is, the Ministry of Finance is required to re-estimate the budget parameters to assess the scope of risk and to take preventive steps if necessary). The development of the system of thresholds includes testing of the indicators on the past fiscal performance[12].

The rest of the Part 2 of the report is devoted to the description of the early warning system developed for the State Budget of Ukraine. Part 2.2 provides the overview of the early warming system, including the classification of shocks, respective indicators, their descriptions and identification of links between indicators and budget items. Also, the issues concerning the sources of indicators and how they are calculated are discussed. Part 2.3 provides the estimates of thresholds, thus completing the early warning system and making it operational. The estimation of thresholds is conducted based mostly on the Ukrainian statistics.

2.2. Early warning system for macro shocks on fiscal stability

We propose that the early warning system to identify the forthcoming shocks for fiscal stability has to contain a list of macro shocks. As defined, the macro shocks cover the external shocks to the fiscal system.

As it was already mentioned in Part 1, the shocks could be categorized in accordance to the budget items affected:

A. Shocks to revenue side of the budget

B. Shocks to expenditure side of the budget

C. Shocks to deficit financing

It is clear that one and the same shock may affect as all parts of the budget, so just one budget item. In the proposed system of monitoring, we identified the major links between the shocks and the budget items affected (see below). Though, further work / elaboration of the system would be necessary to capture all minor/indirect links. To ensure the adequate capturing of all links, the CGE model of Ukraine tailored for the fiscal sphere analysis could be developed.

In addition, the shocks could be categorized by the time horizon:

A. Short-term fiscal shocks (up to one year)

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11 See, e.g., Kaminsky (1999:13)

12 There are several possible approaches, and the best suitable for Ukraine remains to be identified. The test could use either probit/logit models or indicators approach, suggested in the literature. Manasse et al (2003) can be used as an example of the logit model that can be employed. Based on the results of the modeling, the indicators with the most significant coefficients are selected as early-warning indicators. Alternatively, we could use indicators approach proposed by Kaminsky et al (1998). Or even simpler approach, such as used in Kleine et al (2002).

B. Medium term fiscal shocks (risks to fiscal sustainability, 1-5 years)

C. Long term fiscal shocks (above 5 year horizon)

In this project, we would focus on short and medium term fiscal shocks that could affect the fiscal stability of the country within budget year (current budget planning horizon), and within the medium run (expected budget planning horizon if the medium-term budget planning framework would be fully implemented in Ukraine).

The long-term fiscal shocks that remain beyond the scope of the current empirical research include such risks as demographic changes, climate change, etc. These risks are definitely very important for Ukraine's fiscal sustainability, yet sustainability is not the subject of our study. Moreover, there is some work already done on the subject, such as the research of the demographic change impacts on the budget in Ukraine, conducted by the ICPS in 2007. Thus, it was decided (and actually recommended by the Ministry of Finance) not to do the double work.

Below we discuss the shocks and indicators that are to be included into the early warning system, so called "macro shocks". In the next section we also suggest a second, supplementary set of indicators that could be used for impact assessment of fiscal policy changes.

Macro shocks

We identify the following macro shocks as key for Ukraine's fiscal stability:

1. Private domestic consumption shock
2. Enterprise profits shock
3. Shock on foreign trade flows:
    - Due to change in prices for key Ukraine export and import commodities on world market, including energy and other resource prices
    - Due to other reasons than price change (e.g., slowdown of economic development, higher competitive pressure, etc.)
4. Sector shocks:
    - Downfall in agricultural harvest
    - Infrastructure fall-downs
    - Other *(to be studied further)*
5. Domestic prices (goods and services) shock, including the changes in consumer prices, producer prices, etc.
6. Interest rate shock, including the impact of world financial crises
7. Exchange rate shock
8. Shock of political uncertainty (for instance, due to re-elections)
9. Structural reforms (other than fiscal system reform)

Next, we identified the linkages between exact budget items – revenues, and expenditures – and the specified macro shocks, as well as developed the list of measurable indicators that allows monitoring the forthcoming shocks (Table 2.1).

Table 2.1. The list of macro shocks, associated indicators and budget items

#	Shock	Indicators	Major revenue base affected	Major budget items affected (Revenue part)	Major expenditure base affected	Major budget items affected (Expenditure part)
1	Private domestic consumption deviation	Household consumption, wages, household incomes, credits to households, GDP	Domestic consumption Enterprises profits	VAT on domestic consumption EPT, Excises		
2	Enterprise profits deviation	Financial results of enterprises, prices for steel, natural gas and oil, GDP	Enterprises profits	EPT	Transfers & subsidies to separate sectors	Expenditures on Transfers & subsidies to separate sectors
Foreign trade flows:						
3	Change in prices for key Ukraine export and import commodities on world market, including energy and other resource prices	Prices for steel, natural gas and oil, other prices	Export value, import value	EPT, VAT on import, excises, duties		
4	Other reasons than price change (e.g., slowdown of economic development, higher competitive pressure, etc.)	GDP of countries-partners				
Sector shocks:						

#	Shock	Indicators	Major revenue base affected	Major budget items affected (Revenue part)	Major expenditure base affected	Major budget items affected (Expenditure part)
5	Downfall in agricultural harvest	Weather condition (deviation from satisfactory level of average temperature, moisture content in plough layer of soil, total precipitations on the territory of Ukraine, vegetation process) Corn crop, Area harvested, Yield Output in livestock sector Price for crop & animal products	Enterprises profits	EPT	Agriculture enterprises losses	Transfers for losses compensation for agriculture increase
6	Infrastructure fall-downs	Obsolete equipment, state of infrastructure etc.			Transfers & subsidies to separate sectors (enterprises)	Expenditures on Transfers & subsidies to separate sectors (enterprises)
7	Other *(to be studied further)*					
8	Domestic prices (goods and services) shock, including the changes in consumer prices, producer prices, etc	CPI, PPI	Domestic consumption, Enterprises profits	EPT, VAT on domestic consumption	Minimum wages Minimum of subsistence	Wages for public sector Social benefits Transfers to Pension Fund
9	Interest rate shock, including the impact of world financial crises	Interest rate (LIBOR), Interest rate (Eurobonds yield), Interest rate (State bonds yield)	Enterprises profits	EPT	Interest expences for eurobonds growth Interest expences for state bonds growth	Servise expences for external debt Servise expences for internal debt

#	Shock	Indicators	Major revenue base affected	Major budget items affected (Revenue part)	Major expenditure base affected	Major budget items affected (Expenditure part)
10	Exchange rate shock	Exchange rate (UAH/USD; UAH/EUR)	Enterprises profits, Import value	EPT, VAT on import, excises, duties	Value of redemption & interest expenses in UAH	State debt redemption & interest expenses payments in UAH
11	Shock of political uncertainty (for instance, due to re-elections)	Date of elections (re-elections), GDP			Minimum wages	Wages for public sector
					Minimum of subsistence	Social benefits Transfers to Pension Fund
12	Structural reforms				Government investment	Capital expenditures

Finally, we identified the sources of the indicators (Table 2.2). As shown, the most of indicators could be obtained from the Ukrainian statistical sources like the State Committee of Statistics of Ukraine, the NBU, etc.

Table 2.2. Sources of indicators associated with macro shock

	Indicator	*Source*
1	Household consumption	State Committee of Statistics of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
2	Wages	State Committee of Statistics of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
3	Household incomes	State Committee of Statistics of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
4	Credits to households	National Bank of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
5	Financial result of general activity before taxation, profits of profitable enterprises, loses of loss-making enterprises	State Committee of Statistics of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
6	Share of loss–making enterprises	State Committee of Statistics of Ukraine
		Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
7	Steel prices	Ministry of Industrial Policy of Ukraine
		International agencies (such as CRU consulting, London metal exchange, etc)
		Forecast: Ministry of Industrial Policy of Ukraine
		International agencies (such as CRU consulting, London metal exchange, etc)
8	Oil and natural gas prices	Ministry of Economy of Ukraine
		National Electricity Regulatory Commission of Ukraine
		Ministry of Fuel and Energy of Ukraine Leading international agencies (http://www.bloomberg.com/energy/, http://www.wtrg.com/prices.htm, http://tonto.eia.doe.gov/dnav/pet/pet_pri_wco_k_w.htm) Forecast: Ministry of Economy of Ukraine, National Electricity Regulatory Commission of Ukraine, Ministry of Fuel and Energy of Ukraine, Leading international agencies
9	Export value	State Committee of Statistics of Ukraine;
		National Bank of Ukraine;
		Forecast: Ministry of Economy, Ministry of Finance, NBU,

	Indicator	*Source*
		independent organizations within Ukraine, international organizations
10	Import value	State Committee of Statistics of Ukraine; National Bank of Ukraine; Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
11	GDP (Ukraine)	State Committee of Statistics of Ukraine Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
12	GDP (other countries)	International Monetary Fund (World Economic Outlook Database, International Financial Statistics); OECD reports; Eurostat; National Statistical Agencies
14	Weather condition	Ministry of Emergencies and Affairs of Population Protection from Consequences of Chornobyl Catastrophe of Ukraine; Ministry of Agrarian Policy of Ukraine
15	Corn crop, area harvested, yield	Actual data: State Committee of Statistics of Ukraine; Forecasts: Ministry of Agrarian Policy of Ukraine; UkrAgroConsult and Ukrainian Agrarian Confederation; Other (Foreign Agricultural Service (Global Agriculture Information Network)
16	Output in livestock	Actual data: State Committee of Statistics of Ukraine; Forecasts: Ministry of Agrarian Policy of Ukraine; UkrAgroConsult and Ukrainian Agrarian Confederation; Other (Foreign Agricultural Service (Global Agriculture Information Network)
17	Price for crop & animal products	Actual data: State Committee of Statistics of Ukraine; Forecasts: The Ministry of Agrarian Policy of Ukraine; UkrAgroConsult and Ukrainian Agrarian Confederation; Other (Foreign Agricultural Service (Global Agriculture Information Network)
18	Obsolete equipment	State Committee of Statistics of Ukraine Estimations of the Ministry of Economy
19	PPI	State Committee of Statistics of Ukraine Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
20	CPI	State Committee of Statistics of Ukraine Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations
21	Interest rate (LIBOR)	British Banker's Association
	Interest rate (Eurobonds yield)	http://www.cbonds.info Stock exchanges of different countries
	Interest rate (State bonds	The Ministry of Finance of Ukraine

	Indicator	*Source*
	yield)	
22	Exchange rate (UAH/USD; UAH/EUR)	The National Bank of Ukraine Forecast: Ministry of Economy, Ministry of Finance, NBU, independent organizations within Ukraine, international organizations

It has to be emphasized that the development of the system of early warning indicators is impossible without tight collaboration between the Ministry of Finance and other state authorities, including the State Committee of Statistics of Ukraine, the National Bank of Ukraine, etc. Also, it is required to conduct a timely monitoring of situation on world markets and forecasts of the world market via international financial organizations and agencies.

