DETERMINANTS OF SOVEREIGN DEBT TERM FOR TRANSITION COUNTRIES

by

Andriy Bodnaruk

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Abstract

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by Andriy Bodnaruk

Chairperson of the Supervisory Committee: Professor [Name]
Department of [Name]

This study develops several testable hypotheses for government debt term and test one of them, namely, investors' expectations of inflating away debt by the government side. Empirical results show that in the situation when the government tries to borrow under the conditions which are not supported by the market investors signal about that with their feet – some of the auctions may not be carried out. In such a case of "market substitution" by the government money creating institution the effect of increasing debt to GDP ratio on incremental debt duration may be the opposite to what is predicted by the contracting cost theory.

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GLOSSARY

Credit Rating. Formal evaluation of individual's or company's credit history and capability of repaying obligations.

Maturity (of an asset). The period of time from the issuance of the security till the redemption date.

Moral Hazard. The risk that the existence of a contract will change the behavior of one or both parties to the contract, i.e. borrower will refuse to repay its debt or part of it.

Liquidity risk. The risk that arises from the difficulty of selling an asset.

Pooling Equilibrium. The outcome in the market for funds when investors can not distinguish firms of different quality, as there is no mechanism to prevent relatively bad firms to mimic the behavior of relatively good ones.

Screening. Inability of the borrower to rise funds in specific segment of the market due to its low credit rating and adverse selection effect.

Sovereign Debt. i.e., central government nominal debt.

Section 1

INTRODUCTION

Although factors that affect government debt financial decisions are now well-distinguished, most of the literature on the determinants of government borrowing focuses on zero-coupon bonds. The problem of minimization of the debt burden, i.e. debt/GDP ratio, is viewed as the choice of proper maturity length. This paper aims to show that a rationally acting government may increase the efficiency of its debt financing policies, i.e. decrease the costs of debt service, by influencing the level of the interest paid on its debt. Empirical results also show that in the situation when the government tries to ignore market mechanisms and borrow at conditions which are not supported by the investors considerations it will face credit rationing and have to borrow partially internally through its money creating institution.

Throughout this paper I assume the government to be a rational actor which aims to minimize its expenses of raising funds for financing expenditures and is fully knowledgeable about the means it can employ in order to reach its goals. Like any other borrower, the government is constrained in its abilities to borrow funds by its credit record, availability of funds in a specific time segment of the market, its overall debt outstanding, current level of interest rates etc.

The government is also concerned about the impact of its current actions on its future ability to borrow. This means that the government announces default or generates unexpected inflation only if the current gains from debt real value reduction outweigh present value of future losses from undermined credibility. Investors possess only publicly available information while there is some information about the quality of the government's ability to repay its debt, which is inaccessible to investors (i.e. I allow for information asymmetry).

Development of financial markets accelerated dramatically the voluntary flow of capital between countries during the last several decades. With capital flows going more freely to the places where they are valued higher, huge potentials for borrowing have been revealed. At the same time, as a number of countries experienced sustained increases in government debt/GDP ratios, a growing concern for more cost-effective financing strategies emerged. Missale and Blanchard (1994) give estimates that in 1985 for some European countries the debt to GDP ratio is as high as about 80% with Belgium and Ireland taking the lead at 110%.

High levels of indebtedness forced the governments to change the goals of their debt policies from the stability of financing through banks, associated with above market interest rates, to cost minimization in the open market. As DeBroeck et al. (1998) point out[1], governments now systematically aim at minimizing debt management costs. These costs consist of budgetary (accounting) and financial costs. In turn, financial costs include both the

interest costs and changes in the present value (capital costs) of the entire debt portfolio. As a result new financial instruments and methods have been widely introduced as a response to the changing economic environment, e.g. shift from direct placement of the debt to its market flotation, introduction of options, futures, and swaps[1].

This paper argues that given economic conditions in transition countries, acceleration of coupon payments may result in lower sovereign debt financing costs. However, if the government would try to borrow at the conditions, which are not accepted by the creditors, investors would leave the market and the government would be forced to access money from its money creating institution, e.g. Central bank.

Since I assume the government to be a rational agent, the choice of maturity and coupon payment of incremental debt issue reveals to us the point of minimization of servicing costs. The time horizon considered for discounting future losses or benefits for the government from its current actions is defined as the period of time needed for investors to "forget" about default or debt inflating out and put their money again into once defaulted economy. This value is very subjective and depends upon a number of reasons, e.g. expectations about bail out by some of international financial institutions (IFIs) like IMF or World Bank, changes in political regime or investment environment in the country of

[1] For detailed description of structural reforms in sovereign debt market over last several decades see **DeBroeck, Mark, Dominique Guillaume, and Emmanuel Van der Stichele**, *Structural*

consideration etc. Under conditions of no IFIs' intervention and stability of internal institutional setup, frequency of management rotation (~20 years) seems to be a plausible proxy for this time horizon.

