Considerations and implications of issuing sovereign bonds: the case of Mongolia

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Master Essay

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Abstract

The following paper aims to assess Mongolia's recent decision to engage in its first issue of sovereign bonds, announced for the fall of 2010. To this end, both a qualitative and a quantitative analysis of the bond characteristics and implications were conducted. The comparative country analysis provides insight into previous activities on the sovereign bond market, and helps estimate the expected maturity, coupon rate and denomination of the bond. As regards the debt size, a model is developed based on historical data, and then used as framework for the forecast of future country indebtedness. In the end, taking into account all predictions of bond characteristics, and employing the derived econometric model, this work concludes whether Mongolia is able to sustain an issue of sovereign bonds of the announced size.

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I. INTRODUCTION

Throughout the last two decades, the world economy has undertaken radical transformations brought about not only by changed political perspectives, but also by a greater degree of openness to means of raising financing. The developed world started looking in more depth at opportunities in developing and transitioning countries and encouraged their attempts at gathering funds to support their development. One of the means by which such countries can raise debt is by issuing sovereign bonds. Sovereign bonds are bonds issued by a national government and its particular characteristic is that the owner of such a bond may not have any bankruptcy guidelines to turn to in the case of default, as this credit event is typically determined politically and by macroeconomic variables (Di, 2005).

The recent growing popularity of sovereign bond issuance has put under question the advantages and drawbacks of such a decision and the aspects to be considered ex ante and ex post. In their paper on the strategic considerations of the decision to start issuing sovereign bonds, Das, Papaioannou and Polan (2008) believe that the primary benefit of going on the international financial market in this way is building up greater domestic savings. Apart from that, greater leverage could enhance discipline on the broader economy's level, help the country establish a name in the international capital markets and attract more investors. However, all this can only be possible given a scenario of sustainable debt levels.

There are, of course, also risks associated with accessing the international bond market. As the main basis of these instruments is confidence in the future of a country, stability and consistency in macroeconomic policies is an important aspect. The issuer's foreign currency risk exposure, future financial position and liquidity needs, as well as trade effects are important factors which can strongly impact the success of issuing sovereign bonds. This is why extensive research, feasibility tests and projections are required in order to ensure the country is not made more vulnerable through this debt raising activity (Das, Papaioannou & Polan, 2008).

This paper intends to analyze sovereign bonds not only on a general level, but also particularly test the implications on Mongolia's case, a country which has announced its plans to enter the sovereign bond market in October 2010. As the exact characteristics of the expected bond issue are not yet fixed, this work will also suggest the optimal amount of debt

based on econometric estimations, propose a suitable currency denomination and term to maturity of the bond based on a comparative analysis across countries with similar profiles.

II. BACKGROUND AND COMPARATIVE COUNTRY ANALYSIS

1. MONGOLIA

Firstly, it is important to understand Mongolia's macroeconomic and financial background. With a population of 2.66 million people, mostly concentrated in the capital Ulaanbaatar, Mongolia is one of the countries which transitioned to market economy in 1990 after the fall of the Soviet Union. The reforms undertaken in the last twenty years focused on stabilizing the currency, privatizing state-owned companies and developing the private sector. The economy's main drivers are agriculture and mining, and these factors have led to a growth in GDP above 10% per year in 2003-2008 (Mongolia: Microfinance and financial sector diagnostic study, 2009).

An extremely attractive characteristic of Mongolia is its impressive natural resource endowment, and consequently, its great potential in trading these riches. Foreign investors have been drawn to Mongolia by the extensive copper, gold, coal, molybdenum, uranium and tungsten deposits, and these resources are also the drivers behind the country's economy. The support received by the country from the Soviet Union amounted to a third of the GDP, but with the disappearance of the USSR, Mongolia had to cope without any assistance. Therefore, starting 1990, Mongolia went through various ups and downs, managing through recessions and adverse weather events, as well as thriving under new reforms and free market economy (CIA – The World Factbook – Mongolia, 2010).

The period 2000-2002 was marked by extreme weather conditions which affected agriculture and resulted in GDP losses. However, over the years following 2004, Mongolia grew at an average 9% per year owing to the soaring copper prices and the exploitation of the gold reserves. The global economic crisis affected Mongolia in late 2008, as commodity prices suffered a shock and pushed spending below previous levels. An important event occurred in October 2009, when the government agreed on investment plans to develop the Oyu Tolgoi mine, deemed among the world's greatest unexploited copper deposits. In spite of its immense riches, Mongolia still has very strong dependencies with its neighbours: it imports petroleum and electricity from Russia, and two-thirds of all exported goods are bought by

China. This leaves Mongolia extremely sensitive to price changes applied by Russia and to eventual alterations in its terms-of-trade with China (CIA – The World Factbook – Mongolia, 2010).