2.3. Monitoring of fiscal policy changes

Changes in fiscal policy can act similar to external shocks, especially when they are introduced abruptly. The early warning system can not be applied to such shocks, as they are planned by the government, but what can and should be done is their impact assessment. In this section we describe the major fiscal policy variables that should be monitored and changes in which should trigger a reassessment of the budget.

We identify the following fiscal policy changes that are key for Ukraine's fiscal stability:

1. Tax rates change
2. Changed tax base:
    a. Granting of tax privileges, including to SEZ
    b. Expansion of tax base
3. Tax arrears:
    a. Tax due to the budget
    b. Payments owe by the budget
4. Changes in tax administration
5. Growth of protected expenditure items in the State Budget
6. Shock on state debt due to its maturity, currency structure, floating rates
7. Contingent liabilities growth (the risk of calling of contingent liabilities)
8. Lower than planned receipts from privatization
9. Structural reforms (fiscal sphere)

The linkages between the exact budget items – revenues, and expenditures – and the specified fiscal policy shocks, as well as developed the list of measurable indicators that allows monitoring the forthcoming changes (Table 2.3).

It should be emphasized once again that the fiscal policy shocks are in the sphere of fiscal authorities' competence, and thus could be excluded from the early warning system and monitoring as predetermined. Though, they have high importance for the fiscal stability of the country, and are to be monitored for subsequent inclusion into stress testing and assessment of the ability of the system to cope with the shocks.

Table 2.3. The list of selected fiscal policy changes, associated indicators and budget items

#	Shock	Indicators	Revenue base affected	Budget items affected (Revenue part)	Expenditure base affected	Budget items affected (Expenditure part)
1	Tax rates change	Nominal tax rates on EPT, VAT (all kinds), excises and duties	Tax revenues	EPT VAT on domestic consumption VAT on import Excises, duties		
Changed tax base:						
2	Granting of tax privileges, including to FEZ	Date of renewal of free economic zones; # of free economic zones;	Tax revenues	EPT, VAT		
3	Expansion of tax base	Tax base items for taxes	Tax revenues	EPT, VAT		
Tax arrears:						
4	Tax arrears due to the budget	EPT, VAT, excises, duties arrears	Tax revenues	Taxes (all kinds)		
5	Payments owe by the budget	VAT refund arrears (both overdue and non-overdue); Overdue tax bills value	VAT revenues; revenues from duties	VAT refund payments, EPT collection decrease (in long term)		
6	Changes in tax administration	Introduction of electronic tax reporting system by enterprises; tax arrears	Tax revenues	Taxes (all kinds)		
7	Growth of protected expenditure items in the State Budget	Value of protected expenditures (due to the State budget Law)			Government investments (-)	Capital expenditures (-)

#	Shock	Indicators	Revenue base affected	Budget items affected (Revenue part)	Expenditure base affected	Budget items affected (Expenditure part)
8	Shock on state debt due to its maturity, currency structure	State debt maturity, currency structure			Value of state debt service	State debt service payments
9	Contingent liabilities growth (the risk of calling of contingent liabilities)	Value of contingent liabilities (due to the State budget Law)			Value of contingent liabilities	Payments on contigent liabilities
10	Lower than planned receipts from privatization	Privatization receipts			Government investments	Capital expenditures

The list of sources of indicators associated with fiscal policy changes is rather clear. These are tax laws, decrees of the Cabinet of Ministers, as well as information collected by various fiscal authorities. Here, the efficient collaboration between authorities is crucial for ensuring the proper work of the monitoring system.

Table 2.4. Sources of indicators associated with fiscal policy shock

Indicator	*Source*
Tax rates and tax base of VAT, EPT, excises, duties	Tax laws; Tax Code (forthcoming) Cabinet of Ministers' decrees Instructions of State Tax Administration of Ukraine
Level of tax liabilities	State Tax Administration of Ukraine
Level of VAT refund arrears (both overdue and non-overdue)	State Tax Administration of Ukraine The Accounting Chamber of Ukraine
Amount of overdue tax bills (VAT on import, Import Duties)	State Tax Administration of Ukraine; State Customs Service of Ukraine
Introduction of electronic tax reporting system (electronic submission of VAT declarations by enterprises)	State Tax Administration of Ukraine;
The value of protected expenditures	State budget Laws
State debt maturity	Ministry of Finance of Ukraine
Currency structure	Ministry of Finance of Ukraine
Increase of payments on contingent liabilities via the State budget	State budget Laws
Privatization receipts	State Property Fund of Ukraine

Below we provide the example of brief analysis of the potential impact of fiscal policy change and indicators that could be used for its monitoring:

Tax privileges, including due restoration of Special Economic Zones and Territories of Priority Development

One of important fiscal policy change for the Ukrainian economy is the restoration of tax privileges, e.g. by the reincarnation of special economic zones and territories of priority development. It implies the introduction of the wide range of fiscal instruments to promote economic activity in zones, including tax holidays, statutory corporate tax reduction, investment tax allowances (special /enhances deduction against taxable income) and investment tax credit (special deduction against corporate income tax otherwise payable) [13].

These privileges, although might stimulate the economic development in the region, have direct negative impact on budget revenues. Granting new privileges leads to reduction in tax proceeds and can be accounted as an important risk of fiscal sustainability. Moreover, if the process of

[13] If investment tax credit is not repaid by taxpayer, budget losses, resulted from such privilege are higher than losses from investment tax allowances. It is explained by the fact that investment tax allowances reduce only the taxable base by the amount of investments and investment tax credit reduce the tax obligations.

zones creation is discretionary and non-transparent, granted privileges create numerous schemes of tax evasion and avoidance (for instance, loopholes for illegal VAT reimbursement).

In Ukraine the list of possible tax incentives includes exemptions or reduced rates for EPT, exempting investments from taxation, exemptions from import duty and VAT, land tax exemptions and no contributions to the state directed funds. In addition, in 2007 there was an attempt to introduce new set of special custom tariffs, import duty on equipment and its components, deferral of VAT and import duty on inputs, and investment tax credit on EPT.

Summing up, among the revenues of the State Budget, potentially affected by this fiscal policy change are the following:

- VAT (VAT on import, VAT refund)
- EPT
- Import duties

Additionally, governments' investments for infrastructure can be implemented. It would increase state capital expenditures, first of all, on investments in transportation infrastructure (roads, railways, airports); energy infrastructure (gas and oil pipelines, electricity distribution network); telecommunications; innovative infrastructure (centers for technology transfers), education and research systems. Moreover, budgetary loans provision to special zone's administration can be introduced.

The initial indicator of the given risk is the planned date of restoration or enlargement of Special Economic Zones and Territories of Priority Development. There are several possible additional indicators that could be used for the risk estimation (Table 2.5).

Table 2.5 Additional indicators for estimating the fiscal impact of SEZs and TPDs

№	*Indicators*	*Calculation*	*Data source*
1.	Potential losses (as a share of budget proceeds)	((PTR — FP) / TSBR) ∗ 100%	The Ministry of Finance, Derzhkomstat, STA, SCS
2.	Potential reduction in real level of tax revenues (% of GDP)	((PTR — FP) / GDP) ∗ 100%	The Ministry of Finance, Derzhkomstat, STA, , SCS, the Ministry of Economy
3.	Share of privileges in GDP	(FP / GDP) ∗ 100%	The Ministry of Finance, the Ministry of Economy
4.	Investment return on received privileges	(TI / FP) ∗ 100%	The Ministry of Finance, the Ministry of Economy
5.	Coefficient of output efficiency	(TO / FP) ∗ 100%	The Ministry of Finance, the Ministry of Economy

* where PTR-present tax receipts; FP- future privileges; TSBR- total State Budget revenues; TI – total investments; TO – total output.

2.4. How to use the early warning system: estimation of thresholds

As soon as the database of the early warning indicators is compiled, it is required to identify indicator thresholds allowing differentiating between the 'normal' fluctuations and the situation of increased probability of shock realization.

What is the shock in our case? As we study the fiscal stability, the shock is the violation of projected budget parameters that could lead to under- or over-execution of budget item and thus may require the budget revision. Thus, the natural starting point of any threshold search is the macro and fiscal policy parameters embedded in the budget.

There are the following macro parameters that usually published with the budget:

- GDP (nominal and real growth);
- CPI growth rate;
- PPI growth rate;
- Exchange rate;
- Financial result of general activity before taxation;
- Profit of profitable enterprises;
- Loses of loss-making enterprises;
- Wage bill;
- Average wage (nominal and real growth);
- Exports of goods and services (nominal in USD and real growth);
- Imports of goods and services (nominal in USD and real growth).

The initial threshold for macro parameters could be set as a certain deviation of the macro parameters embedded in the budget, and actual (estimated on the basis of up-to-date information) figure of the macro indicator. For instance, the re-estimation of the budget could be required if the actually observed (re-estimated) real GDP growth rate is 2 percentage points above or below than the figure embedded in the budget. The exact levels of thresholds are to be identified by the econometric and statistical means.

Though, such threshold is to be taken with caution. Let's consider the links between the major budget items and the GDP. We compare the execution of government revenues and expenditures vs. planned levels and the actual nominal GDP level vs. forecast level underlying the State budget. Table 2.6 shows how the actual nominal GDP deviated from the official forecast stipulated in the Budget Law, and what was the level of revenues execution.

Table 2.6. The GDP and fiscal revenues: projection vs. actual result (UAH m)

Year	*Nominal GDP forecast underlying the State budget*	*Actual nominal GDP*	*GDP deviation from projected level*	*Nominal fiscal revenues (planned)*	*Nominal fiscal revenues (actual)*	*Execution of fiscal revenues (deviation)*
2002	210000	225810	**7.5%**	48293	45468	**-5.9%**
2003	247000	267344	**8.2%**	56300	54987	**-2.3%**
2004	341900	345113	**0.9%**	70496	70274	**-0.3%**
2005	409500	441452	**7.8%**	108154	105192	**-2.7%**
2006	512500	537667	**4.9%**	132677	133464	**0.6%**

Source: Ministry of Finance, Derzhkomstat, Budget laws

As could be seen, in 2002-2006 the actual nominal GDP was always higher than the projected in the Budget Law. Though, fiscal revenues execution was always lower than the projected level (excluding the year 2006). Moreover, in the year 2004, when the GDP 'overshot' was the lowest, the under-execution of the revenues was also the lowest.

Table 2.7. The GDP and fiscal expenditures: projection vs. actual result (UAH m)

Year	*Nominal GDP forecast underlying the State budget*	*Actual nominal GDP*	*GDP deviation from projected level*	*Nominal fiscal expenditures (planned)*	*Nominal fiscal expenditures (actual)*	*Execution of fiscal expenditures (deviation)*
2002	210000	225810	**7.5%**	53891	44348	**-17.7%**
2003	247000	267344	**8.2%**	58692	56120	**-4.4%**
2004	341900	345113	**0.9%**	81561	79381	**-2.7%**
2005	409500	441452	**7.8%**	119493	112831	**-5.6%**
2006	512500	537667	**4.9%**	145427	137063	**-5.8%**

Source: Ministry of Finance, Derzhkomstat, Budget laws

The same is true for the expenditure part of the budget as well. The systematic underestimation of nominal GDP did not result in the higher nominal execution of expenditures.