I provide a brief survey of the existing theories of corporate debt financing and their applicability to the government borrowers, literature review and hypotheses development in Section II. Empirical implementa-tion is described in Section III. Results and Discussions come in Section IV. Conclusions sum up this paper in Section V.

Reforms in Government Bond Markets, IMF Working Papers, WP/98/108, August 1998.

Section 2

THEORIES DESCRIPTION, LITERATURE REVIEW, AND HYPOTHESES DEVELOPMENT

Theories and numerical case studies on the determinants of debt maturity choice focused mainly on corporate bond issues are useful in evaluating determinants of maturities for sovereign debt issues. According to Barclay and Smith (1995), there are three widely regarded nonmutually exclusive theories that have been offered to explain corporate debt issuance decisions: contracting-costs hypothesis, signaling hypothesis, and tax hypothesis. I provide brief descriptions of each of these theories with the peculiarities related to the issuance of government debt discussed separately within each theory. Each theory is followed by testable hypotheses that follow from it.

Section 2.1

Contracting costs theory

The contracting costs theory of debt maturity choice is based on a conflict between principals (providers of funds) and agents (managers or borrowers of funds). Agents may have objectives, e.g. maximization of enterprise

market share (for the private company) or investment into particular socially desirable project (for public sector authority), which conflict with principals'. This phenomenon is known as an agency problem[2].

Several points should be taken into account during the cost of borrowing determination. First, investment expenditures, once incurred, are largely irreversible; i.e. they are mostly sunk costs that cannot be recovered [either because they are industry-specific or due to adverse selection ("lemons problem")]. Second, investments can be delayed, giving the firm an opportunity to wait for new information about prices, costs, and other market conditions before it commits resources[2]. Therefore, each investment has an option value of being postponed.

The usually taught rule to "invest in a project when the present value of its expected cash flows is at least as large as its costs" is invalid and should be adjusted for the value of an option[3]. The value of these options depends

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[2] According to Allen, Franklin and Stephen Morris, *Financial Applications of Game Theory*, Wharton Business School working paper, 98-23-B, p.13 there are three kinds of agency problem for a private enterprise:

a) between stockholders and bondholders;
b) between stockholders and managers;
c) "debt overhang" , when the equityholders become reluctant to undertake profitable projects only because bondholders will have claim to a large part of cash flow from these.

Some of these kinds of conflicts are equally true for government borrowers with public authority playing a role of both owner of the project and manager of funds.

[3] $N(K_1)=b-?P'(K_1)+?C'(K_1)$, where $N(K_1)$ – expected present value of current and future marginal revenue products of capital, b – cost of purchasing capital now, ? -- discount factor, $P'(K_1)$ – marginal put option of selling the capital acquired now in the future at the price higher than now, $C'(K_1)$ – marginal call option of purchasing the capital in the future at the price lower than now.

For detailed description of the adjusted NPV rule for in-vestment decision making and its correspondence with q-theory of investment see **Abel, Andrew B., Avinash K. Dixit, Janice C. Eberly, and Robert S. Pindyck**, *Options, the Value of Capital, and Investment*, NBER Working Paper

on the likelihood that the firm will exercise them optimally, i.e. the projects would be undertaken under the most favorable market conditions.

Since option values increase in the risk of the underlying assets shareholders have an incentive to increase the riskiness of projects and so to divert the benefits transfer to debtholders[3]. This leads to distortion of investment decision-making and breeds conflict between stock- and debtholders. As Barclay and Smith (1995) argue, "the benefits from undertaking profitable investment projects are split between firm and investors. In some cases, bondholders capture enough of the benefits so that stockholders have an incentive to reject otherwise positive net present value projects.

With more growth options in the firm's investment opportunity set the conflict between insiders and outsiders is greater. The shareholders can control this incentive problem in several ways: by including less debt in the firms capital structure, by including restrictive covenants in its indenture agreements, or (what is important for this paper) by shortening debt maturity. For example, if the debt matures before any opportunity to exercise the real investment options, this disincentive to invest is eliminated. Thus, the firm, which has more growth options in its investment opportunity set, should employ shorter-maturity debt."

No.5227, August 1995 and also **Dixit, Avinash K. and Robert S. Pindyck**, *Investment Under Uncertainty*, Princeton, Princeton University Press, 1994.

A number of papers support the contracting-costs hypothesis. Myers (1977) showed that borrowers with high potential agency cost[4] of debt would shorten the maturities of their liabilities.

Barclay and Smith (1995) found that the firms with high growth opportunities have less long-term debt. They also find that (a) larger firms and (b) those with good credit ratings have more longer-term debt as the above properties lower the monitoring costs. Consistent with the results of Barclay and Smith (1995), Stohs and Mauer (1994) reported that long-term debt is most likely to be issued by large firms with low growth opportunities. According to Elton and Green (1997) liquidity is inversely related to maturity of corporate bond issues. Opler and Guedes (1996) find that large firms with investment grade credit ratings typically borrow at the short end and at the long end of the maturity spectrum, while firms with speculative grade ratings typically borrow in the middle of the maturity spectrum.