As regards the Mongolian financial sector, it is dominated by banks – the Bank of Mongolia and commercial banks – which control the majority of all assets. This dependency on the banking sector has been an impediment to the country as banking crises hit in the 90s, but the last years witnessed a notable recovery and great increases in the number of loans outstanding. However, the beginning of 2008 showed signs of decline in the profitability of the banking sector and posed questions about the macroeconomic stability of the country overall. The economy suffered a setback due to the fall in copper prices, as the country's foreign currency reserves were deeply affected and liquidity problems drove the entire system into a slowdown (Mongolia: Microfinance and financial sector diagnostic study, 2009).

The strong positive developments in economic growth and debt management had decreased external debt to a record level of 33% of GDP in 2008. In spite of the severe situation experienced by the country due to the economic crisis, growth is expected to stabilize at a sustainable level starting 2013. This is when the Oyu Tolgoi mine has been scheduled to start production and significant current account surpluses are expected to arise. According to the IMF, Mongolia will go through a recovery phase during 2010-2013, after which projections indicate that the country could improve its access to external funding after 2013 through cheaper and less restrictive borrowing terms (Mongolia: Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009).

From the pool of countries which have issued sovereign bonds, we selected three which are most similar to Mongolia in their resource endowment, dependency on foreign investors and overall instability. These three countries illustrate the most probable, best and worst case scenario respectively. We begin by looking at the closest country, both geographically and in what regards its dependencies.

2. UKRAINE

Ukraine suffered a series of economic problems at the end of the 90s, which were caused by its strong tie to the Russian economic and political environment. Just as Mongolia, Ukraine is influenced to a great extent by its biggest trade partner, Russia, and boasts significant mineral reserves. Therefore, one of the great causes for volatility in its economy is the terms of trade for its exported goods. Strong competition on the market for steel and iron affects negatively the prices and considering that these exports are the driving force behind the entire economy, any external crisis on the commodities' market will hit Ukraine harder than others (Gritsenko, 2009). Another key factor is political risk, which has been a current problem ever since Ukraine gained independence and for which there are no prospects of improvement in the near future. Conflicts in the local political arena are strongly correlated with the economic downturn experienced lately through the fall in the currency, the need for IMF assistance and the hit taken by the steel industry on account of the low commodity prices (Ukraine: Running out of options, 2009).

Ukraine entered the market for sovereign bonds in August 1997, with an issue of bonds denominated in US dollars, with a total value of 450 million USD and a maturity of one year. Compared to other emerging market bond issues, Ukrainian bonds had a very low time to maturity and, consequently, did not pay out any coupons (Grigorian, 2003, p. 19). The country's long-standing dependence on external support created a significant pool of loans which could no longer be repaid in 2000, as initially agreed. Ukraine defaulted on its bonds denominated in USD and DM and debt restructuring ensued in the form of exchange agreements (Sovereign default and recovery rates, 1983-2008, 2009, p. 18). Estimates place the recovery rates on these bonds issued between 1998 and 2000 in a range from 40.8% to 81.8%, with international bonds' recovery rate at 59.9% (Sturzenegger & Zettelmeyer, 2008, p. 793).

These unfortunate events should provide an important lesson to learn from in what regards the decision to attract funds using sovereign bonds. Both Mongolia and Ukraine suffer from poor domestic markets and are highly dependent on the economic situation of the neighbouring countries. Just as Mongolia exports great amounts of coal to China, Ukraine depends on the world demand for steel and iron, and continues to import gas from Russia (Gritsenko, 2009). These interdependencies weaken the stability of these countries and global

economic downturns in the commodity market can have catastrophic effects on their financial position.

Mongolia should consider the case of Ukraine as the worst scenario and properly assess its financial position in order to prevent default at all costs. The high spreads generated by low confidence and high risk of the country have placed Ukraine in a quite critical position where its only solution is to turn to take on further debt from Russia (Apps, 2010). Considering this, Mongolia needs to ensure that its position is covered and that its takes on a sustainable amount of debt, so as to prevent future economic and political issues from arising.

There are also some positive lessons to be learned from Ukraine's return to the international capital market with Eurobond issues subsequent to the default. As the domestic debt market could not meet the country's needs, it had to turn to external financing means, such as foreign assistance and revenues from privatizations. The external environment was in Ukraine's advantage, GDP had grown significantly in 2000-2002 and public debt had decreased to a sustainable level. These are the circumstances in which Ukraine managed to re-open the Eurobond issues towards the end of 2002 and access the international capital markets even before the IMF concluded its assistance program (Assessing the determinants and prospects for the pace of market access by countries emerging from crises: Further considerations, 2005, p. 14).