This simple exercise shows the deviation of the macro indicator from the threshold doesn't necessarily mean that the deviation of the budget item goes in the same direction. Thus, the system of early warning indicators, to be useful, should study the links between macro shocks and budget items at disaggregated level, as at the level of budget as a whole the results are misleading. However, even in this case the links between macro shocks and budget items could be distorted by the administrative decisions.

For indicators that do not have a direct reference in the Budget forecast (e.g. metal prices), we would suggest to use the concept of standard deviation. For instance, if the indicator volatility violates 1 standard deviation (estimated on historical data), the threshold is considered to be violated.

The use of thresholds is only a first indication of the possible shocks. Further investigation is required to identify how high is the shock probability and how severe is the impact of the shock on the fiscal stability.

2.5 Conclusions and next steps

The literature, we have covered so far, proposes diverse methods for approaching the issue of fiscal stability assessment. Though, it became clear that no unique comprehensive framework have been developed yet. According to our information, the work on development of such a framework is undertaken currently by the IMF, yet its results have not been made public. At the moment, IMF has a general description of a framework for fiscal vulnerability, which we used as a starting point in our work.

The early warning systems for fiscal management are also in the course of development. There are several empirical studies that try to develop early warning indicators for assessment of risks to the fiscal stability, yet there is no ready framework that could be used for regular risks monitoring. We could not also find much evidence of practical application of early warning systems in the fiscal sphere in other countries, with exception of "fiscal distress indicators" used

in local budgets in the US. In sum, at the moment we have only some separate analytical instruments at our disposal, and no solid reference point on the early warning system for fiscal risks assessment.

In addition to the early warning systems, we reviewed a range of other approaches and techniques for fiscal risk management, as well as their practical application. They include: IMF framework for financial stability assessment, estimation of cyclically adjusted balance and of contingent liabilities, UK approach to fiscal stress testing and sensitivity analysis, as well as an assessment of intergenerational fairness indicators.

For empirical part of the research we concentrated on elaboration the early warning indicators system (leading indicators system, notification system) for identification of fiscal risks on the early stages of the tendency. The system should include thresholds that when broken will signal on approaching fiscal problems. So far, at the empirical part we described the risks valid for Ukraine on which we plan to concentrate and provided examples how the threshold and indicators will be estimated.

Part 3: Signaling system for fiscal sector

3.1 Introduction

The development of the early warning system (EWS) was spurred by the persistence currency and banking crises in the emerging markets in the 1980s and 1990s. All these studies can be divided in two main approaches:

3) limited dependent variable probit–logit models

4) the indicators approach

The first approach has been authored by Kaminsky et al (1998) and Kaminsky (1999), while the second one was developed by Berg and Pattillo (1999). These were followed by a range of modifications by other authors.

As a part of its surveillance activities, the IMF uses both approaches: the Developing Countries Studies Division (DCSD) model (a probit model) and a modification of the Kaminsky, Lizondo, and Reinhart (KLR) Crisis Signals model. Other central banks and government agencies have also developed their models: for example, the European Central Bank has a multinominal logit model, described in Bussiere et al (2002)); U.S. Federal Reserve has a probit model, suggested by Kamin, Schindler, and Samuel 2001. A range of investment banks have also developed their models: Goldman Sachs uses GS-watch (Ades, Masih, and Tenengauzer, 1998), Credit Suisse First Boston has Emerging Markets Risk Indicator

(Roy 2001), Deutsche Bank does Alarm Clock (Garber, Lumsdaine, and Longato 2001), and

Moody developed a Macro Risk model (Gray, Merton, and Bodie 2003). The models of the investment banks differ somewhat from those of central banks and the IMF: in their definition of the crisis they stress changes in exchange rates and interest rates (because they are likely to affect the profitability of foreign exchange trading or investment positions); moreover, these models have shorter horizons (1-3 months).

In what follows, we describe the two basic approaches to EWS - probit/logit and indicators approach - with examples of their application in particular studies. Both approaches have the same components:

1. Definition of a crisis
2. Choice of explanatory variables
3. Testing
4. Setting thresholds

The difference lies in the method of testing and in setting the thresholds. The probit-logit approach uses a model for testing, while the indicators approach does not employ any econometrics, but involves a simple calculation of the number of correctly and incorrectly predicted crises. Moreover, the approaches differ on the type of threshold they employ: while the probit/logit models set the threshold in terms of values of the dependent variable, in the indicators approach the threshold is set for each independent variable. The merits and drawbacks of each method, as well as implications for the character of the resulting EWS are discussed later in this chapter.

3.2 Definition of a crisis

In the EWSs on currency crises, researchers normally use exchange market pressure (EMP) variable as a dependent variable. EMP variable is normally a combination (a weighted average) of a change in the exchange rate and change in some other variables, such as the interest rate and foreign exchange reserves. In their EWS for predicting sovereign debt crises, Manasse et al

(2003) define the crisis as being in default by Standard &Poor's definition or receiving a large non-concessional IMF loan (in excess of 100 percent of quota).

The EWS model is set in a binary form, with the dependent variable (Y) denoting an occurrence of a crisis:

Y = 1 (crisis)
= 0 (no crisis)

The crisis is normally defined in terms of deviation of Y from its average value. For example, Bussiere and Fratzscher (2002) consider a deviation equal to two standard deviations from the country average as indicating a crisis. Kaminsky et al (1998) define the crisis as a deviation of the exchange market pressure index from its mean by more than three standard deviations.[14]

3.3 Choice of explanatory variables and data refinement

3.3.1 Methods of variables selection

The two most commonly used methods of selection of the explanatory variables are theory-based selection and event-study analysis. The preliminary choice of variables is based on some economic theory or tested relationships, then variables may be subjected to an event study analysis.

For example, the construction of EWSs for currency crises, the researchers normally depart from the theories of currency crises. So, the traditional theory of currency crises, developed by Krugman, postulates that under fixed exchange rate regime, the excessive credit expansion is going to lead to the loss of international reserves and, subsequently, to a currency crisis. So, based on this theory, domestic credit expansion and the loss of reserves could serve as leading indicators of a crisis. Other authors extended this theory and included other related variables, such as evolution of the real exchange rate, trade and current account balance, domestic interest rates and some others. In the literature on sovereign debt crises there no such a coherent theory as for currency crises, so for development of the EWS for predicting such crises researchers base their selection of explanatory variables on separate studies that test particular relationships between sovereign crises and particular variables, as well as general economic theory.[15]

In order to see whether selected explanatory variables behave abnormally around the time of crises, one can use an event study analysis. It is not obligatory, but could be helpful in the design of the model for the EWS. This analysis is based on the graphical representation of time series of the explanatory variables and comparison of the timing of their significant deviations with the timing of crises. For example, Manasse et al (2003) use such analysis before constructing a model for predicting sovereign debt crises; based on the graphical depiction of movements in such variables around the moment of a crisis, they make some preliminary conclusions about the suitability of particular variables to serve as early warning indicators. The event study analysis can be used as in addition to the theory-based selection, so as a separate tool for choice of possible leading indicators when relevant theories are absent.

3.3.2 Form of variables

In EWS models, independent variables are taken with a lag to reflect the time difference between the change of values of the explanatory variables and the occurrence of the crisis. For currency crises, some authors use two years horizon (Kaminsky, Lizondo and Reinhart (1998) and Berg and Pattillo (1999b)), others use one year horizon (Bussiere and Fratzscher (2002)). The choice

[14] See, for instance, Schnatz (1998) for a thorough discussion on the definition of the crisis.
[15] See, for example, Manasse et al (2003)

of the time horizon is determined by a compromise between two conflicting objectives: to get a warning about a crisis as early as possible and to have a reliable warning. The majority of authors chose the time horizon based on the policy maker's preferences, but one could also do an optimization exercise, as described in Bussiere and Fratzscher (2002).

Catão and Sutton (2002) suggest that in addition to the levels representation of independent variables, one could introduce some volatility variables. In particular, they use standard deviations as a measure of volatility. By using such variables in their logit EWS for sovereign debt crises, Catão and Sutton (2002) get better results than by using variables in levels. The authors find that volatility increases the risk of a sovereign default.

In addition to simple time series of leading indicators, one could also use composite leading indicators (CLI). Such indicators are used, in particular, by OECD (see OECD (1987), OECD (2000a), OECD (2000b), OECD (2006), Arnaud and Hong (2001)). They include different time series in one index, with weights assigned to each time series.

Based on the review of the existing literature, we can conclude that unique solution for the series composition could not be proposed. Some series, like industrial production, stock index or monetary aggregates are common and significant for many countries but in general the series reflect the peculiarity of the economy. The list of most popular series used for CLI includes: industrial production; selected commodity output variables (crude oil, crude steel etc.); selected manufacturing variables (deliveries, stocks, new orders etc.); construction; domestic trade; labour market series; CPI and PPI; money aggregates; interest rates; financial variables; exchange rate; international trade; BoP. Appendix 3 contains the list of series used by the OECD for different countries.

Although for Ukraine and specifically for budget performance many of the listed variables do not have direct impact we can not be sure that they do not catch some other non-numerical tendency which affects the analyzed deviations. For instance, FSTS index (or JP Morgan spread) do not have direct impact on budget revenues or expenditures; however, it could signal about approaching problems (bad harvest, political tension etc.) which will be clearly reflected on budget proceeds.

Important that in addition to the quantitative indices, OECD CLI includes qualitative indicators that come from business tendencies surveys or consumer confidence surveys. Processing of the indicators is a bit more complicated but they clearly reflect expectations of economic agents and have direct impact on future economic performance. Ukraine local institutes conduct similar surveys which could be incorporated to the signaling system for identification of approaching fiscal problems.

3.3.3 Data refining[16]

The literature on the methodology of construction of leading indicators pays particular attention to time series processing. Data processing in most methodologies include detrending, smoothing and normalization.

The goal of detrending is just to remove the mid- and long-term trend for working with the "turning points" (deviation form trend). Several methods for detrending are proposed. The most popular for leading indicators estimate seem to be Phase-Average Trend (PAT). Also could be used Period to Period Changes (PPC) method and well known Hodrick-Prescott Method. The PAT was designed specifically to separate the long-term trends from medium-term cycles. The method is considered to give better predictive power to leading indicators; however, it seems to be more complicated for calculations. PPC method looks simpler and it is based on transforming data to stationary series from applying the period to period changes data. The Hodrick-Prescott

[16] The section is based on the review of OECD (1987), OECD (2000a), OECD (2000b), OECD (2006) and Arnaud and Hong (2001).

Method has advantage of removing "cyclical" component (not only trend) from the series. Also it is perceived as a simple and flexible tool for detrending.

Smoothing (in contrast to detredning) removes some short-term irregular movements, which could give false signals about "turning points". Publications mention Months for Cyclical Dominance (MCD) moving average as a tool for smoothing.