Governments do not issue equity and debtholders can hardly legally claim part of the country's GDP or other assets as compensation in the case of default. However, the conflict over following the conditions of the contract and the monitoring of the proper use of funds is still present in the

[4] According to **Morris, James R.**, *Factors Affecting the Maturity Structure of Corporate Debt*, unpublished manuscript, University of Colorado at Denver, January 1992 agency costs may be interpreted to include direct and indirect costs of financial distress; monitoring and bonding costs, including costs and constraints imposed by the presence of informational asymmetry; the opportunity loss incurred when debt financing leads to distorted incentives and suboptimal investment decisions by the firm.

case of governments' expenditures financing. Government's benefits from lower debt servicing costs come in a form of greater voters' support, which could be achieved by either lower tax rates or greater voters' satisfaction from the public sector performance (roads, parks, clean air etc). The lower interest governments should pay to investors for funds provision, the lower the levels of taxation on voters in order to repay the debt. Similarly, greater variety and quality of public goods provided by the government increases consumers' welfare. Hence, governments have incentives to retain the benefits from the projects they are involved in and their objectives do not necessarily coincide with objectives of investors. Higher levels of voters' support serve as a public sector equivalent to monetary rewards to stockholders in private enterprises.

Contracting costs theory provides the ground for several hypotheses about different factors that can influence government's debt instrument choice.

2.1.1 Expectations of Inflating Away Debt (Proxy: Debt/GDP ratio)

One way in which governments and corporate debt issuers differ is that governments can inflate their nominal debt, i.e. reduce the real value of their obligations through monetary expansion. Governments have an incentive to inflate nominal debt away as it decreases their debt burdens. They resist the urge of inflating away debt if the rewards are small, and the cost of lost reputation is high.

Another reason why the governments may inflate their debts away is a pressure from international financial institutions (IFIs). According to Phillips and Druckerman (1999) IFIs, which are being concerned about instant bail out of investors in developing countries, may at some moment require sovereign governments to reduce payments (in real terms) on their debt as volume of accumulated debt burden becomes substantial. Governments may fulfill these requirements by either trying to renegotiate the terms of borrowing with creditors or by printing money.

The essence of the conflict between providers of funds (investors) and the borrowers (government) is that as investors become increasingly afraid about lower (or even negative) real pay-off they start to require guarantees that their expected pay-off will not be altered by the government side. Therefore, an increase in the debt/GDP ratio with maturity of the debt portfolio held constant leads to higher expected inflation, which is reflected in higher inflation–risk premia required by lenders. By decreasing the responsiveness of the market value of the outstanding debt to volatility in nominal interest rates, the government decreases the potential gains from creation of unexpected inflation, thus signaling to investors that it has no intention to inflate the debt and calming inflation expectations.

Given that the rewards from unexpected inflation increase with debt level, and maturity, Missale and Blanchard (1994) argue that the government will keep its noninflational pledge credible by decreasing maturity as debt volume increases[4]. Ceteris paribus, shorter maturity of government bonds

implies lower sensitivity of the debt real value to unexpected inflation. Higher debt/GDP ratio would than have negative effects on maturity of issues and their duration. Markiewicz (1997, p.21) indirectly supports the idea of shortening the maturity of government bonds with higher indebtedness or persistent inflation: “the first half of the year was characterized by a low level of demand (for government debt). The most important reason was low demand for 26- and 52-week T-bills (that time longest debt securities of the Polish government), connected with a still high level of monthly inflation and a high risk of short-term investment”. Thus, government do not necessarily has to make steps to reduce maturity of the debt, as investors will signal about the necessity to change the structure of government debt market from the demand side.

However, from the arguments presented below in this paper it can be inferred that shortening debt maturity leads to higher costs of borrowing associated with poor or insubstantial credit record (liquidity risk and screening). Although shorter maturity of the debt leads to lower inflation premia on the same time it increases the investors concern about its ability to collect money at higher speed than before, which is reflected in higher default risk premia. Shortening debt maturities causes inflation pressure to fall, but default risk to rise.

An increase in the level of coupon payments also lowers debt duration. Higher coupon payments expose investors to higher reinvestment risk. However, higher coupons enable governments to shift the risk of the

problems associated with overly short repayment of the loan to investors. Thus, higher debt/GDP ratio would induce governments to raise the value of coupon payments and have negative effect on duration.