On the basis of the 2002 success, Ukraine issued two new sovereign bonds in 2003, both with a ten-year maturity, and managed to push the spreads very low, due to oversubscription. The costs of these loans were much lower than the ones incurred by the 2002 issue and suggest greater confidence in the country's prospects and improved rating in the international markets (Assessing the determinants and prospects for the pace of market access by countries emerging from crises: Further considerations, 2005, p. 14). This impressive comeback also highlights the importance of seizing the opportunity in the global market and using the country's internal improvements to boost investors' perspectives on the future. It is important not only to time the market, but also to make positive changes through better administration and reforms that can bring the country back on track. Mongolia needs to adequately assess its capacity to pursue such value-enhancing policies in the medium- to long-term, as well as capture the trends in the global economic arena before committing to a new debt issue.

3. INDONESIA

Apart from Ukraine, Indonesia is another country which can be compared to Mongolia from the point of view of the issues it is confronted with. On a constant basis, Indonesia is dealing with poverty, corruption, devising appropriate economic and financial reforms, and is highly reliant on the exports of oil and natural gas to other Asian countries and the US (CIA – The World Factbook – Indonesia, 2010).

The economy suffered a great shock during the Asian financial crisis in 1997, but now it is projecting a stable growth rate of around 6 to 7% for the coming years. Analysis shows that Indonesia's exports have been underperforming compared to other Asian countries and possible explanations lie in the lower foreign direct investment and reduced cost competitiveness. The country has been set back by various natural catastrophes in 2004 and 2006, but the greatest impact to the economy came from soaring oil prices in 2005. Although Indonesia has been performing positively during the last years, improvements are still necessary in order to ensure a good investment climate and full international trade integration (Indonesia – European Community Strategy Paper, 2007).

Compared to other countries, Indonesia has been very adept at managing its public debt, bringing it down from over 90% of GDP in 1999 to an impressive 57% of GDP in 2004. The explanation for this phenomenon lies in the higher growth in GDP compared to the increase in debt and the maintenance of a fiscal surplus both before and after the crisis (Ishikawa, 2005). Indonesia is thus an example to follow in this matter, and provides a good benchmark to ensure that the amount of debt does not overwhelm the country's economy.

In spite of the impressive track record in the early 2000s, the global financial meltdown left a mark on Indonesia by raising its external borrowing costs. The country spreads jumped to almost 1,200 basis points from about 200 basis points before the crisis. Fiscal policies and reforms in the financial sector helped Indonesia decrease its spreads in 2007, but the sudden increase witnessed at the onset of the financial crisis raised questions (Indonesia: Selected Issues, 2009). In the IMF Country Report from June 2009, entitled *Indonesia: Selected Issues*, a "spreads model", which incorporates both local and external variables, is used to explain the fluctuation in the spread. The results are easy to interpret: the highest impact came from the external factors, followed by political and finally macroeconomic factors.

Therefore, the external environment can have a very serious effect on sovereign spreads in the case of a country with a proven track in volatility, but there are also many other factors which can have an even greater impact on a country's borrowing costs. Possible suggestions for Indonesia's policy makers would be to keep inflation low, forge agreements that would give access to affordable external financing and approaching fiscal policies from a medium-term perspective (Indonesia: Selected Issues, 2009).

These ideas can apply very well to Mongolia's case as well and should be taken into consideration as valid points when assessing the optimal debt level for the future. The perspective should be skewed to the medium-term, and buffering the impact of higher indebtedness by having other cheap external financing options could prevent future distress situations. Indonesia's profile and long-term performance resembles Mongolia's to the greatest extent, so some of this research could provide valuable insight into how to manage the crisis and how to ensure sustainable performance even with higher spread and debt levels.

4. CHILE

After having analyzed a worst case scenario and a closest comparable country, we also selected a country that shares some common characteristics with Mongolia but which has been quite active in the sovereign bond market and can provide a positive example to follow. Chile became a democratic nation in 1990 and throughout the last decades has enjoyed strong financial institutions and consistent economic policies and which have granted stability to the country. Similar to Mongolia, it is very rich in copper and generally commodities are the driving force of the economy. The country's GDP grew at about 8% per year from 1991 to 1997, but experienced a crisis during 1998 and 1999. After these critical years, growth stabilized at 4%. Chile maintains a counter-cyclical fiscal policy system which protects the economy in periods of recession and low copper prices, and the reserves accumulated in this way were used in the last two years to boost the economy despite the global downturn (CIA – The World Factbook – Chile, 2010).

