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# **Quantitative Methods in Accounting and Finance**



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**METHODS OF DEFINING THE INTEREST RATE  
AMOUNT BASED ON THE ANALYSIS  
OF THE DYNAMICS OF THE IGLB MARKET  
OF UKRAINE**

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**Summary:** The article considers approaches to optimizing the determination of interest rates by the internal government loan bond of Ukraine based on the consideration of the terms of funds attraction and the general dynamics of rates percent on the financial market of Ukraine.

**Key words:** discount rate, national debt, internal government loan bond (IGLB), variable coupon rate.

## **1. Introduction**

The problem of national debt and approaches to its solution is urgent for many countries. One of the traditional methods is the use of such instruments as issuance of government bonds. Among economically developed countries, government securities play a significant role in financing public spending, maintaining liquidity in the banking sector and economy development as a whole. They are considered the most reliable and liquid among other debt instruments as long as they are secured of all state resources. Even the traditional hierarchy of the security of bonds in developed countries has the following sequence: central government bonds and bonds guaranteed by it, municipal bonds and debenture bonds. In Ukraine, the most common bonds are so-called “internal government loan bonds” (IGLB), which are issued by the Ministry of Finance, which guarantees their timely repayment. The Law of Ukraine on the State Budget of Ukraine regulates the issue of the government securities of Ukraine for the corresponding year. This law establishes the limit size of the public external and internal debt. The Cabinet of the Ministers of Ukraine determines loans amounts on IGLB. The National Bank of Ukraine is the general agent for service and repayment of IGLB. The National Bank of

Ukraine on behalf of the Ministry of Finance makes the primary distribution of IGLB. The resources received from the bonds are included in the state budget. The IGLB instrument allows the Ministry of Finance to attract necessary funds in a relatively short time (up to ten days), and the distribution of bonds simultaneously with regular repayment theoretically allows avoiding significant imbalances of the counter flow of payments and an abrupt range of cash amounts on the financial market

The IGLB market of Ukraine has been characterized by a rapid growth of public loans since its inception. Correspondingly, the public debt has also grown. All this affects the stability of the national currency, the rate of inflation and the nature of the economic development of the state in general. So the question of the correspondence of the present IGLB market with the domestic economy state is important so that the imbalance caused by liabilities overcharge does not result in the complications (or even impossibility) of their service. Lastly, there exists risk for the entire financial system of the state.

## **2. Aspects of the IGLB market of Ukraine**

The development of the IGLB market, and therefore the dynamics of the internal debt liabilities of Ukraine, followed the same scenario as in most emerging countries:

- growth of conducted auctions;
- growth of the amount of the IGLB issue;
- curtailment of the terms of bonds repayment;
- growth of the IGLB profitability.

Such a monetary and credit policy leads to the formation of the stable negative structure of public debt and simultaneously stimulates the potential investors to invest money not in the real economy sector, due to the high profitability and reduction of the terms of funds attraction – but in the government bonds, which means financing government's budget deficit. Therefore, the state debt on the IGLB can be described as expensive, relatively short and, unfortunately, unevenly distributed for the period of repayment. In this situation, the government has to generate different ideas for the possibility of further borrowings in order to service and repay the previous. The Ministry of Finance rises the profitability at the primary distribution of the IGLB, and this becomes a significant burden for the budget. Besides, the internal debt service occurs together with the external debt, which also tends to increase. Taking into account a constant threat of a significant devaluation of the national currency, the market development of the IGLB generally meets the question of the expediency of investing money in the government bonds that are denominated in UAH, because for investors the expected real income may be not only low, but generally negative. Such imbalance of the market of debt liabilities and the absence of an integrated system approach in this sector form a classic financial pyramid with all the potential threats of such an entity. The imbalance issue

of IGLB leads to a hidden issue of money, when the National Bank indirectly takes part in financing the state deficit by IGLB buyout (as in Ukraine the direct financing of the government is forbidden by the law). Therefore, the yield on the IGLB on the secondary market is 1.5–2 times higher than the yield on the primary market, and the National Bank of Ukraine is one of the main buyers of the IGLB on the primary market. From the economic point of view, the credits of the Central Bank (CB) and the investments of CB in government securities is the same thing; and in either case the Central Bank puts into circulation non-cash money, without being restricted previously by involved funds. The formation of an all-sufficient, parasitic and credit market which is separated from production is a result of such an approach. The IGLB yield greatly exceeds the yield of investments in production. In addition, there is transformation of investment resources into consumption resources: funds are directed to social services, salaries, pensions, etc. Another negative factor is the presence of a significant part of the non-residents among the owners of the IGLB, and this is a threat for the financial stability of the state and the issue of its economic security, when non-residents can start to leave this market.