Finally, some authors propose to use normalization (standardization) for minimizing the influence of cyclical amplitude. However, normalization probably could not be appropriate for all series (it is not very popular approach).

3.4 Testing

3.4.1 Limited dependent variable probit/logit models

In the probit and logit models the dependent variable has a binary form:

Y = 1 with probability P
= 0 with probability (1-P)

The aim of the model is to estimate the effect of the indicators X on the probability P of experiencing a crisis Y:

$\Pr(Y = 1) = F(X\beta)$

A negative value of a coefficient would mean that this particular variable decreases the probability of a crisis, while positive sign would mean that the variable makes a country more vulnerable to a crisis.

The logit model uses logistic distribution, so that the relationship takes the form:

$$\Pr(Y = 1) = F(X\beta) = \frac{e^{X\beta}}{1 + e^{X\beta}} \quad (1)$$

As Manasse et al (2003) note, compared to the probit model, the logit typically performs better when the dependent variable is not evenly distributed between the two outcomes (i.e. the probabilities of crisis and non-crisis are different), which is normally the case for crises.

In addition to the pre-selection methods described above (theory-based and event analysis), in case of use of probit/logit models authors also normally run individual regressions for each variable. Then, the variables that performed best in these individual regressions are put into a general model. Based on the model testing, insignificant variables are excluded.

3.4.2 The indicators approach

The use of indicators approach in the EWS for predicting currency and banking crises was suggested in Kaminsky and Reinhart (1996), and then further elaborated in Kaminsky et al (1998), Kaminsky (1999) and Goldstein et al (2000).

As in the probit/logit model, the authors first select the candidate indicators to include. For that, they observe different theoretical and empirical literature on currency and banking crises and also do graphical depiction (event analysis) of the behavior of each indicator around crises. As a

result, as set of the most likely leading indicators is selected. The final choice of the indicators, as well as their threshold levels, is based on the calculation of the noise-to signal ratio, as described below.

3.4.3 Setting thresholds

One of the key components of the construction of a EWS is setting the thresholds. A threshold is a probability level above which the predicted probability signals most reliably that a crisis is about to occur. The threshold should be chosen in way that maximizes the number of the right signals and minimizes the number of wrong ones. Setting a threshold too low may results in too many signals sent, both right and wrong ones (the latter are called Type II error). By contrast, high threshold levels will lead to reduction in the number of wrong signals, but also an increase in the number of missing crisis signals (Type I error). The choice of the threshold depends on the judgement on the relative importance of Type I errors versus Type II errors. Bussiere and Fratzscher (2002) argue that Type I error is more important, as its consequences cost the economy more than those of Type II error (the consequences of the crisis that was not prevented are more costly than the cost of preventive measures that were taken to avert the crisis that actually did not happen.

Setting thresholds in the indicators approach

Kaminsky (1999) suggests selecting the best indicators based on the noise-to signal ratio, which is calculated using the following logic.

First, some arbitrary threshold level is chosen. The threshold can be defined in the same units as the respective indicator: Kaminsky and Reinhart (1996) suggest as an example a threshold for returns on equity at minus 15 %. It means that all returns that are equal or less than minus 15% would signal a crisis. Alternatively, the threshold can be defined in terms of the percentage of observations in the total number of observation that exhibit anomalous behavior (i.e. for which the returns fall below 15%).

Then, for the given threshold level for a particular indicator, a noise-to-signal ratio is calculated using the following methodology.

The matrix below depicts all possible outcomes that a EWS can produce.

	Crisis occurs within the defined time horizon	No crisis occurs
Indicator issues a signal	A	B
Indicator does not issue a signal	C	D

The noise-to-signal ratio is a ratio of false signals to all possible bad signals divided by the ratio of good signals to all possible good signals:

$$\omega = \frac{B/(B+D)}{A/(A+C)} \qquad (3)$$

An alternative way to describe this relationship is:

$$\omega = \beta / (1-\alpha)$$

Where β is Type II error, and α is Type I error.

The noise-to-signal ratio is calculated for different thresholds, and the threshold that gives the lowest noise-to signal ratio is chosen as optimal for the particular indicator. The same procedure is done for all other indicators (in the indicators approach, thresholds are set for each independent variable).

Finally, based on the comparison of the noise-to-signal ratios of different indicators, those with high ratio are dropped out of the system. At this point, the construction of a univariate EWS is complete.

Yet, this type of EWS was criticized for not being able to provide a synthetic picture of the vulnerability of a country. In particular, as Bussiere and Fratzscher (2002) note, it is difficult to rank (in terms of vulnerability) a situation with only indicators A and B in a critical zone with another situation where indicators C and D are in the red. In response to this problem, Kaminsky (1999) and Goldstein et al (2000) proposed a composite indicator that combines effects from the univariate ones. In particular, Kaminsky (1999) suggested using the weighted sum of signals of all indicators, where the inverse noise-to-signal ratio plays the role of a weight. In such a way, more accurate indicators are given more weight.

In its work, the IMF uses such a composite indicator. The IMF sets threshold for the composite indicator by minimizing an equally weighted sum of false alarms and missed crises (IMF, 2002).

Setting a threshold in the probit/logit model

The main difference of the threshold setting procedure in the probi/logit framework is that it is set for the dependent variable (not for independent ones, as in the indicators approach).

The derivation of a threshold involves the following steps:

1) The specified model is run on the actual data and for each period a probability of a crisis is obtained.
2) A arbitrary cut-off (threshold) probability is selected
3) If the actual value for a particular period exceeds the threshold, the indicator of a crisis is set equal to one for this period, if not – zero. This procedure is repeated for all periods.
4) The calculated crisis indicator for each period is compared with the actual crisis data for that period (with a lag), i.e. whether there was a crisis or not and whether the calculated indicator predicted the outcome correctly
5) Other thresholds are tested in the same way (Steps 3 and 4 are repeated)
6) An optimal threshold is selected.

The general rule for an optimal threshold is that it has to have the minimum of Type I and Type II errors.

IMF in its application of the probit EWS, gets the optimal threshold by minimizing an equally weighted sum of false alarms and missed crises (IMF, 2002). One could use the same approach as Kaminsky (1999) uses, i.e. minimizing the noise-to-signal ratio. Bussiere and Fratzscher (2002: 33-36) employ a loss function to solve simultaneously for the optimal threshold and time horizons.

3.5 Discussion of the two approaches

The main difference between the two approaches is that the probit/logit models allow estimating the probability of a crisis as one number, resulting from interaction among all explanatory variables. By contrast, the indicators approach allows assessing the contribution of each particular factor.

In their critique of the probit/logit approach, Kaminsky et al (1998) point to the limited information these model provide on the significance and character of contribution of each factor to the probability of a crisis, because the variables either enter the equation significantly, or they do not enter at all. Another drawback of this approach is that due to it non-linearity, the coefficients in the model do not reflect the marginal contribution of each variable to the probability of a crisis. Finally, as the probit-logit approach combines effects from all variables into one probability estimate, it does not show the effect of each factor separately, so that it is difficult to say where the crisis is coming from.

Bussiere and Fratzscher (2002: 27) tried to address these weaknesses and showed that one can estimate the effect of a particular factor in the logit model by holding all other variables at their average at tranquil times.

The indicators approach, by contrast, allows assessing the impact of each factor, yet, it is less capable of providing a summary measure of the risk of the crisis. The composite indicators, as proposed by Kaminsky (1999) and Goldstein et al (2000), were subject to a substantial critique (see Bussiere "Book Review…").

3.6 Limited dependent variable probit/logit models (practical application)

3.6.1 Practical application

The early signaling system was designed to be user-friendly and easy for updating and incorporating of more advanced estimates. Every month a user will update the database for recent statistics and will check what the fresh numbers are talking about perspectives of budget execution. The system will show if crisis risks are growing or decreasing given the new information about economic situation is available.

A user will see Table 3.6.1 for every risk (in our case VAT and EPT proceeds) at Excel file. Column "Current observations" should be filled in with new statistics. Automatically, on the right hand (columns "Lag1,…, Lag6") the table will show if the recently released statistics increases probability for crisis or not. If a user observe "0" at a cell – that means normal stance. Increase in probability for crisis will be signaled with "1" value. A detailed instruction on usage of the system is available in Manual.

We restricted period of risks analysis to six month perspective (6 lags) since monthly statistics can catch only short-term tendencies. At the same time we include to the system results for all six months. Considering all observations (probability for crisis) we have better vision to risks perspective i.e. better signaling system. Six observations increase accurateness for detecting of approaching crisis.

Interpretation of the presented at the interface table results (Table 3.6.1.) should be the following:

1) "0" value of signaling indicator means low probability for crisis at Lag N (in N month from now) under currently observed value of reference variable.

2) "1" value of signaling indicator means highly probable crisis at Lag N under currently observed value of reference variable.

A user (analyst) should draw conclusions by himself about the seriousness of the tendency. The signaling system would indicate if the recent statistics break thresholds or not (for different lags). However, the user should analyze by himself if the observed signals should be considered as important or could be viewed as Type I (or Type II) errors (see 3.*6.2 Fit to historical data*).

The described system could be easily updated (corrected) by a user. Only basic econometric knowledge and experience with econometric packages is necessary.

The system could be updated with revision of the estimated beta coefficients (and subsequent revision of thresholds). First of all, the coefficients are subject to revision when new statistics (and crisis) are observed. In this case a user just updates the database and re-estimates the proposed regressions. Second possible way for improvement is more profound methods of data processing (smoothing, detrending). Third option for revision of beta coefficients is related to corrections (or revision) of crisis definition. See Manual for details.

In addition to the coefficients correction the system can be updated with inclusion of some new series or replacement of some current variables with more appropriate. Again a user can easily do the operation with use of probit model which is included to Stata package.

Important component of the system is the mechanism of thresholds estimations. The thresholds are calculated according to the methodology described by Kamiskiy (1999) based on the noise-to-signal ratio. The estimate process involves the values of generated probabilities i.e. the coefficients estimated for probit model. That means that user should have to revise the thresholds when updating or correcting beta coefficients.

For calculating the thresholds a simple mechanism was designed in Excel. The optimal value of threshold is automatically calculated. A user should just have two series to obtain results (dependant series and generated probabilities). The value of best-fit threshold is indicated with minimum value of "noise-to-signal ratio" (see 3.*6.8 Thresholds*). The mechanism of calculation could be used both for single- and multiple-regressions. See Manual for details.

Table 3.1. Interface for table with signaling indicators

	Units	Current observations	Lag1	Lag2	Lag3	Lag4	Lag5	Lag6
Real wage index	change, % m/m	1.05	0	0	0	0	1	0
FSTS	change, % m/m	1.02	1	0	0	0	1	0
Industrial output	change, % m/m	1.08	0	0	1	0	0	0
Retail trade	change, % m/m	1.15	1	1	0	0	0	0
Construction	change, % m/m	1.10	0	0	0	0	0	1
CPI	change, % m/m	1.03	1	1	1	0	0	0
PPI	change, % m/m	1.02	1	1	1	0	0	0
NEER	change, % m/m	1.00	0	0	0	0	0	0
REER	change, % m/m	1.00	0	0	1	1	0	0
JPMorgan	change, % m/m	1.03	1	1	1	1	0	0

3.6.2 Fit to historical data

Test on historical data (year 2007) produced satisfactory results. Signaling indicators for EPT (Method 1 and 2) produced many crisis signals prior to positive shocks (no negative shocks in 2007 was observed). For VAT (Method 1) the system also signaled well on positive shocks. However, (i) the system produced many false signals about approaching crisis (Type I error); (ii) for VAT negative shocks the system does not have enough signaling indicators which restricts capacity in predicting negative shocks.