Concerning the history of Chile's sovereign debt, the government started issuing bonds at the beginning of 1999 in order to take advantage of its positive assessment received from international investors and rating agencies and to create a public benchmark for subsequent issues of corporate bonds. Moreover, this move would facilitate external evaluations of the

economy's well-being and provide an efficient signaling method for all investors. Chile issued sovereign bonds first in April 1999, then in October 2001, April 2002 and January 2003, according to Rojas and Jaque (2003). The first two issues and the last one were denominated in US dollars and had a ten-year maturity, while in April 2002 the government also issued euro-denominated bonds with a three-year maturity. Chile's bond spreads exhibited much greater stability than other Latin American countries' and its macroeconomic stability was recognized also by Moody's and Standard & Poor's in the investment-grade ratings they awarded Chile (Rojas & Jaque, 2003).

An analysis of the sovereign spreads' determinants gives insight into what determines the cost of external financing for an entire economy. In the case of Chile, the spreads are strongly influenced by the ratio of short-term debt to international reserves, which is actually an indicator of international liquidity. Logically, lower liquidity on the global market would lead to higher spreads. Moreover, more intensified exports and higher economic growth would decrease the country's financing costs as investments in the economy become relatively safer. Chile is also affected by fluctuations in US interest rates, as these determine the degree of liquidity on a global level (Rojas & Jaque, 2003).

Such an analysis illustrates the importance of external factors on the evolution of sovereign bonds and provides suggestions on what factors to keep under check when assessing Mongolia's case. We consider Chile as the best case scenario as it is one of the countries which have successfully used sovereign bonds to enhance its economic position. Its spread determinants are also of interest in the analysis on Mongolia because of the similar country profiles in what regards the economic drivers. Mongolia could learn from Chile that more intensive trade agreements and counter-cyclical policiesprove can enhance the country's financial position and hedge the economy against global shocks. The dependency on commodities trade calls for a risk management mechanism that can protect the overall economic system in periods of low prices by accumulating reserves in periods of high prices.

5. IS MONGOLIA READY? QUALITATIVE RESULTS FROM THE COMPARATIVE ANALYSIS

The comparative analysis conducted above has the purpose of answering a key question in what concerns Mongolia's intentions of issuing sovereign bonds: Is Mongolia ready for such

a step? Will this decision further the country's long-term goals or hamper its development by imposing even more obligations? Assessing the situations of other countries helped give insight into what should be avoided and what measures could advantage Mongolia.

The case of Ukraine highlighted how dangerous all country interdependencies can be and how the macroeconomic fluctuations can severely impact a country up to the point of default. When the domestic market is so weak and external support is always necessary, issuing additional debt could put the entire system in great distress. Indonesia went through crises as well, but applied effective fiscal reforms that would protect the economy in the medium-term. In spite of its problems with poverty, unemployment, corruption and inefficient regulatory system, Indonesia learned to keep its indebtedness low enough to not place the country in distress in periods of recession. This example also teaches about the importance of having alternative (and relatively cheap) options of financing in case external support is necessary. Chile is a true model in what regards keeping control over natural resources and turning economic cycles to the economy's advantage. The counter-cyclical system employed in Chile protects the country from shocks in commodity prices and reforms improving the economic and political stability helped earn Chile a very good country rating in the international market.

Mongolia has been making considerable progress in the last decade as well, but structural problems such as corruption, political instability and reliance on exports to neighbouring countries still place it in a delicate position. Projections indicate that with the beginning of copper production from the Oyu Tolgoi mine in 2013, the country will enjoy stable growth and substantial current account surplus. However, there is always a degree of risk associated with such a venture and the country is about to take on debt in the fall of 2010. IMF believes that external debt will not become a serious problem for Mongolia, even though it might resort to increased borrowing in 2009-2010 to meet fiscal needs. The risk of distress is considered low, but the assumptions rely on the success of the Oyu Tolgoi project, which would cover any deficits that might have to be incurred before 2013 (Mongolia: Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009).

IMF also analyzed the possibility that Mongolia accessed the sovereign bond market in 2009 and contracted additional debt of 200 million US dollars as a result. Estimates place

Mongolia in the B-rated group of countries, along with Pakistan, Lebanon, Argentina, Ecuador and Ukraine (it should be noted that these countries have already defaulted). On this basis, and taking into consideration the current conditions on the international market, Mongolia's first sovereign bond issue could have a quite high spread, of about 1500 basis points. There is a possibility of receiving institutional support in this issue and decreasing the spread by improving the market confidence, but in any case, this issue would drive external debt slightly beyond the thresholds (Mongolia: Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009).

Overall, the IMF estimates paint a quite positive picture of Mongolia's creditworthiness and future prospects in dealing with its debt burden. However, they all assume successful and timely exploitation of the Oyu Tolgoi copper reserves, as well as low or no significant shocks to copper prices in the medium-term. Mongolia is also expected to promote prudent policies which foster stability, but given the typically high political risk, this aspect should still be treated as a variable. Therefore, it is very important to properly quantify the risk associated with Mongolia's future plans and to assess how additional debt will affect the country's financial position.