2.1.2. Central Bank Independence (Proxy: Central Bank independence index)

The main role of the Central bank in the modern economy is to preserve the stability and sustainability of monetary aggregates and other nominal variables. However, the ability of Central bank to devote itself to keeping inflation under control depends very much upon how independent it is from the government, specifically from the ministry, which is in charge of government spending. Complete separation of the functions of Central bank and the government leaves no room for the government for expanding its short-term expenditure capacities by printing money. On the other hand, Central bank subjection to the government transforms it into the manageable instrument of the government's policy. It might be said, that the degree of the central bank independence affects the depth of the conflict between government issuance agency and investors and imposes limitations upon government’s ability to cheat investors.

Governments would be more likely to follow the policy of inflating away debt when the central banks are not independent from them. According to theoretical papers by Emerson (1992) the more independent in the central bank the more its promise to keep inflation down will be believed and the

more it is capable in holding up inflationary pressure. The theory has empirical backing: several studies (Alesina and Summers (1990)) show that countries with independent central banks are better in keeping inflation low. For this paper it means that greater degree of central bank independence calms down investors' fears about the reduction of the real value of their sovereign debt holdings by governments' side and decreases the inflation premia investors' demand. This is a testable hypothesis that greater degree of central bank independence would lead to greater duration of government domestic debt through lower expected inflation premia.

2.1.3. Liquidity risk and Screening (Proxy: Credit Rating)

The risk of not being able to refund debt because of deterioration in financial or economic conditions can motivate governments to lengthen the maturity of their debt[5]. Diamond (1991) and Sharpe (1989) notice that bad news about firm's financial health coming at the refinancing date push investors to require higher default premia on new debt. Short financing may also trigger default at an intermediate date because lenders might early exit over refinancing. In this situation otherwise benefits-maximizing managers will be forced to undertake risky projects with negative NPV. Diamond (1991) refers to liquidity risk as the risk of a firm being forced into inefficient liquidation because refinancing is not available. Even if this extreme outcome isn't realized short-term debt can still cause a loss of project rents if it has to be refinanced at an overly high interest rate

because of credit imperfections, i.e. suboptimal investment policy (Opler and Guedes (1992), p.3).

Although liquidity risk forces some firms to borrow long-term, they may be unable to do so at any price. High yields on risky loans can induce a moral hazard problem – the willingness to pay high risk premia is a signal a would-be borrower is a bad risk, thereby deterring potential creditors from extending loans[6]. Only firms with high credit ratings could borrow long-term. Low-quality borrowers would be screened out.

Empirical papers by Opler and Guedes (1994), Barcley and Smith (1995) show that the inability of lowly ranked firms to access funds long-term and their unwillingness to borrow at shorter maturities places them in medium-time segment of the market. They found that the lower the credit rating of the firm the more short-term is the character of its debt obligations. At the same time, issuers with high credit quality would borrow at short and long maturities. The maturity choice in this case would be dictated by the investment opportunity set of each individual borrower.

Like any corporate borrower the government has its credit record, which determine credit risk premia investors would require on its incremental debt issues. Similarly to corporations' behavior, governments, which expect to have substantial improvements in tax collection in the near future, would prefer to borrow shorter-term to avoid unnecessary transfer of funds to investors. Governments, which lack investors' credibility,

would need to build credit record and borrow short-term trying to gradually move to longer durations.

Ukraine's OVDP have always been rated as a speculative (junk) bonds (BBB or lower) or lower. Hence, data should reveal a tendency for Ukraine to issue short-term notes with a trend toward medium-term notes.

Section 2.2

Signaling theory

According to Cuny and Talmor (1997), when investors and firm's insiders possess identical information, the liabilities of the firm will be priced in a way that makes the firm indifferent to the composition of its financial liabilities. However, Flannery (1995) argues that if the market's information is less accurate than insiders' information, firms of different quality will be indistinguishable to outsiders, who will treat high and low quality borrowers equally. A pooling equilibrium will result and firms of different quality would be assigned same interest rates. This averaging approach benefits low quality issuers at the expense of high quality issuers. High quality issuers could borrow at lower costs if information was equally known by insiders and outsiders. There is an incentive for good borrowers, which are under valued by the market, to help investors to recognize them.

Lenders would also benefit from knowing true information about borrowers. However, moral hazard hampers the direct transfer of information between market participants. Borrowers cannot be expected to be entirely straightforward about their characteristics. There may be substantial rewards for exaggerating positive qualities while verification of the true characteristics of the borrower by outside parties may be costly or impossible.

For projects of good quality to be financed, information transfer must occur (Flannery 1995, p. 21). Insiders' information may be transferred if the actions of entrepreneurs ("which speak louder than words") can be observed[7]. The firm can facilitate this transfer in several ways. The one of interest to us is to issue securities which are most overpriced (least undervalued) by the market, i.e. to issue bonds for which difference between market and fair discount rate is the greatest on the compounded interest rate basis.