The performed testing also clearly revealed that the proposed framework will benefit of larger number of reference series since the number of valid signaling indicators will increase (thus improving adequacy of crisis prediction). Interesting that in relative terms (crisis signals/total number of valid signals) those ratios that exceeded 50% almost perfectly indicated on approaching crisis (within 6 months).

Also very important that the system did not show any confusing outputs:

- increasing signals for negative shock leads to proportional reduce in signaling for positive shock;

- the sign of signal and shock coincide – no contradictions were observed;
- Type II error was not observed (no signal with shock observed);

3.6.3 Dependant variables

VAT and enterprise profit tax were chosen for construction of dependant variables. Time-consuming data-processing did not give possibility to work over all budget items (other tax revenues, non-tax revenues, budget expenditures).

Dependant variables were transformed in binary dummy variables which represent either crisis (1) or normal stance (0). The crisis was estimated with two methods. The first one counted crisis if budget proceeds deviated (by more than 15%) from the plan of budget revenues (in nominal values). The second method took budget proceeds as a ratio to GDP and counted crisis if the actual budget revenues deviated by more than 1% of GDP. Important the thresholds for these two methods were estimated considering that crisis occurrences should amount not less than 30% of observations. The rule is rather arbitrary; however, it is considered as appropriate since (i) we need enough observations for calculations; (ii) crisis is not something that could happen too often. Thus 30% criterion was chosen. As a result we estimated 15% threshold for the first method and 1% of GDP for the second method.

3.6.4 Series

The series pre-selection was based on (i) analysis of macro-shocks at the theoretical part of the report, (ii) OECD experience for series which proved to have predictive power in other countries. The most probable candidates for the series were expected to reflect situation with:

- real sector (GDP, industrial output);
- investment sentiments (construction);
- consumer confidence (retail trade);
- price level (CPI, PPI);
- household earnings (wages);
- business environment at the economy (FSTS, JP Morgan ukr spread);
- terms of trade (exports, imports, NEER, REER);

For the purpose of the study we concentrated on monthly statistics. In addition to economic logic we paid particular attention to (i) timeliness of statistics release; (ii) if the series reflect some expectations at the economy; (iii) if the series affect or are assumed to correlate with state budget proceeds. Economic intuition of forecasting experts also was important factor for the series pre-selection. Detailed list of selected candidates for independent variables is presented at the table 3.6.2. The list is subject to enlargement.

The selected series were transformed either in year-of-year terms or in month-of-month change. All series were presented in real terms except for exports and imports (which have real growth rates only on quarterly basis).

For leading indicator the detredning plays very important role. As described in previous sections OECD proposes to use Phase Average Trend (PAT) method for sorting out crisis movements of variable from trend dynamics. However, the method is very complicated and could not be applied for short series as we have for Ukraine. Therefore, for the purposes of the study we used simple Hodrick-Prescott filter for detrending.

Table 3.6.2. Independent variables, monthly data

Series	Units	Reference (at Stata)
GDP	%, real change, y/y	gdpry
Wages	%, real change, m/m	wagerm
	%, real change, y/y	wagery
CPI	%, real change, m/m	cpim
	%, real change, y/y	cpiy
PPI	%, real change, m/m	ppim
	%, real change, y/y	ppiy
NEER	%, real change, m/m	NEERm
	%, real change, y/y	NEERy
REER	%, real change, m/m	REERm
	%, real change, y/y	REERy
FSTS index	%, real change, m/m	PFTSrm
	%, real change, y/y	PFTSry
Construction	%, real change, y/y	construction yoy
Industrial output	%, real change, y/y	indoutputyoy
Retail trade	%, real change, y/y	retail yoy
Steel prices Global index	%, real change, m/m	stglobm
	%, real change, y/y	stgloby
Steel prices Europe index	%, real change, m/m	steurm
	%, real change, y/y	steury
JP Morgan ukr spread	%, real change, m/m	JPM mom
	%, real change, y/y	JPM yoy
Merchandise exports	%, change, m/m	exportrm
	%, change, y/y	exportry
Merchandise imports	%, change, m/m	importrm
	%, change, y/y	importry

3.6.5 Regressions

After data processing we verified the series which demonstrate statistically significant relation with dependant variable. The operation is the final stage of the series selection process. Sign and statistical significance of relation were the key criteria for inclusion of the variable to the list of approved series.

Important, the sign is considered dominant criteria to the significance indication. For practical use we considered that 30% statistical significance margin is acceptable. Although classical theory in econometrics propose traditional 5% significance, practicing econometricians recognized that real life data rarely could show this level of significance. In reality we hardly can meet perfectly correlated socio-economic series, and economic logic coupled with sign of coefficient should be put on the first place.

The verification process was based on single-variable lag model. We identified the following series: industrial output, retail trade, construction, FSTS index, CPI, PPI, JP Morgan index, REER, NEER, real wages, steel price index, GDP growth rates. The obtained results are in line with economic logic.

Identification of the functional form for the multi-variable regression was the next step for verifying relations between dependant variables and the series. Unfortunately, combined regressions did not show any reasonable results. Although significant, the signs of estimated coefficients for the set of tested combinations contradict general economic logic. The obtained results do not mean that there is no functional form of multi-variable regression. Most likely, the chosen depth of analysis did not give possibility to identify this functional form (depth of data processing). OECD experience proposed that single-variable models were opted for leading indicators (while multi-variables were used only when reasonable relations were identified).

3.6.6 Signaling indicators

The signaling indicators (1/0 – crisis/ no crisis) are calculated based on the generated probabilities for crisis occurrence (Y) and estimated thresholds for every single variable and lag. The probability value (Y) is estimated based on probit model methodology. As suggested by Kaminsky we used probit model for estimation of β coefficients based on real independent variables and generated binary dependant series (see above).

Calculation of probabilities (Y) was an inverse process based on already available β coefficients. Y was generated for observed X. According to probit model definition Y is normally distributed function of ($z = a + b*X$) with mean at zero and standard deviation at 1.

The key parameters for identification of the stance (crisis/ no crisis) are: (i) beta coefficients; (ii) estimated optimal threshold. If the generated probability value Y exceeds threshold than we have "1" (crisis probable), if not – than "0" (normal stance). Basically, the performance of the signaling system depends on accurateness of estimated thresholds and beta coefficients.

Important that we can apply the same approach to multi-variable model. The only difference will be in the number of beta coefficients which are estimated for every variable included to the model. In this case the estimated function will be $Z = \beta*X$ (β – vector of coefficients and X – matrix of observations).

3.6.7 Beta coefficients

For calculation of signaling indicators we were to estimate beta coefficients for the identified series for 6 lags. Those coefficients which were either insignificant or have wrong sign were excluded from the signaling system.

As a result, only part of the signaling indicators fit to the selection criteria (sign and significance) and was finally accepted to the signaling system. At the tables 3.6.3-3.6.4 we present number of signaling indicators that proved to be valid. For instance, for "jpmyoy" we identified two signaling indicators which have significant beta coefficients with correct signs while the rest signaling indicators for "jpmyoy" were excluded due to incompliance with the criteria. Important, at the table 3.6.3 we suggested cumulative results for all shock (negative/positive) and all dependant variables (VAT and EPT). Table 3.6.4 present the same information with split on shocks and dependant variables.

The tables were composed to show erratic coverage of risks with signaling indicators. Important that eventually we have good set of signaling indicators for negative and positive shocks for EPT and positive shock for VAT. At the same time negative shocks for VAT could not be efficiently identified (only two signaling indicators for Method 1 proved to be relevant) – see Table 3.6.4. The selected for analysis series do not catch crisis in VAT underexecution.

Surprisingly but some logical relations did not pass the selection criteria. For instance, industrial output showed neither good sign nor acceptable significance level. Similar situation was observed with PPI and real wage index in yoy terms (see Table 3.6.3). GDP, construction and steel index looks the most appropriate reference series with real predictive power for Ukraine. Interesting results were observed for the so called negative shocks (underexecution). As mentioned above, for VAT we were not able to identify any reference series which can catch any relation between changes in economy and underexecution of VAT proceeds (see Table 3.6.4.). Provisionally, we concluded that for VAT the reimbursement process can distort observed results.

Table 3.6.3 Number of signaling indicators included to the signaling system

Method 1 Variables	Number of signaling indicators (for 6 lags)	Method 2 Variables	Number of signaling indicators (for 6 lags)
real wages index yoy	0	neer yoy	6
real wage index mom	12	pfts mom	6
pfts yoy	6	reer mom	12
cpi mom	1	reer yoy	12
ppi mom	11	cpi mom	6
indoutputyoy	0	ppi mom	6
constryoy	12	constryoy	12
ppiyoy	0	steel glob mom	8
steel glob mom	18	steel europe mom	11
steel europe mom	16	jpm yoy	4
gdp yoy	12		
jpm yoy	2		

Table 3.6.4 Number of signaling indicators included to the signaling system (decomposed by shocks and by dependant variables)

Method 1					Method 2				
	Positive shock		Negative shock			Positive shock		Negative shock	
VAT	real wages index yoy	0	real wages index yoy	0	VAT	neer yoy	6	neer yoy	0
	pfts yoy	6	pfts yoy	0		pfts mom	6	pfts mom	0
	industrial output yoy	0	industrial output yoy	0		industrial output yoy	0	industrial output yoy	0
	retail yoy	6	retail yoy	0		steel glob mom	0	steel glob mom	0
	steel glob mom	4	steel glob mom	2		steel europe mom	0	steel europe mom	0
	steel europe mom	6	steel europe mom	0					
	jpm yoy	2							
EPT	real wage index mom	6	real wage index mom	6	EPT	reer mom	6	reer mom	6
	cpi mom	0	cpi mom	1		reer yoy	6	reer yoy	6
	ppi mom	6	ppi mom	5		cpi mom	0	cpi mom	6
	indoutputyoy	0	indoutputyoy	0		ppi mom	0	ppi mom	6
	constryoy	6	constryoy	6		constryoy	6	constryoy	6
	ppiyoy	0	ppiyoy	0		steel glob mom	5	steel glob mom	3
	steel glob mom	6	steel glob mom	6		steel europe mom	5	steel europe mom	6
	steel europe mom	6	steel europe mom	4				jpm yoy	4
	gdp yoy	6	gdp yoy	6					

3.6.8 Thresholds

Important part of the work was thresholds estimation. For the purpose we adopted the "noise-to-signal ratio" approach proposed by Kaminsky. For every single-variable model we generated probability values based on historical numbers of the series. We generated a set of hypothetical thresholds for probability values (Y) within the range of [0;1] with a 0.05 step . According to Kaminsky methodology for every threshold we calculated a value of "noise-to-signal ratio". For

every generated series of probabilities (Y) we accepted a threshold which gave the lowest value of “noise-to-signal ratio”.