This situation is not some know-how of Ukraine. A similar situation is in many emerging countries, and even developed countries face similar problems. Against this background, even Ukraine is a state with a relatively small debt load (at the end of the first quarter of 2012 the public debt was 27% of GDP), but the time at which this debt appeared also should be taken into account: Ukraine as a state has existed for only two decades, and the government bond market even shorter. Over the years, the IGLB in the Ukrainian financial space has transformed from the universal instrument for solving urgent government's problems into a burden for the same budget, when the Ministry of Finance is forced to service and repay previous borrowings by attracting funds for new profitable bonds.

When talking about the riskiness of a debt instrument, then risks themselves are evaluated from the point of view of the investor. But reducing the risks of the investor means a simultaneous increase of the risks of the issuer. The profitability on the government bonds for the investor and, consequently, the expenses for the issuer are determined not only by an interest rate, but by the term of bonds distribution and the amount of certain IGLB issues in the credit portfolio of the investor. Taking into account the fact that the issuer, in state's person, is not just a party of the bond market, but the basis for the whole financial system of the state, the question of a complex harmonization of debt obligations acquires particular relevance. The analysis of the IGLB and the main factors of influence on the mechanisms of its functioning provides essential theoretical and practical material to make estimations for both the expediency of investments in government securities and optimization of servicing liabilities by the issuer (the state).

One of the methods concerning the optimization of the government bond market is an approach that is based on the bonds issuing with a variable coupon

rate. Since financial assets on the market are usually characterized by a considerable variation of the interest rate, and at the time of a crisis this becomes the most accented, then borrowings for a long time at a variable interest rate should help to reduce the active and passive imbalances caused by the very dynamics of the current interest. European countries laid the foundation of the bonds with a variable interest rate in the early 1970s. Usually as a guideline for the re-calculation of the coupon rates the bets London Interbank Market are taken: LIBOR (bid proposals), LIBID (rate of demand) or LIMEAN (arithmetic mean between the aforementioned two), which are calculated daily by BBA Exchange based on the quotations of the leading banks as of 11.00 am according to Hrinvych. Sometimes the treasury bills of the US government are used as a guideline. The variation of interest rates may be supplemented by a margin change, which can vary throughout the life cycle of bonds, gradually decreasing as it approaches the day of securities repayment. Also, such methods are worked out when the issuer can update a coupon rate (but the investor has the right of early presentation of the bonds for repayment). Another popular method concerning the reduction of mutual risks at a variable coupon rate (both issuer and investor) is the imposition of restrictions on its possible changes. This limitation can be “above”, “bottom”, or on both sides – the so-called “corridor”.

### 3. Analysis of the current dynamics of the IGLB market of Ukraine

If one looks at the dynamics of the interest rates on the financial market of Ukraine in recent years, one can see not only their changes, but also some inconsistency of their dynamics. For example, Figure 1 and 2 show the dynamics of the NBU discount rate and the dynamics of the interest rate for the deposit attractions of the financial institutions from the third quarter of 2006 to the first quarter of 2012.

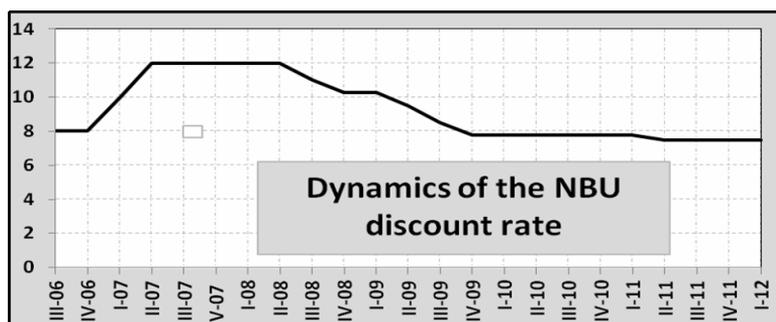
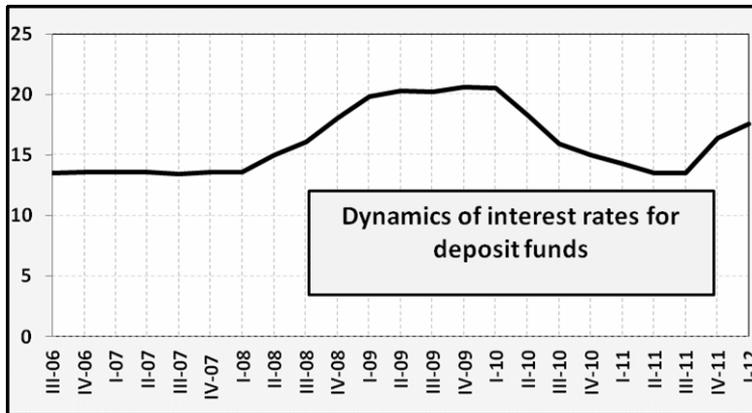