Since the firm is assumed to possess information superior to that of private investors, the firm which is more optimistic than investors about its capacity to repay its debt considers all the market's required default premia to be excessive. However, the premium on long term debt appears to be the most unreasonable one because the market imputes a higher probability of credit quality deterioration than the insiders do. Ceteris paribus, a relatively bad firm would prefer long debt for the converse

reason. It follows that a firm's choice of debt maturity may signal its inside information to the market[8].

Flannery (1986) theoretically supports the signaling hypothesis. He shows that under asymmetric information with positive fixed transaction costs of debt issue, it is possible for relatively good borrowers to distinguish themselves by floating short-term debt. At the same time, relatively bad borrowers are forced to issue long-term debt since the benefits of mimicking the strategy of "good guys" would be outweighed by the costs associated with multiple issuance of short-term debt. Kale and Noe (1990) extend the analysis of Flannery for the case of positive correlation between performance of firms in different periods. They show that under positive costs of acquiring information separating equilibrium, when borrowers of different quality issue bonds of different maturity, is stable.

Since I assume the investors to possess only publicly available information government insiders are better positioned to judge about the prospects of the country as a borrower. Letting for information asymmetry I see the government as a party which tries to maximize its gains from the information symmetry and in this sense the government for me is not different from the corporation.

The hypothesis which naturally follows from the signaling theory is that greater levels of information asymmetry require borrowers to suffer higher transaction costs in order to bring the true information about themselves to

the market. This pushes them into the shorter-term segment of the market. In the presence of transaction costs longer-term debt will be optimally used by governments, which do not anticipate improvement in future cash flows. On the other hand, the use of short-term debt can signal optimistic expectations about government's tax revenue collection in next periods.

For the countries like Ukraine, which do not anticipate tax revenue collection to improve substantially in the future, it is expected to show evidence of movement toward longer-term bond issuance.

It is particularly difficult to observe and measure information asymmetry, especially for governments, which have no explicit value. In this case the choice of an appropriate proxy is very important. For corporate borrowers Smith and Watts (1992) find that the market-to-book ratio is significantly associated with the firm's observed debt choices, however, this proxy is of little applicability for sovereign borrowers. Morris (1992) links monitoring costs, asymmetric information and debt maturity by the size of the firm. According to the latter, the greater level of public information regarding large firms lowers the cost to creditors of monitoring them. Thus, lenders to large firms are less exposed to the risks of informational asymmetry, and firm size can serve as inverse measure of informational asymmetry, which is consistent with an argument that large firms are expected to use more long term debt because of lower transaction costs.

This proxy also looks plausible to be used a measure of asymmetric information in public sector as well as the largest economies are also best monitored.

Section 2.3

Tax Theory

The main point of the tax hypothesis of corporate debt is that debt maturity is responsive to the tax advantages of the debt to issuers, which, in turn, are determined by the shape of corporate tax function. Governments do not pay taxes on their own debts and are not concerned with tax shields benefits. Therefore, tax theory for corporate debt maturity structure can not be applied in its pure form to the government debt structure determination. The interest tax level, however, affects government debt maturity and coupon value choice indirectly by affecting the timing of tax revenues and investors' tax liabilities.

When governments rise debt interest taxes, interest rates they have to pay on their marginal debt issues go up immediately as the yield curve automatically adjust to keep after-tax real interest rate unchanged. On the other hand, governments collect larger tax revenues on the recently issued, but so far have not redeemed bonds, which owners did not anticipate such a move from the government and did not include this new tax premia into

their required after-tax return on investment. As a result credibility of government actions is undermined and investors would apply excessive risk-premia to new debt issues. Higher tax rates, thus, lead to higher borrowing costs and push governments to shorter-term debt issuing.

Empirical evidence in support of this hypothesis is presented in the paper by Eijffinger, Huizinga, and Lemmen (1996) who investigate the partial case of non-resident interest withholding tax. Eijffinger et al. (1996) find a one-to-one relationship between non-resident interest withholding tax, the pre-tax required yield on governments T-bills, and maturity of medium term notes. Therefore, Eijffinger, Huizinga, and Lemmen (1996) conclude that, ceteris paribus, governments, which increases interest withholding taxes (both for resident and non-resident investors) worsen its terms of borrowing today that results in shortening the maturity of the debt.

Discounted present value of investors' tax liabilities affects after-tax return investors receive. Ceteris paribus, higher investors' tax liabilities push them to ask for higher pre-tax interest rate and, therefore, lead to higher borrowing costs.

The problem of investors' tax liabilities effect is best developed in a literature on the tax implications of corporate debt maturity choice. Mauer and Lewellen (1987), Emery, Lewellen and Mauer (1988) and Brick and Palmon (1992) stress that, ceteris paribus, with a convex corporate tax function (corporate) borrowers tend to accelerate interest payments to

increase the present value of their tax shields, while lenders seek to deter interest payments to the future to minimize the PV of their tax liabilities. The upshot is that a maturity strategy that accelerates interest payments is more costly to the borrower, on before-tax basis, than a maturity strategy that slows down interest payments, since a premia has to be paid to lenders to induce them to accept larger tax bills[9].