Important, the thresholds depend on generated probabilities i.e. on the estimated coefficients of regressions. That means that for updating or revision of the econometric relations the thresholds also should be revised.

3.6.9 Notes and comments on possible improvements

1) We could omit some important series which have predictive power. For instance, among probable candidates for the omitted series are growth rates of Ukraine trade partners like Russia and EU. The drawback could be solved with more intensive data-mining process. The user of the system can deal with the problem gradually by testing all possible series which proved to be leading in other countries or are believed to have predictive power for Ukraine.

2) Arbitrary definition of crisis (and thresholds) is also a weak point which should be considered more closely in further studies. In our work we referred to budget revenues plan as a benchmark which should reflect expectations and knowledge of the Ministry of Finance. Therefore only those values that deviate strongly from the revenues plan were perceived as crisis. In this case we have two major weaknesses.

   The first one is related to political component of the identified budget revenues plans. Unfortunately, very often the proposed by the Ministry of Finance numbers reflect neither economic situation nor insight of the Ministry experts but some political reasoning. At our work we did not have possibility to deal with that problem.

   The second weakness is related to the value of GDP which is used at the second method of dependant variable calculation. The problem was indicated by the Ministry of Finance. Theoretically we have to use expected GDP since that will reflect actual expectations of revenues in ratio terms (to GDP); however, in practice the forecasted GDP is available only in yearly terms while calculations were for monthly data. Therefore, we had to use for calculations expected budget proceeds and actual GDP numbers which could create bias at the generated series. Unfortunately, the problem could not be solved perfectly. Even if we generate monthly (or quarterly) values based on the forecasted GDP number, the values will be a rough estimate and will be hardly better than with historical numbers. Even though we should recognize the problem and deal with it if some way could be found.

3) Surveys results inclusion

   Survey results play important role in early signaling system. The point is that they reflect expectations in economy which is beneficial for predictive power of the system. We did not include survey results in our analysis but it will be important component of further studies. Several surveys are conducted on permanent basis and already have some historical series which means that their results could be used for the current study purposes. Specifically we know about Consumer Confidence index prepared by ICPS and distributed on paid basis (since 2000). Also IER proposes Quarterly Enterprise Survey since 2002. In 2006 the NBU also started comprehensive survey of Ukrainian enterprise expectations. The indices estimated at the studies could be used for testing with only minor processing.

4) Quarterly data inclusion

   Processing of quarterly data is another potential way for improvement. Within current work we did not consider quarterly data while some series could be obtained only on quarterly basis (like terms of trade). Moreover, quarterly data for both dependant and

series are of better quality since they are usually revealed after thorough inspection of collected statistics (by State Statistics Committee). Specifically for tax revenues, quarterly data have more smooth behavior (than monthly) since some payments could vary within a quarter while for sure should be arranged by the end of it.

However, quarterly data will mean that we deal with risk assessment rather than leading indicators. Huge lag with quarter statistics delivery means that the system could signal only about long-run risks while short- and mid-term crisis will be far behind the date of statistics publication.

5) Simple approach for detrending and short series is also important drawback of the study. Basically, the problems are interrelated. Short series do not give possibility to use Phase Average Trend (PAT) method (recommended by OECD) for detrending. The problem could be dealt with time when longer time series will be available for Ukraine.

6) Smoothing and normalization

According to OECD methodology the series which are used for leading indicators estimate should undergo a set of other more complicated processing procedures like smoothing and normalization. Smoothing (in addition to detrending) removes some short-term irregular movements, which could give wrong signals about “turning points”.

Normalization is another technique which standardizes the amplitudes of the cyclical movements and leaves the relative magnitudes of the irregular movements unchanged. However, normalization could be applied to indices while we use the so called diffusion method

7) Diffusion index. At our work we use growth rates of indices which is a bit different approach than OECD apply for different countries (named diffusion index). OECD leading indicators are based on simple indices. Diffusion index is seen inappropriate for composite leading indicator; however, it fits well to our needs.

8) Truncated series. For calculation of negative and positive shocks we split our observations of dependant variables for two sub-sets. The first one represented crisis with positive sign (overexecution) the second one represented sub-set of crisis with negative sign (underexecution). As a result we made estimations for truncated series. For the purpose of the study we did not find any better option to deal with positive and negative shocks; however, truncation could create significant problems for the estimated coefficients. We see the problem of truncation an important way for further study.

3.7 Practical application of the 'indicators' approach

The 'indicators' approach (see section 3.4.2 The indicators approach) is another method of shocks' identification, which can have negative effect on budget receipts and break (violate) the fiscal stability. In contrast to limited dependent variable probit–logit models, the indicators' approach is much simpler and does not employ any econometrics.

3.7.1 General Overview

The 'indicators' approach is generally a kind of an 'early warning system'. It allows predicting (determine) the crisis before its occurrence (with a certain lag-period) and based on historic evaluation of the crises and assessment of shocks which are typical of Ukrainian fiscal system. The method allows to determine the influence of exogenous factors (indicators) on the fiscal stability and estimate the threshold for each factors (level above this threshold causes the violence of the fiscal stability).

The evaluation of factor's significance and its threshold is based on the model, which allows receiving all possible changes of the factor that occurred before the crisis. It enables to forecast occurrence of a crisis in the future.

3.7.2 Selection of variables

Due to the 'indicators' approach dependent and independent variables are used. The dependent variables represent the fiscal stability and are determined as endogenous parameters. The independent variables are considered to be exogenous parameters, which influence the fiscal stability. The 'fiscal stability' is defined as a balance of Central fiscal budget of Ukraine. It is the capability of the government to ensure (provide) sufficient amount of financial resources to cover the budget expenditures.

The fiscal system is regarded as unstable if the execution of central fiscal revenues is below the target level (which is the planed level). The revenues under-execution can lead to:

1) Under-financing of budget expenditures; or/and
2) State debt growth, and consequently, growth of state borrowings (debt load).

The model operates with two dependent variables including:

(1) receipts from the value added tax (VAT)
(2) revenues from the enterprise profit tax (EPT)

These two dependent variables were chosen on the base of their significance for the Central fiscal budget of Ukraine. As a matter of fact, their total share in the Central fiscal revenues constitutes over 55%, which is the clear evidence of their high significance in regard to the fiscal stability.

The independent variables (indicators), used in the model, are the factors that have the most influence on dependent variables. The selection of such independent variables and setting their optimal thresholds are the main goals of the 'indicators' approach. The list of independent variables (indicators) including their abbreviations is presented in Table 3.7.1.

Table 3.7.1. The selected list of independent variables (indicators)[17]

Indicator	Abbreviation
Real GDP (yoy) decrease	gdpryunit
Real wages (mom) decrease	wagerm
Real wages (yoy) decrease	wagery
CPI (yoy) – case of inflation	cpiy-n
CPI (yoy) – case of deflation	cpiy-p
CPI (mom) – case of inflation	cpim-n
CPI (mom) - case of deflation	cpim-p
PPI (yoy) - case of inflation	ppiy-n
PPI (yoy) - case of deflation	ppiy-p
PPI (mom) - case of inflation	ppim-n
PPI (mom) - case of deflation	ppim-p
Nominal effective exchange rate (NEER-mom) appreciation	neerm
Nominal effective exchange rate (NEER-yoy) appreciation	neery
Real effective exchange rate (REER-mom) appreciation	reerm
Real effective exchange rate (REER-yoy) appreciation	reery
PFTS index Real (mom) decrease	pftsrm
PFTS index Real (yoy) decrease	pftsry
Industrial output real (yoy) decrease	indoutputry
Industrial output real (mom) decrease	indoutputrm

[17] notation conventions:

- CPI – Consumer Price Index;
- PPI – Producer Price Index;
- PFTS index – the major indicator of Ukraine stock market development calculated on the base of trading results of First Trading Stock System – the biggest national trade platform;
- JP Morgan Spread – the risk indicator for Ukrainian state bonds. Provided by the JPMorgan Chase & Co. Calculated as yield spread of Ukraine state bonds and U.S. Treasury securities (taken as conditional risk-free yield);
- yoy - year-on-year change;
- mom - month on month change.

Indicator	Abbreviation
Index retail sales (yoy) decrease	indexretailyoy
Index construction (yoy) decrease	indexconstyoy
JP Morgan Spread real (mom) increase	jpmrm
JP Morgan Spread real (yoy) increase	jpmry

3.7.3 Negative and positive influence of the independent variables

There are two types of the influence of **independent variables** on the fiscal stability set by the model –they can be either 'positive' or 'negative'. In case of negative influence the deviation of independent variable (increase or decrease of its value) will lead to decrease in the value of dependent variable. For instance, real GDP decrease as a consequence of economic recession in the country can lead to the decrease of enterprises' profit, and consequently, to the drop of EPT receipts. Another example can be CPI growth over the certain level ('threshold level'). Under the gradual growth of real incomes increase in CPI can lead to decrease of purchasing capacity and consumer demand, and in the end, to the decrease of VAT receipts.

Due to positive influence the change of value of independent variable will lead to increase of value of dependent variable, i.e. to the improvement of the fiscal stability. It is beyond the scope of our research as we concentrate on the changes of independent variables (indicators) which threaten the fiscal stability.

3.7.4 Definition of a 'shock' for dependent variables

The model defines a state of shock for the fiscal system when the fiscal stability is violated. Due to our methodology it occurs when the dependent variable deviates from the certain optimal value under which the system remains stable. Considering the specificity of our fiscal system the **'shock'** for dependent variables occurs when the VAT and the EPT revenues are under-executed by 5% from the planned level (negative deviation of dependent variables from the planned level). The 5% - level is estimated empirically using VAT and EPT historic data.

3.7.5 Selection of 'signaling horizon'

In accordance with the 'indicators' approach **'signal'** is determined as 'negative' change of independent variable over the determined threshold level. This term is used to define so called **'signaling horizon'**. It is the time period from the signal appearance till the moment when the **crisis** occurs (i.e. the negative deviation of dependent variable reaches 5% from the planned level envisaged in the central fiscal budget). In the model this period is set as **6 months.** Thus, the model fixes all negative changes of independent variable within the interval of 6 month before change of dependent variable.

The whole data are given as a percentage of growth or decline rate of the variable in order to fix fluctuations of certain variables above the threshold level.

There are two types of independent variables used in the model[18]:

[18] Real GDP decrease is taken as year to year change only.

- As the percentage change in the level of the variable with respect to its level a year earlier;
- As the percentage change in the level of the variable with respect to its level a month earlier.

The use (inclusion) of these two types of variables in the model is explained by specific nature of some indicators estimation and by the efforts to specify the relationship between the level of influence of the variables and their type.