III. THEORETICAL FRAMEWORK: OPTIMAL DEBT STRUCTURE ANALYSIS

Recently, with more and more emerging economies entering the sovereign bond markets, numerous studies have been conducted to analyze the optimal debt structure for the first-time issuers and the probability that those might default, depending on the local economic, financial and political conditions. Determining the best amount of debt for a first-time issuer is highly complicated, since the inferences must encompass the overall stability of the political system, social aspects, and the exposure of the economy under question to the international macroeconomic environment and to the global financial system.

In this section, for comparative purposes, we refer to four academic papers with entirely dissimilar and independent hypothetical approaches. The first one can be treated as the most complex, in terms of its theoretical and empirical underpinning, but the complexity of the analyses decreases with the sequence. The last study, because of its straightforward and explicit methodology, has been selected and applied to the case of Mongolia. The estimation

results will be presented further in the section IV. We will also refer to the first and third studies in our empirical prognosis.

Model I: Erce (2008)

Erce (2008) makes a great contribution towards estimating the role played by domestic and international financial market conditions in the composition of the sovereign bond structure of an issuer. The paper employs a structural model, which takes account of financial and demographic conditions in target developing economies. The model is implemented on a sample of public bond issues over the period 1990-2005. The data includes values attributable to maturity, spread, amount issued, currency denomination and credit rating.

The main goal of the paper is to analyze how the size and maturity of the debt issue are jointly determined. The analysis is represented in a supply - demand equilibrium model of the following form:

$$(1.1) \quad M_{it}^{demand} = \alpha S_{it} + \theta_M X_{it} + \omega_{it}^{D}$$

$$(1.2) \quad M_{it}^{supply} = \beta S_{it} + \theta_s X_{it} + \omega_{it}^{S}$$

$$(1.3) \quad M_{it}^{demand} = M_{it}^{supply} = M_{it}$$

Where M_{it}^{demand} is the preferred maturity for the central government, M_{it}^{supply} is the preferred maturity for the investors, S_{it} and M_{it} are the spread and maturity of the bond issued by country i at time t. Both S_{it} and M_{it} are endogenous variables and X_{it} is the vector of exogenous variables. The errors (ω_{it}^{D} and ω_{it}^{S}) are assumed to be well-behaved, that is:

$$E(\omega_{it}^{D}) = E(\omega_{it}^{S}) = E(\omega_{it}^{D}\, \omega_{it}^{S}) = 0$$

After certain manipulations the author derives the following outcome:

$$(1.4) \quad Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it}$$

Where Y_{it} is country i's access to the international financial market at period t. B is a 2x2 nonsingular matrix and Γ is a 2xK matrix of exogenous factors. ε_{it} is I.I.D. When the issuance decision is analyzed with a Probit model, the equation (1.4) takes the following format:

$$Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it} \qquad if \qquad I_{it} = 1$$

I_{it} takes the value of 1 if the country taps the international capital market at time t. When this issuance decision is incorporated into the analysis, the model transforms into:

$$(1.5) \quad I_{it} = \Psi X_{it}^{I} + \upsilon_{it}$$

That is, equation (1.5) is the issuance decision.

The paper also derives political risk. First it regresses the sovereign credit ratings against a set of macroeconomic factors with OLS (ordinary least square) method:

$$rating_t = \theta X_{it}^{\ rating} + \varepsilon_{it}^{\ rating}$$

The suggestion is that the residual term can be seen as a measure of political risk:

$$\varepsilon_{it}^{\ rating} = rating_t - \theta X_{it}^{\ rating}$$

Thus, the higher are the rating residuals, the higher political risk they indicate.

At the end, the study estimates the issuance decision – equation (1.5) – with an already obtained political risk ($\varepsilon_{it}^{\ rating} \in X_{it}^{I}$), estimates the size variable with those external factors relevant to its formation and, finally, simultaneously determines the spread and maturity terms with a structural model.

Erce (2008) concludes that: "better developed domestic financial markets and looser international financial conditions raise developing countries ability to tap international markets." Also these two complementary conditions appear to be important determinants of the sovereign debt structure and substantially affect the spreads. The results are quite intuitive, yet from this study it can be learnt that the assessment of the domestic and international market conditions, their interdependence and the various scenarios which may affect their future image, are crucial in the determination of the optimal debt structure for a country like Mongolia.

Model II: Grigorian (2003)

Grigorian (2003) looks at the determinants of a country's overall debt structure. With a comprehensive macroeconomic model, the paper explicitly derives the relationship between three imperative aspects of the decision to tap international capital markets: internal factors, external factors and a possible market access. The analysis, most importantly, suggests that the possibility to access global markets primarily depends on the existence of excess demand for the sovereign bonds to be issued by the central government.