Figure 1. Dynamics of the NBU discount rate

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].



**Figure 2.** Dynamics of interest rates for deposit funds

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].

To estimate the degree of the fluctuations of the abovementioned interest rates by the traditional statistical method, one needs to calculate the amplitude of the fluctuations in interest points. For the discount rate the amplitude is:

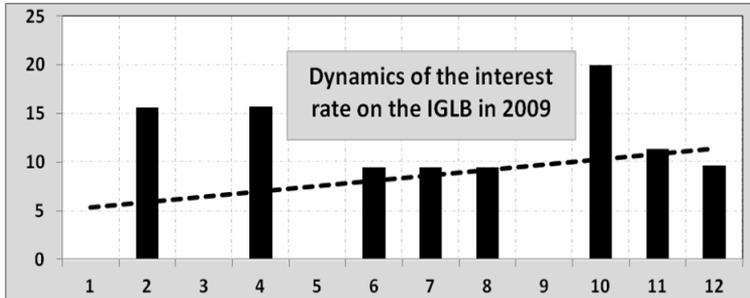
$$A = 100 \left( \frac{12}{9.22} - \frac{7.5}{9.22} \right) = 48.8.$$

The amplitude of the fluctuations at the rate of 48.8 percentage points indicates a significant irregularity behavior of the NBU discount rate over the past five years.

The same is shown by the behavior of the interest rate for the deposit involvement in the abovementioned period:

$$A = 100 \left( \frac{20.6}{16.08} - \frac{13.4}{16.08} \right) = 44.8.$$

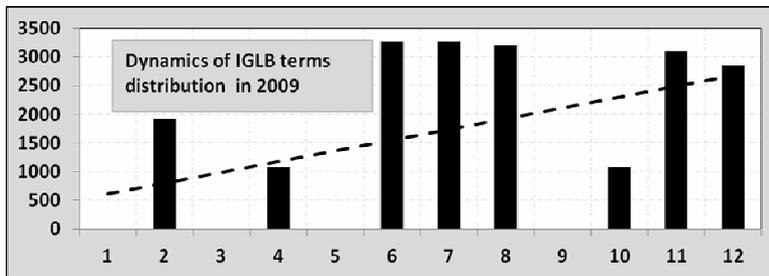
When the amplitude of fluctuations over five years reaches almost 50 percentage points, and the borrowings on the IGLB market reach a 10-year term, then the changes of the interest rate at fixed coupon payments bring risks for both the issuer, when the market trends show a reduction of the interest rate, and the investors when the latter risk to invest in low-margin bonds. And this low profitability, of course, turns out only later. This is not just a theoretical danger that hypothetically can be formed. This is a real situation that occurred on the financial market of Ukraine in recent years. Figures 3, 5 and 7 show how the average interest rates on IGLB changed in 2009, 2010 and 2011.



**Figure 3.** Dynamics of the interest rate on the IGLB in 2009

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].

Figures 4, 6 and 8 show the dynamics concerning the IGLB terms distribution, that is, the average duration (in days) to bonds repayment issued in 2009, 2010 and 2011. In other words, they show a term for which funds were borrowed in a certain month of a relevant year. As the interest rate of the attraction also changed during the year, so for the issuer it would be desirable that the funds will involve for a short term at a high interest and *vice versa* – the funds at a low interest involved for a long term. Obviously, the investor's interest will be the opposite, but to the point, until the issuer has no evidence of the default or bankruptcy.