3.7.6 Calculation of noise-to-signal ratio

This coefficient is the main element of the model since it helps to estimate (evaluate) the significance of the variables and the threshold level which is necessary for shock fixation and crisis occurrence.

The noise-to-signal ratio is calculated by the following formula:

$$noise\ to\ signal\ ratio = \frac{B/(B+D)}{A/(A+C)},$$

Which is interpreted by using the below matrix:

	Shock (during next 6 months)	Shock (during 6 next months)
Signal was issued	A	B
No signal was issued	C	D

Thereby, for noise-to-signal ratio calculation model is able to fix next combinations:

A) Conditional "high quality" signals: combinations A and C.

In these cases the model fixes a state of shock for dependent variable so the crisis occurs. In A case the crisis is confirmed by the corresponding signal or "good" signal. In C case the crisis occurs but without any signal fixing.

B) Conditional "bad quality" signals: combinations B and D.

In these cases there are no crises occurred and that is no deviation of dependent variable from its planned level fixing by the model. In B case the model fixes the signal when the crisis is absent so the signal is "false". In D case both signal and crisis are absent so the signal is "dummy".

As the result of different combination quantity calculation which the model can produce we get noise-to-signal ratio which is ratio of all "false" signals that divided on all "bad quality" signals to all "good" signals that divided on all "high quality" signals.

Therefore, this ratio determines quality or significance of each independent variable. It's obviously that variable with minimum noise-to-signal ratio has the best quality and predictive power (or type 1 and 2 mistakes will be at minimum for it).

The threshold for each independent variable is determined as independent variable value which is corresponded with the minimum noise-to-signal ratio. As the result, the model is actually solving optimization task which is aimed on calculation of minimum threshold. When the independent variable value for concrete month overrides the threshold, the model fixes the probability of crisis in fiscal stability which may occur in the next 6 month after month when the signal appeared.

3.7.7 Interpretation of findings

After completion of conducted calculations for each combination "independent variable – dependent variable" the following results were obtained (see Table 3.7.2).

Table 3.7.2. The significance level and thresholds for independent variable determination by the "indicators approach" method (monitoring categories)

Dependencies	Percentage of distresses called (%)	Good signals as percentage of possible good signals (%)	Bad signals as percentage of possible good signals (%)	Noise to signal ratio	P (distress/signal) (%)	P (distress) (%)	P (distress/signal) - P (distress) (%)	Optimal threshold
	1	2	3	4	5	6	7	8
Category #1 : P (distress/signal) - P (distress) > or = 10%:								
ppiy-p to EPT	71	54	5	0,09	97	79	19	11%
cpiy-p to EPT	74	48	5	0,10	97	79	18	7%
indexretailyoy to EPT	65	48	5	0,10	97	79	18	17%
pftsry to EPT	56	30	5	0,17	95	79	17	13%
neery to EPT	50	34	5	0,15	96	80	16	3%
gdpryunit to EPT	41	20	5	0,25	93	78	15	4%
ppim-p to EPT	71	37	10	0,27	93	78	15	0%
cpiy-n to EPT	18	20	5	0,25	93	79	14	15%
indexconstyoy to EPT	75	47	10	0,21	90	76	14	3%
reery to EPT	26	20	5	0,25	93	80	14	12%
pftsrm to EPT	65	17	5	0,30	92	79	13	-5%
indexretailyoy to VAT	70	46	8	0,17	97	86	12	18%
pftsry to VAT	41	29	8	0,26	96	86	10	18%
wagery to EPT	24	11	5	0,44	89	79	10	0%
jpmry to VAT	74	21	3	0,12	92	82	10	2%
Category #2 : 0% < P (distress/signal) - P (distress) < 10%:								
wagery to VAT	14	21	8	0,38	94	86	9	9%
ppiy-n to VAT	46	17	8	0,46	93	86	7	21%

Dependencies	Percentage of distresses called (%)	Good signals as percentage of possible good signals (%)	Bad signals as percentage of possible good signals (%)	Noise to signal ratio	P (distress/signal) (%)	P (distress) (%)	P (distress/signal) - P (distress) (%)	Optimal threshold
	1	2	3	4	5	6	7	8
ppiy-n to EPT	15	17	10	0,59	86	79	7	21%
cpim-n to VAT	78	27	15	0,57	91	86	6	1 %
cpiy-p to VAT	30	27	15	0,57	91	86	6	6%
cpim-p to EPT	94	38	25	0,66	84	79	5	0%
indoutputrm to EPT	62	14	10	0,71	83	79	4	-5%
pftsrm to VAT	95	56	38	0,68	90	86	4	2%
indoutputry to EPT	56	27	20	0,75	83	79	4	4%
ppim-p to VAT	73	32	23	0,72	89	86	4	0%
cpiy-n to VAT	62	40	31	0,77	89	86	3	11%
wagerm to VAT	89	38	31	0,80	88	86	3	0%
ppim-n to EPT	9	6	5	0,89	80	78	2	2%
cpim-p to VAT	73	36	31	0,86	88	86	2	0%
reerm to VAT	94	69	62	0,89	87	85	2	-1%
indoutputrm to VAT	97	96	85	0,88	87	86	2	13%
neerm to VAT	89	68	62	0,91	87	85	1	-1%
jpmrm to VAT	32	8	4	0,47	83	82	1	16%
wagerm to EPT	50	11	10	0,89	80	79	1	-3%
Category #3 : P (distress/signal) - P (distress) < or = 0%:								
ppim-n to VAT	97	96	92	0,96	86	86	0	-1%
jpmry to EPT	59	24	11	0,44	69	68	0	-9%
indexconstyoy to VAT	97	93	68	0,74	84	84	0	39%
jpmrm to EPT	100	91	58	0,63	74	74	0	-50%
neery to VAT	36	22	23	1,06	85	85	0	6%
cpim-n to EPT	68	25	25	0,99	78	79	-1	1%
ppiy-p to VAT	65	71	77	1,09	85	86	-1	20%
neerm to EPT	100	68	65	0,96	79	80	-1	-1%
indoutputry to VAT	97	78	92	1,18	84	86	-2	14%
reerm to EPT	100	68	70	1,04	77	80	-2	-1 %
gdpryunit to VAT	89	76	92	1,22	83	86	-3	9%
reery to VAT	33	23	31	1,33	82	85	-4	9%

The findings' interpretation is following:

(A) At the very beginning the "overall quality" of indices is determined. For this purpose the following indicators must be calculated: (1) percentage of distresses called (%); (2) good signals as percentage of all possible good signals (%); and (3) bad signals as percentage of possible good signals (%). These indicators that shows the separate indicators common ability to predict distresses of fiscal system.

(B) The minimum noise-to-signal ratio (4) and threshold (8) for each dependency must be determined.

(C) Than dependencies are distributed on categories due to their predictive power indicator which is calculated as a difference between probabilities (based on historical data) when model was able to predict the crisis (5) and when it was not able to produce the signal about the forthcoming crisis (6).

Dependencies' distribution on categories is carried out with the aim of determination a number of independent variables which is needed to be monitored by the Ministry of Finance with the top priority because of critical impact of given independence variables on the State budget stability.

The category #1 includes dependencies with the best predictive power which have "the predicted crises" and "the unpredicted crises" probabilities difference more than 10%. They must be monitored in the first place. Taking into account the fact that category #1 may include an unlimited number of variables we admit **high probability of the crisis when more than 50% of independent variables included in category #1 are exceed their thresholds.**

The category #2 includes dependencies with worse predictive power than the first one but they also can be used for monitoring in case of ambiguous situation in category #1 for additional verification.

The category #3 includes dependencies with the worst predictive power which are to be excluded from the monitoring list.

3.7.8 Dependencies' interpretation and monitoring process

In the last testing of model the following results were obtained (see Table 3.7.2). The tested dependencies were distributed on three categories according to selection criteria. The first and second categories of dependencies were excluded from the monitoring list due to their low predictive power. Accordingly, our monitoring will cover the dependencies from the category #1 only which have the "predictive power probability difference" more than 10%.

Than it's needed to describe the dependencies from the macroeconomic point of view taking into consideration the corresponding thresholds. In our case, based on model specification that the crisis probability appears on 6 month interval after signal was fixed, interpretation will be the following:

- **«ppiy-p to EPT»**: after PPI growth rate decrease more than 11% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. Such kind of situation is usual in case of domestic goods and services world market's price growth rate deceleration that leads to reduction of revenue and net income of domestic companies which are export-oriented.
- **«cpiy-p to EPT»**: after CPI growth rate decrease more than 7% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. This dependency reflects Ukraine's peculiarity when domestic consumer market has been growing much faster comparing with the developed countries. That was caused by the population income and consumer prices level growth which helped the domestic companies to increase their market shares rapidly. So the price level growth was an important factor for enterprises'

profitability increase and growth in EPT collection. This dependency reflects an optimal level of CPI which doesn't distress of fiscal system.

- **«indexretailyoy to EPT»**: after retail sales growth rate decrease more than 17% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. The main reason is reduction of retail sales growth rate that leads to decline of corporate revenue and net income.
- **«pftsry to EPT»**: after PFTS Index growth rate decrease more than 13% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. This dependence can be explained that every stock market index like PFTS Index is actually "early warning indicator" for corporate profits for total in the national economy. The matter is that the current price of market securities in fact reflects future expectations of institutional investors about companies' profitability whose securities are being traded at stock market. So, the PFTS Index growth rate decline may predict future problems on corporate profits and EPT execution, respectively.
- **«neery to EPT»**: after nominal effective exchange rate appreciation of national currency (hryvnia) growth rate increase more than 3% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. From firm's point of view (especially for export-oriented company) hryvnia appreciation leads to exchange rate losses because for revenues are being received in foreign currency company gets less amount of national currency. Such losses will cause negative impact on export-oriented companies' net income margin. On the other hand, hryvnia appreciation should reduce the price for imported goods and services for firms but this positive influence on corporate profitability will show itself only in long-run horizon because national companies import mainly investment goods.
- **«gdpryunit to EPT»**: after real GDP growth rate decrease more than 4% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. Real GDP growth rate is the indicator of business activity across the country and therefore it can be also used as conditional indicator of companies' profitability. Thereby, real GDP growth rate slowdown can indicate about shortfall in companies' revenue and net income.
- **«ppim-p to EPT»**: this dependency interpretation is similar to «ppiy-p to EPT» ones. The only difference is in units – the growth rate is calculated in month-to-month term – and threshold which is 0% for this case.
- **«cpiy-n to EPT»**: after nominal CPI growth rate increase more than 15% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged. This dependency interpretation is contrary for «cpiy-p to EPT» one. It explains high consumer inflation negative effect on enterprises' profits which should decrease due to slump in effective demand.
- **«indexconstyoy to EPT»**: after construction index growth rate decrease more than 3% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged because decrease of growth rate in construction will decrease the overall profits in country including enterprises' profits in construction and related industries.
- **«reery to EPT»**: this dependency interpretation is similar to «ppiy-p to EPT» ones. The only difference is about unit: in this case the independent variable is real effective exchange rate appreciation which lets exclude inflation influence from dependence like "exchange rate – EPT collection". So, the exact interpretation of this dependency is following: for ensuring of planned EPT collection real effective exchange rate appreciation growth rate shouldn't be more than 12% yoy.
- **«pftsrm to EPT»**: this dependency interpretation is similar to «pftsry to EPT» ones. The only difference is in units – the growth rate is calculated in month-to-month term – and threshold which is -5% for this case.