Although governments, unlike the corporate borrowers, cannot exercise benefits of tax shields they do benefit from acceleration of interest payments as it leads to higher present value of tax revenues they receive from investors. However, governments can not go in this direction too far as increases NPV of investors' tax liabilities which causes demanded interest rates to rise.

A point should be made that there is also another reason for the government to accelerate repayment of the debt. By repaying debt in stages an issuer increases the credibility of its actions, thus driving down its default premium, i.e. improving its credit rating, and, therefore, being able to borrow at lower cost in the future.

The following citation from *Financial weekly, 11, 1999, p.7* backs the argument that repaying debt in stages, i.e. turning to issue coupon bonds, leads to rise in credibility of borrower's actions and lowers cost of borrowing in the future.

" Ukrainian Finance Ministry on March 16 paid coupons

> totaling EUR 73.75 mln. on its eurobonds, the ministry's press secretary, Irina Bezverkha, told Ukrainian News on March 17. "We paid yesterday. It was a scheduled payment and it was made," Bezverkha said. Ukraine floated EUR 500 mln. in two-year eurobonds through SBC Warburg on March 17 last year. The eurobonds carry a 14.75% annual coupon.
>
> "[The payment of the coupon] is a joyous fact because payments on loans have to be made. True, there is no money but all countries make payments on their eurobonds Otherwise, their assets will be frozen. Everyone understands this and within days we felt a rise in interest in our eurobonds among resident banks," said a representative of one of the Ukrainian banks with 100% foreign capital. "

As it could be inferred from the last paragraph payment of the coupon boosted investors' confidence in the credibility of government's promises and drove up demand for bonds. One may conclude, that if Ukrainian were to issue new eurobond issue at this time the cost of borrowing would be lower than few days before coupons were paid.

I expect higher interest tax rates to have negative effect both on maturity and coupon value. Overall effect on the debt duration is, therefore, ambiguous and will be tested in the empirical part of this paper.

Section 3

EMPIRICAL IMPLEMENTATION

Section 3.1

The Empirical Approach

In the previous sections I reviewed theories which suggest that investors' expectations of inflating away debt, liquidity risk and screening, degree of central bank independence, asymmetric information, and taxation are important determinants of government debt duration. I test these theories by investigating whether the duration of new government debt issues can be explained by proxies for theoretically important government characteristics. The main empirical predictions and predicted signs on proxy variables discussed in previous sections are summarized in Table I.

In this paper, I used the incremental approach for the evaluation of the impact of determinants of the maturities of government debt issues. Contrary to the balance-sheet approach, which considers the maturity of all liabilities the government has outstanding, the incremental approach examines the maturity of incremental debt issues. According to Opler and Guedes (1994):

> The incremental approach, for example, provides relatively weak test of theories, which relate properties of asset mix to the

> maturity of its liabilities. On the other hand, the incremental approach is providing better results when testing theories of maturity choice, which rely on a financial unit's short-term financial position or transient information about its future prospects. Another advantage of the incremental approach is that it can identify the determinants of financing choices at all points of the maturity spectrum[10].

The results are potentially sensitive to the reliability of data as they were provided by an independent non-government organization and may not fully reflect the dynamics of the Ukrainian debt market and economy development.

Section 3.2

The Data

I use the database of government debt issue from January 1996 until June 1998 compiled by TACIS, whose staff members monitored Ukrainian ministry of finance OVDP auctions. Issues in this database were excluded if the auction were announced to be as such that did not take place – there were 118 of them. These restrictions result in 970 OVDP issues to be used in my empirical analyses. Data items include the maturity date of new issues, issue date, issue features, and issue amount. Duration of the debt issue is derived from the available data using standard formulas:

D ? *duration*; *r* ? *yield to maturity*

$$\frac{dP}{P} ? \ ? D * \frac{dr}{1 ? r}; \quad D ? \frac{\sum_{i?1}^{n} i * \frac{CF_i}{(1 ? r)^i}}{\sum_{i?1}^{n} \frac{CF_i}{(1 ? r)^i}}; \quad \textit{where } P ? \textit{ price}; CF_i ? \textit{ cash flow in pe}$$

I measure debt/GDP ratio using TACIS data for monthly nominal not seasonally adjusted GDP and monthly nominal domestic debt outstanding. My results for expectation of inflating away debt hypothesis are potentially sensitive to the quality of data I had to work with. It was impossible for me to find data on amount of nominal domestic debt held by non-government institutions and organizations. Therefore, I had to substitute it for overall domestic debt outstanding, which does not perfectly correlate with the former variable as the share of the National bank of Ukraine on the OVDP market varied over time.

In my regression, weighted average (by number of securities sold) monthly duration of OVDP auctions is a dependent variable of monthly debt/GDP ratio. It resulted in 30 observations.