The model emphasizes five main steps of the general process:

1. The sovereign determines the amount it needs to borrow by estimating its demand for external funds, which is a decreasing function of the cost of borrowing. The computed demand function crucially depends on the internal economic conditions.

2. The sovereign estimates the supply of external funds (investors' willingness to purchase), which is affected by the intrinsic risk profile - the credit rating of the country. It is an increasing function of the rate of return on the bonds to be issued.
3. The spread is then computed as (r^*+s^e) where r^* is the global interest rate.
4. At this stage, the authorities decide whether or not to issue the debt instrument. The issue takes place only in the case if there is excess external supply of funds at the pre-calculated rate of $(r^*+ s^e)$. The amount of the issue is fixed depending on the size of the excess supply.
5. An offer is made, either at (r^*+s^e) or at a different spread, following the central government's discretion, also based on the excess supply.

The paper derives the following linearized forms of the equations for the demand and supply functions, which can be estimated. These are derived from the constrained optimizations of the respective utility functions of the agents in the borrowing and creditor countries.

(2.1) $D_{t+1} = \gamma_0 + \gamma_1 W_t + \gamma_2 G_t + \gamma_3 Y_t + \gamma_4 B_t + \gamma_5 r_{t+1} + \varepsilon_{t+1}$

(2.2) $St = \gamma_0^* + \gamma_1^* Y_t + \gamma_2^* r^* + \gamma_3^* Y_t + Er_{t+1} + \varepsilon_{t+1}$

where Y_t *– national output*

G_t *- government expenditures*

B_t *- total indebtedness to the rest of the world*

W_t *- value of the stream of net future income*

r_t *- time-varying interest rate*

r^* *- the constant global interest rate*

Er_{t+1} *- the expected interest rate*

Following this study, a country should issue sovereign bonds only if it can identify an estimable degree of investors' willingness to purchase its bonds overcoming its demand for foreign funds. That is, if and only if $S_{it} - D_{it} > 0$.

Model III: Afonso (2002)

Afonso (2002) analyzes the determinants of sovereign debt ratings assigned by the two most influential credit rating agencies, Moody's and Standard and Poor's. The author uses linear and logistic transformations of the rating scales, employs those as the dependent variable, selects a set of explanatory variables and conducts a regression analysis on the sample of 29 developed and 52 developing countries. The author chooses this approach because the credit

ratings, in his view, represent the assessment of the overall situation in the borrowing nation and indicate about the country's development. Moreover, lower ratings lead to higher yields subscribed to the bond issues and, consequently, raise financing costs to the governments leading to higher default risk.

The paper by Afonso (2002) recruits the rating classifications of S&P (and Moody's), such as from AAA (Aaa) to C(C). It selects only those sovereigns with high quality, above B-(B3), ratings. Then it constructs a new variable *RATING*, which takes the value from 1 to 16 depending on the country's credit rating. For instance, 1 stands for the highest scale AAA (Aaa) and 16 represent the minimum B-(B3). The cross sectional regression of the following form is then carried out on the dependent variable *RATING*.

$$(3.1) \quad RATING_i = \alpha_0 + \alpha_1 GDPPC_i + \alpha_2 INFL_i + \alpha_3 GDPGR_i + \alpha_4 DEVELOP_i + \\ + \alpha_5 DEBTX_i + \alpha_5 DEFAULT_i + \alpha_7 BUDGET_i$$

The set of explanatory variables included in the analysis are the following: ***GDP per capita, inflation rate, GDP real growth rate, development indicator, default indicator, external debt-to-exports ratio****, government deficit as percentage of GDP, current account deficit as percentage of GDP, central government spending as percentage of GDP and debt-to-GDP ratio.* Both the development and default indicators are dummy variables which take the value of 1 if the country is developed or had previously defaulted on its obligations. The paper concludes that the first six highlighted variables are most significant in explaining the creditworthiness of a sovereign.

Therefore, when suggesting on the optimum bond characteristics of the first-time issuer, one should take into account the above-mentioned variables. This matter will be addressed in more detail in the empirical tests section.

Model IV: Ramsey, Gritz and Hackbart (1988)

The last study in the sequence, by Ramsey, Gritz and Hackbart (1988), the most straightforward and least complex, is considered to be the most applicable to the case of Mongolia. The analysis has been conducted in 1988 but its implications are still valid in the contemporary world. The paper evaluates the concept of debt capacity index measure for individual states of the United States. Of course, all sovereign states of the USA use their own methodologies when calculating their sustainable debt levels. For instance, the ratio of

debt service to the state revenue can be set to a maximum of 5%, or the general obligations debt can be structured so that it does not exceed 8% of the state property tax revenue, etc. However, the present analysis incorporates all those methodologies into a single statistical model.