- **«indexretailyoy to VAT»**: after retail sales growth rate decrease more than 18% (yoy) the probability of VAT plan level execution shortfall for 5% and more is emerged. Such a case can be explained by the solvent demand slump and decrease of retail sales volume which includes VAT in goods and services prices.
- **«pftsry to VAT»**: after PFTS Index growth rate decrease more than 18% (yoy) the probability of VAT plan level execution shortfall for 5% and more is emerged. The interpretation is similar to «pftsry to EPT» ones in general and matches the case of enterprises' profits decrease due to market share's shrink and revenue shortfalls. That all causes shortfall in VAT on domestic goods and services collection.
- **«wagery to EPT»**: after real wages growth rate decrease more than 0% (yoy) the probability of EPT plan level execution shortfall for 5% and more is emerged because it may lead to effective demand reduction inside the country and domestic enterprises' profitability decrease.
- **«jpmry to VAT»**: after JP Morgan EMBI + Ukraine spread growth rate increase more than 2% (yoy) the probability of VAT plan level execution shortfall for 5% and more is emerged. The JP Morgan EMBI + Ukraine spread is indicator of risk level for Ukraine state bonds and therefore it can be used as general indicator of business activity fluctuations and debt capital cost in Ukraine. Its increase can indicate about future problems in VAT collection.

Than it's needed to conduct monitoring on monthly basis of dependencies and independence variables thresholds which are present in category #1. If more than 50% of independent variables during the month were over corresponding thresholds the model fix the probability of crisis in EPT or VAT collection. In such case the Ministry of Finance makes arrangements concerning EPT or VAT collection target correction and looks for reasons of the crisis.

The independent variables thresholds need to be renewed each quarter by the incoming data renewal and extension in model. Than model is needed to be recalculated and than monitoring process continues on the next quarter.

3.7.9 Conclusions

As a whole, developed model for finding threats to fiscal stability is actually the "early warning system" which allows finding and evaluating risks for planned figures for EPT and VAT achievement as well as determining time and reasons of their appearance. The indicator approach should become one of the "quick tools" in the Ministry of Finance routine work which should help the ones to conduct smart decisions about plan levels of EPT and VAT collection in advance.

Abbreviations

CAB - cyclically-adjusted balance
CGE – computable general equilibrium
CLI – composite leading indicator
DCSD – Developing Countries Studies Division
EMP – exchange market pressure
EPT – enterprise profit tax
EWSs - early warning systems
FSA – fiscal stability assessment
FSI – financial soundness indicator
IMF – International Monetary Fund
MCD – Months for Cyclical Dominance
NEER – nominal effective exchange rate
PAT – Phase-Average Trend
PPC – Period to Period Changes
REER – real effective exchange rate
VAR - value at risk
VAT – value-added tax

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Annex 1

Vulnerability indicators proposed in Hemming and Petri (2000)

Measurement of Fiscal Vulnerability Indicators

Indicators	Measures
Fiscal position indicators	
Weak initial fiscal position	Overall fiscal balance as a share of GDP Other fiscal balance measures as a share of GDP (where relevant) Net financial debt as a share of GDP Size of automatic stabilizers (small/average/large) Average and maximum rates of tax (for each main tax)
Incomplete coverage of government fiscal activity	Revenue covered in fiscal data as a share of general government revenue Expenditure covered by fiscal data as a share of general government expenditure
Poor accounting and control	Fiscal balance measured from above-the-line relative to the fiscal balance measured from below-the-line
Insufficient balance sheet information	Gross debt (yes/no) Net financial debt (yes/no) Other balance sheet data (yes/no)
Sizable uncovered contingent liabilities	Gross contingent liabilities as a share of total revenue Net contingent liabilities as a share of total revenue **Or** Description of main contingent liabilities and quantification of largest net contingent liabilities
Significant quasi-fiscal activities	Quasi-fiscal activities as a share of total revenue **Or** Description of main quasi-fiscal activities and quantification of largest quasi-fiscal activities
Short-term fiscal risk indicators	
High sensitivity of short-term fiscal outcomes to changes in key macroeconomic variables	Impact of variations in forecast GDP growth, inflation, balance of payments, exchange rate, and interest rates on the fiscal balance
Inappropriate debt structure	Maturity (short, medium, and long term), interest rate structure (fixed vs. variable rates), and currency composition of debt
Variable revenue sources and expenditure programs	Impact of variations in other economic and noneconomic determinants of revenue and expenditure on the fiscal balance
Calling of uncovered contingent liabilities	Net contingent liabilities as a share of GDP; expected payments in connection with guarantees, etc
Other expenditure risks	Description of programs and policies that give rise to risks
Longer-term sustainability indicators	
Unfavorable debt dynamics	5–10 year projection of gross or net debt as a share of GDP, and change in the primary balance as a share of GDP required to stabilize the debt ratio at the current level or at a specific target level
Low government debt rating and/or high interest rate premia	Information is available on the Bloomberg web site to calculate interest rate premia

Adverse demographic trends	Long-term projection of retirement age and school age population relative to total and working population; impact on expenditure as a share of GDP and on tax rates
Rapid resource depletion	Years of usable reserves at current exploitation rate; resource-related revenue as a share of total revenue; resource-related financial assets as a share of GDP; serious environmental degradation (yes/no)
Expenditure indicators	
Large share of nondiscretionary spending and/or transfers	Nondiscretionary spending and transfers as a share of GDP
Excessive military spending	Military spending as a share of GDP
Significant gaps in expenditure	Programs for which spending as a share of GDP is significantly below the average for comparable countries
Revenue indicators	
Inelastic revenue system	Tax elasticity or buoyancy
Highly-concentrated tax revenue	Revenue composition, particularly trade tax revenue as a share of total tax revenue
Frequent tax law changes	Major tax changes, especially new exemptions and other reliefs, every year or every two years (yes/no)
Extensive earmarking	Revenue from earmarked taxes as a share of total revenue
Reliance on grants and other unstable nontax revenue sources	Nontax revenue as a share of total revenue; composition of nontax revenue
Fiscal management indicators	
Large expenditure arrears and use of netting arrangements	Expenditure arrears as a share of total revenue; significant netting of arrears (yes/no), inability to report on sizable arrears (yes/no)
Marked deviation between the original budget and the budget outturn	Expenditure outturn relative to original expenditure; resort to large supplementary budgets (yes/no)
Nonexistent or weak medium-term budget planning	Effective medium-term budget planning (yes/no)
Long delays in preparing and auditing final accounts	Length of time between end of fiscal year and (i) preparation of final accounts and (ii) release of audited accounts
Large tax arrears and use of tax offsets	Tax arrears as a share of total revenue, sharp increase in tax arrears (yes/no), significant tax offsets (yes/no)
A large stock of tax refunds, especially for VAT	Stock of tax/VAT refunds as a share of tax/VAT revenue
Out-of-date taxpayer register	Currentness of taxpayer register by main tax (up-to-date/adequate but needs updating/completely out-of-date
An ineffective tax audit program	Coverage of tax audit (adequate/inadequate), targeting of tax audit (appropriate/inappropriate)
Government effectiveness indicators	
Poor results from surveys of public sector performance, corruption etc.	Information available from the Institute for Management Development World Competitiveness Report; the Transparency International Corruption Perceptions Index

Annex 2

Table 2.3. The Core Set of Financial Soundness Indicators

Indicator	*Indicates*	*Comment*
Deposit-taking institutions[a]		
Regulatory capital to risk-weighted assets	Capital adequacy	Broad measure of capital, including items giving less protection against losses, such as subordinated debt, tax credits, and unrealized capital gains
Regulatory Tier I capital to risk-weighted assets	Capital adequacy	Highest quality capital such as shareholder equity and retained earnings, relative to risk-weighted assets
Nonperforming loans net of provisions to capital	Capital adequacy	Indicates the potential size of additional provisions that may be needed relative to capital
Nonperforming loans to total gross loans	Asset quality	Indicates the credit quality of banks' loans
Sectoral distribution of loans to total loans	Asset quality	Identifies exposure concentrations to particular sectors
Return on assets and return on equity	Earnings and profitability	Assesses scope for earnings to offset losses relative to capital or loan and asset portfolio
Interest margin to gross income	Earnings and profitability	Indicates the importance of net interest income and scope to absorb losses
Noninterest expenses to gross income	Earnings and profitability	Indicates extent to which high noninterest expenses weakens earnings
Liquid assets to total assets and liquid assets to short-term liabilities	Liquidity	Assesses the vulnerability of the sector to loss of access to market sources of funding or a run on deposits
Net open position in foreign exchange to capital	Exposure to FX risk	Measures foreign currency mismatch

a. Domestically controlled institutions, that may be grouped in different categories according to control, business lines, or group structure.

Annex 3

OECD Composite Leading Indicator Components

Country	Components
Korea	- BoP, Capital& Financial Account - Finished goods stocks, industry - Stock of manufactured goods - Money supply M2 - Long term bond yield - Business situation, future tendency, industry
New Zealand	- Business situation, future tendency, industry - Consumer confidence - Retail trade, total value - Unemployment registered - Money supply, M1 - 3-month bank bills rate
Czech Republic	- Finished goods stocks, industry - Retail sale, volume - Selling prices, future - Tendency, industry - Price expectations, consumers - Money supply, M2 - Share price index, total
Hungary	- Money supply, M1 - Central Bank, base interest rate - Hours of work, manufacturing - Production, future tendency, manufact. - Unemployment registered - Imports, value - Share price index
Poland	- Production, tendency, industry - Real effective exchange rate - 3 month interbank rate - Unfilled vacancies - Production of coal
Slovak Republic	- Retail trade sales, volume - Production, future tendency, industry - Selling prices, future tendency, industry - Share price index - Net trade
Brazil	- Demand, future tendency - Export volume - Semi non-durable goods production - Share price index - Terms of trade
China	- Money supply, M2 - Cargo handled at ports - Chemical fertilizer production - Enterprise deposits - Imports from Asia - Non-ferrous metals production
India	- Business Confidence

	- Imports - Exchange rate, USD - Money supply, M1 - Deposit interest rate - Share Price Index - IIP Basic Goods - IIP Intermediate Goods
Indonesia	- Exchange rate, USD - Exports - Imports - Call money rate - Share price index - JSX Composite
Russia	- Crude oil prices, world - Demand level, manufacturing - Money supply, M2 - Net trade - Share price index
South Africa	- Building plans - Confidence - Interest rate spread - Motor car sales - Order inflow - Share prices

Source: compiled from OECD (1987), OECD (2000a), OECD (2000b), OECD (2006), Arnaud and Hong (2001).