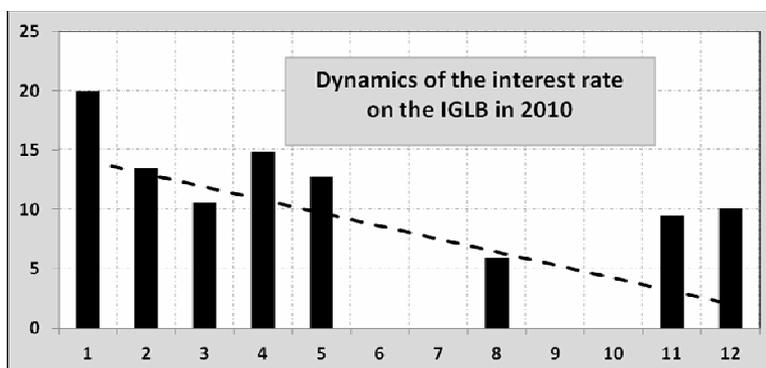
**Figure 4.** Dynamics of IGLB terms distribution on 2009

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].

The dashed lines in the figures mark the linear trend of the interest rates dynamics and the terms dynamics of funds involved. As can be seen in 2009, the Ministry of Finance of Ukraine borrowed money on the IGLB market for longer terms. On the one hand, this is good, because the payment term is deferred; on the other hand, the involvement took place against the background of the interest rate's growing.

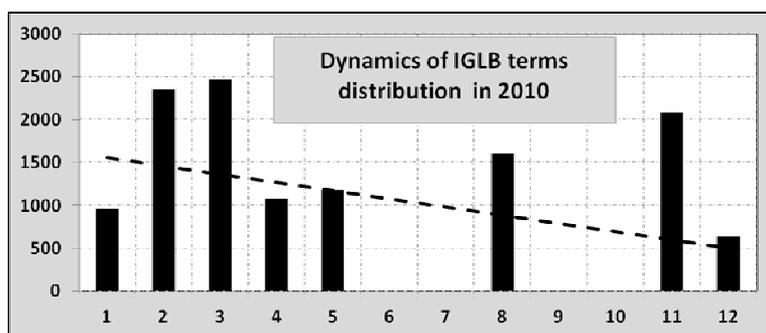
In 2010 again imbalance appeared: the interest, at which the government attracted funds, tended to decrease, but the terms for which the funds were involved during the

year also showed a decrease. Therefore, at the beginning of the year, long-term credits were involved at a relatively high percentage, and then short-term borrowings were involved at lower percentage. Again the involvement term and the interest at which the state involves funds are in imbalance, which is not in favor of the issuer.



**Figure 5.** Dynamics of the interest rate on the IGLB in 2010

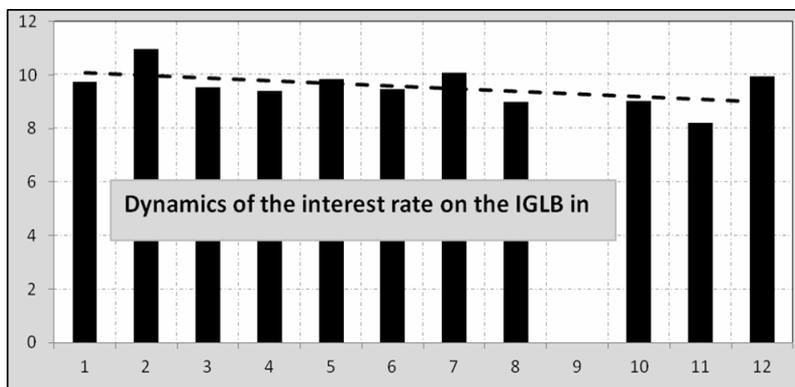
Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].



**Figure 6.** Dynamics of IGLB terms distribution in 2010

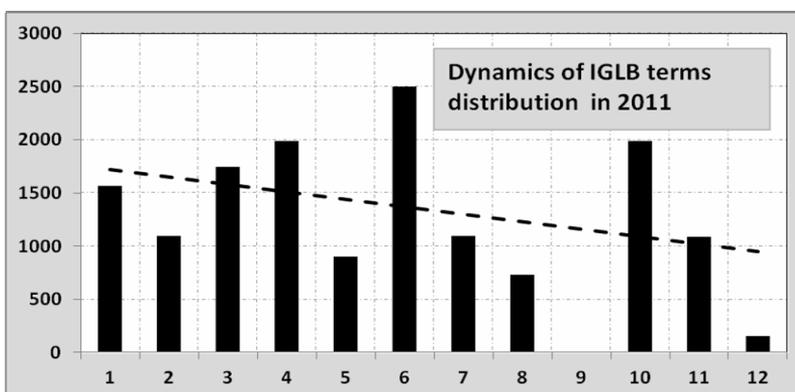
Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].