The general idea behind the analysis can be explained in three steps:

1. Review incumbent methodologies for estimating the "optimal" debt structure that the local governments follow.
2. Reformulate the existing techniques to encompass broader aspects.
3. Test the reformulated model on the case of Kentucky.

The principle is similar to the approach adopted by Afonso (2002), because this study also relies on the regression analysis, which recruits macroeconomic factors as independent variables. The main question to be answered is: "How much debt is affordable given the current projected economic and demographic condition?" One of the authors' previous research (Ramsey & Hackbart, 1988) concludes that the ratings assigned by S&P and Moody's are strongly related to four macroeconomic factors: ***state revenue, per-capita income, population and assessed value of real property***. Accordingly, the present paper first regresses the debt service variable on these four independent variables using historical data. The authors argue that if all four can be proven to have a strong relationship to the annual debt servicing of the government, they simply can be forecasted for the upcoming periods so that the future debt servicing capacity can also be determined. The general regression takes the following form:

$$(4.1) \quad Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

Y – *annual debt servicing*
X_1 – *assessed value of real property*
X_2 – *state revenue*
X_3 – *per capita income*
X_4 – *population*

Provided that the econometric considerations are fully satisfied, namely, after making sure that there is no heteroskedasticity, autocorrelation or multicollinearity, that the F- test results

are acceptable, and that the coefficients have the expected signs and are statistically significant, the forecasts of the independent variables can be obtained by regressing those on time sequentially in line with the general form:

(4.2) $X_1 = a_1 + b_1 t$

(4.3) $X_2 = a_2 + b_2 t$

(4.4) $X_3 = a_3 + b_3 t$

(4.5) $X_4 = a_4 + b_4 t$

where t is an independent variable which represents time $\{t \in 0,1,2,3\ldots\}$

a and b are the coefficients.

If time is significant in explaining the changes in the values of all four X's (if the t-ratios and R^2 values are significant), then the regression results of the equations (4.2) – (4.5) can be used to predict their future values. The forecasted values can then be replaced in the main equation (4.1) to predict the future debt servicing capacity of the state.

One must bear in mind that in the case of Mongolia the choice of variables is not restricted to the ones employed in this study. There is full flexibility in the selection of both the dependent and independent variables, all is up to the discretion of the researcher. Variable suggestions from Afonso (2002) should also be considered.

IV. EMPIRICAL ESTIMATION AND MODEL SPECIFICATION (FOLLOWING RAMSEY, GRITZ & HACKBART (1988))

Data

The data has been collected from the electronic World Bank Database (http://databank.worldbank.org). The full list of considered variables is presented in the Appendix 1. Mongolia has abandoned its Soviet-style ruling principles and shifted towards Democracy in 1990. Therefore, only the post-1990 time frame should be considered in the optimal debt structure analysis for the sovereign bonds to be issued by the end of 2010. Depending on the availability of the accounts, we decided to rely on the annual statistics covering the period 1992-2008. Any missing values had to be filled in from the IMF data base and from the yearly bulletins issued by the National Statistics Office of Mongolia. And those that were not filled in belong to the variables that were not included in the regression. All estimations were obtained with EViews 6.0.

Choosing the variables

What the third and fourth theoretical analyses suggest can be incorporated into the following table:

Study	Afonso (2002)	Ramsey, Gritz & Hackbart [RGH](1988)
Dependent variable	$RATING_i$	Annual debt servicing
Independent variables	GDP per capita Inflation rate GDP real growth rate Development indicator Default indicator External debt-to-exports ratio Government deficit as % of GDP Current account deficit as % of GDP Central government spending as % of GDP Debt-to-GDP ratio	Assessed value of real property State revenue Per capita income Population

Trial No 1

We conducted our first regression trial with the annual debt servicing as the dependent variable:

(T1) $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$

Y = Annual debt servicing (current USD)
X_1 = GDP per capita (current US$)
X_2 = Inflation, consumer prices (annual %)
X_3 = Population, total
X_4 = Goods exports (BoP, current US$)
X_5 = GDP growth (annual %)

The current value of debt servicing, representing the book value rather than the real value, was chosen as an appropriate regressand. Following the dependent variable in its current terms, all independent variables were also taken in their current values. Debt servicing was chosen to be the dependent variable following RGH (1988): “For this research it was decided to use annual debt service payments as the dependent variable since it is the annual commitment of debt service that is important to policy and budget decision-makers.” The authors provide a solid justification why this variable should replace Y in the regression, considering the interest rate volatility and how “the level of debt "supportable" can quickly change given such volatility.”