Section 4

RESULTS AND DISCUSSIONS

Contrary to expectations the accumulation of domestic debt as a percent of GDP has positive effect on duration of Ukrainian OVDP (Table II). For every 1% increase in debt/GDP ratio fitted value of weighted average duration increases by almost half a month. T-statistics of 6,10 make this result statistically significant at 99% confidence interval. The obtained result contradicts both contracting cost theory and empirical results achieved by Missale and Blanchard[11] (1994) for Belgium, Italy, and Ireland.

Although the results of regression analysis may look disappointing at first sight they are consistent with what was happening in the OVDP market during the period of observation.

According to TACIS, in the beginning of 1996 share of the NBU in the OVDP market was about 18% with all the rest occupied by both resident and non-resident investors. With country's debt burden increasing investors became worrying about government's ability to pay back its loans and pressed for a move to shorter maturities (durations). In its turn, the government wanted to borrow longer-term to defer payments of substantial amounts of money to later periods. In July 1997 inconsistency between demand and supply of OVDPs became substantial enough for bonds on a

few auctions to be not sold at all. By this lack of demand for bonds of longer than 3-months maturities (Table III) investors signaled to the government that if the government still wanted to borrow outside the NBU it should have followed market rules. Nevertheless, Ministry of Finance continued to issue longer-term bonds, investors started to leave the market, and their place was filled by the NBU: in the middle of 1998 share of NBU in the OVDP market was 60-65%. Here we can observe the phenomenon of “market substitution” by the government institution.

Chart I presents dynamics of quantity of OVDP actions which were announced as such that did not take place from January 1996 till June 1998. As soon as number (NTP: not taken place) and share (NTP/All; All – number of all auctions expected to be held during the certain month) is positive it means that there is a mismatch between the terms at which government wanted to borrow money and investors were ready to lend them to the government. One can see that from July 1998 onward the government did not care about sticking to the market requirements, which is reflected in permanently positive values of variables of interest.

Finally, as the NBU started to lend more and more money to the government it led to an increase in the money supply and additional inflationary pressure. Money supply growth combined with still increasing amounts of domestic debt outstanding at some point would have forced the NBU to give up current fixed exchanged rate. As we already know August of 1998 appeared to be the date of hryvna collapse.

Section 5

CONCLUSIONS

In this paper a number of testable hypothesis for government debt term are developed and one of them, namely, investors' expectations of inflating away debt by the government side is tested. I found that if the government tries to borrow under conditions, which are not supported by the market, investors signal to the government about that with their feet – some of the scheduled auctions may not be carried out. As a result, in the situation of "market substitution" by the government money creating institution the effect of raising debt to GDP ratio on incremental debt duration may be the opposite to what is predicted by the contracting cost theory.

Table I: Summary of Empirical Prediction and Proxy variables used

			Expected effect of Proxy on		
Theories	Determinant of debt term	Proxy	Maturity	Coupon	Duration
	Expectations of inflating away debt	Debt/GDP	-	+	-
Contracting costs	Liquidity risk and screening	Credit rating	+	*	+
	Central bank independence	CBI index	+	-	+
Signaling	Asymmetric information	Economy's size	-	*	-
Tax	Interest Tax Level	Interest tax rate	-	-	?

* -- theoretical prediction is not developed

Table II: Regression Estimating the Determinants of Government Debt Duration

LS // Dependent Variable is WADuration*
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.950884	0.567249	8.727880	0.0000
Debt/GDP	54.99882	9.006205	6.106770	0.0000
R-squared	0.571161	Mean dependent var	7.794326	
Adjusted R-squared	0.555846	S.D. dependent var	2.662707	
S.E. of regression	1.774558	Akaike info criterion	1.211444	
Sum squared resid	88.17360	Schwarz criterion	1.304857	
Log likelihood	-58.73981	F-statistic	37.29263	
Durbin-Watson stat	0.879634	Prob(F-statistic)	0.000001	

* WADuration – weighted average duration for auctions that happened in each of the 30 months in observation

Chart I
Dynamics of # of OVDP auctions that were announces as such that did not take place