The year 2011 was characterized by relatively stable interest bonds on IGLB, which were issued by the Government of Ukraine (9–10%) with a small tendency to decrease throughout the year. But unfortunately the bond market conditions forced the government not to “guess” the terms of money attraction. Again, more expensive costs were involved for a longer period than more cheaper. For the investor, it is beneficial. For the government borrowings dynamics, it is a factor. This favors further trends of public debt increasing.



**Figure 7.** Dynamics of the interest rate on the IGLB in 2011

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].



**Figure 8.** Dynamics of IGLB terms distribution in 2011

Source: author's own work on the basis of the data from the Statistical Office of Ukraine [<http://www.ukrstat.gov.ua>].

#### 4. Approaches to optimizing the setting of the IGLB interest rate

Since the most defensible argument for the bonds with a variable coupon rate is their pricing behavior – with increasing of the base rate, the interest on a coupon also increases and with decreasing, it also decreases – so the securities quotation is more inert in comparison with other alternatives under a stable coupon rate. The issuer has the ability to optimize its obligations over time on an unstable market,

and the investor receives some insurance in the case of a significant increase in the base rate, and therefore these bonds can be as a conservative element of an investing portfolio.

This confirms the justification of the method concerning the possibility of the release by the Ministry of Finance of Ukraine of the IGLB with a variable coupon interest. The question of the frequency of changing the interest rate on IGLB should be connected with the term when one or another issue of IGLB occurs.

Consequently, the relevance of the approach concerning the possibility of the IGLB issue with a variable coupon interest by the Ministry of Finance of Ukraine can be confirmed. The question how often one should change the interest rate on IGLB should be connected with the term for which the IGLB issue is placed. European experience shows that for a long-term involvement (more than 10 years) the change of coupon rates on government bonds occurs every six months (at least quarterly). Due to a relatively low lending rate of the European Central Bank (compared to Ukraine's) for the last five years, which changed from 1.75 to 5.25% [<http://www.ecb.eu/home/html/index.en.html>], this range for Ukraine on the IGLB market was from 5 to 20%, that is, 4 times larger. In order to comply with the same "accuracy" of the interest rates dynamics as for Eurobonds with a variable coupon, one should change the coupon rate at least four times. This is confirmed by comparing the average absolute growths of the interest rates on Eurobonds and IGLB of Ukraine. If the "European" dynamics in 2008–2011 shows approximately the average of 0.01% per month [<http://www.ecb.eu/home/html/index.en.html>], then the absolute average growth of the interest on the IGLB in 2009, as Figure 3 shows, in Ukraine was:

$$\Delta_{2009} = \frac{15.60 - 9.66}{11} = 0.54\%$$

In 2010, as Figure 5 shows, this amounted to:

$$\Delta_{2010} = \frac{20.0 - 10.05}{11} = 0.9\%$$

In 2011 certain stabilization (almost "European") of this index was observed and the average absolute growth of the interest rates on IGLB was:

$$\Delta_{2011} = \frac{9.75 - 9.94}{11} = -0.02\%$$

If one does the averaging over three years, one will get the amount of 0.04%. Again we come to a conclusion that the domestic dynamics is four times larger, and therefore the change of the interest rate should occur four times faster than on Eurobonds for a variable coupon. This requires a corresponding correction once a month or every two months.

The disadvantage of the bonds with a variable interest rate, when the investor does not have the possibility to determine accurately in advance his or her revenue, is the offset by the decrease of the risks concerning the income acquisition and the growth of the reliability concerning the solvency of the issuer. Also, to some extent, it deprives the issuer of the possibility of issuing the bonds that are denominated in a foreign currency and avoiding range risks, which at the time of the economic instability are almost impossible to predict.

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<http://www.ecb.eu/home/html/index.en.html>

## METODY OKREŚLANIA WYSOKOŚCI STOPY PROCENTOWEJ WYKORZYSTUJĄCE ANALIZĘ DYNAMIKI RYNKU OWPP UKRAINY

**Streszczenie:** W artykule przedstawiono podejście do optymalizacji określania stopy procentowej na rynku obligacji państwowych Ukrainy. Zaprezentowana metoda bazuje na obliczaniu terminów zapadalności obligacji i na analizie ogólnej dynamiki stóp procentowych na finansowym rynku Ukrainy.

**Słowa kluczowe:** stopa dyskontowa, dług narodowy, obligacje państwowe, kupon ze zmiennym oprocentowaniem.