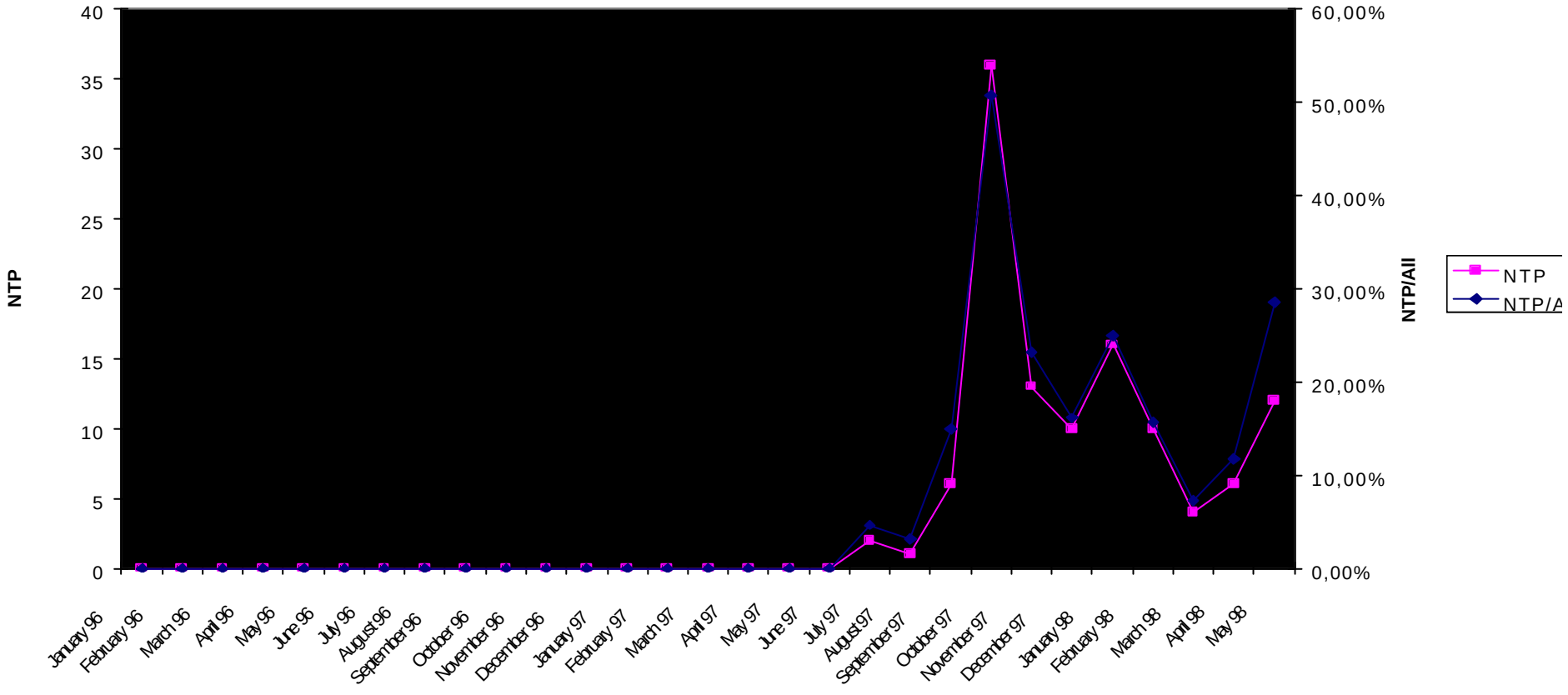

Table III
Monthly statistics on Number of Auction that were not Carried Out,
Weighted Average Duration of Debt Issues, and Debt to GDP ratio.

Date of auction	WADuration	debt/GDP	NTP3	NTP6	NTP9	NTP12	NTP
January 96	3,000	0,05%	0	0	0	0	0
February 96	3,518	0,07%	0	0	0	0	0
March 96	3,917	0,08%	0	0	0	0	0
April 96	6,419	0,13%	0	0	0	0	0
May 96	4,568	0,69%	0	0	0	0	0
June 96	6,304	1,11%	0	0	0	0	0
July 96	7,535	1,63%	0	0	0	0	0
August 96	7,168	1,70%	0	0	0	0	0
September 96	3,910	1,94%	0	0	0	0	0
October 96	4,907	2,38%	0	0	0	0	0
November 96	5,417	2,65%	0	0	0	0	0
December 96	5,501	2,91%	0	0	0	0	0
January 97	9,368	3,65%	0	0	0	0	0
February 97	8,560	4,22%	0	0	0	0	0
March 97	7,688	4,98%	0	0	0	0	0
April 97	9,008	5,40%	0	0	0	0	0
May 97	9,491	5,68%	0	0	0	0	0
June 97	11,293	6,87%	0	0	0	0	0
July 97	11,629	8,02%	0	2	0	0	2
August 97	11,683	8,63%	0	0	0	1	1
September 97	12,075	8,78%	0	1	3	1	5
October 97	11,847	8,68%	0	9	11	1	21
November 97	7,971	8,56%	1	3	2	1	7
December 97	8,028	8,87%	2	2	0	3	7
January 98	9,125	9,00%	1	11	1	3	16
February 98	9,835	9,48%	0	3	2	5	10
March 98	9,087	9,60%	0	0	1	3	4
April 98	8,974	9,58%	0	0	0	3	3
May 98	9,817	9,55%	0	0	0	2	2
June 98	6,189	10,20%	0	0	1	1	2
Overall for the period			4	31	21	24	80

where NTP3 – number of 3 months auctions that were not carried out

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