Results:

The overall correlation between the variables was poor (Appendix 2.1.a). The raw regression without any transformation of the variables provided unsatisfactory results. (Appendix 2.1.b) None of the variables turned out to be significant, the R-squared appeared to be negative and the F-statistics suggested about the joint insignificance of the regressors. Therefore, in the next regression the variables were taken in their natural logarithms, except inflation and GDP growth, since their respective values were negative in certain years. (Appendix 2.1.c) The results did not change significantly. Ln(GDP per capita) and Ln(Exports) variables came close to become relevant, however, there was no other indication of a healthy regression. The Wald test conducted on the rest of the variables, excluding the mentioned two, suggested absolute insignificance of those. (Appendix 2.1.d). After making the last attempt by including only the Ln(GDP per capita) and Ln(Exports) series, it was made clear that there was no relationship, whatsoever, between the chosen variables, and that the model had to be entirely reformulated.

Trial No 2

Our next attempt took the following form:

(T2) $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$

Y = Annual debt servicing (current USD)
X_1 = GNI (current US$)
X_2 = Goods exports (BoP, current US$)
X_3 = Use of IMF Credit (DOD, current USD)
X_4 = GNI per capita, Atlas method (current US$)
X_5 = Inflation, consumer prices (annual %)
X_6 = Population, total

Once again, annual debt servicing was the dependent variable, as employed by RGH (1988). The Xs, on the other hand, differed from the first trial. GDP per capita was replaced with GNI. The GNI is the account of all products produced by the enterprises owned by the citizens of a country. GDP refers to the total output produced within the borders, irrespective of the ownership. GNI was seen to be a reasonable replacement for the RGH's State Revenue variable. Also the use of the IMF (International Monetary Fund) credit seemed to be an important factor influencing the annual debt servicing obligations of Mongolia. Therefore, it was included as the third regressor.

Results:

The correlation between all variables appeared to be poor (Appendix 2.2.a) Judging by the overall correlation matrix, there was no reason to continue on with regressions of any functional form containing the chosen variables. Mongolia's annual debt servicing was clearly not dependent on the rest of the macroeconomic factors and could neither be explained nor predicted by those.

Trial No 3

The main idea behind the third attempt was to rely on the total external debt, as the dependent variable, instead of debt servicing. We chose this variable since it encompasses the full extent of external support received by Mongolia, as opposed to annual debt servicing, which is dependent on unpredictable interest rate fluctuations. The model took the following from:

(T3) $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$

Y = *External debt stocks, total (DOD, current US$)*
X_1 = *GNI (current US$)*
X_2 = *Goods exports (BoP, current US$)*
X_3 = *GNI per capita, Atlas method (current US$)*
X_4 = *Use of IMF Credit (DOD, current USD)*
X_5 = *Inflation, consumer prices (annual %)*
X_6 = *Population, total*

Results:

The correlation matrix exhibited far more favorable results (Appendix 2.3.a). Total external debt appeared to be highly correlated with most of the independent variables, except inflation and IMF credit. The raw regression implemented straight on the values of the variables also led to a much better outcome, with the intercept, IMF credit and population figures displaying statistical validity. The F-test statistics suggested the joint significance of all variables and the adjusted R-squared value climbed up to 98% (Appendix 2.3.b). Therefore, the next step was to run the regression on the natural logarithms of the variables, excluding inflation. The results did not change much (Appendix 2.3.c). Ln(GNI) and Ln(IMF_credit) seemed to be most irrelevant, therefore, the Wald test was conducted to check the joint significance of those two (Appendix 2.3.d). The test suggested that the variables should be dropped. The regression excluding Ln(GNI) and Ln(IMF_credit) series is provided in the (Appendix 2.3.e). The end results improved substantially, all of the employed variables appeared to be

statistically significant. Hence, the following model was chosen to be developed further in the upcoming analyses:

$$Ln(Total\_Ext\_Debt) = \underset{(-9.37)}{-107.04} \underset{(-3.75)}{-0.38\ Ln(GNI)} + \underset{(1.99)}{0.24\ Ln(Exports)} \underset{(-7.93)}{-0.002\ (Inflation)} + \underset{(10.26)}{8.9\ Ln(Total\_Population)}$$

R-squared	0.987867
Adjusted R-suqared	0.983823

The t-ratios are given in brackets.

Coefficient interpretation

After having run the regression and obtained preliminary good results, a check of the direct implications set forward in the model is necessary. That is, each coefficient should be analyzed whether it fits expectations and common sense.

First of all, LNGNI exhibits a negative coefficient, which implies that when total external debt rises, GNI decreases. This is a quite logical movement, since the GNI contributes to the interest payments on external debt, and with a higher amount of debt comes a greater interest obligation (Statistical Manual – External Debt Relationship to National Accounts, 2010). Moreover, the regression was estimated based on historical data and it is quite intuitive that countries with higher GNI do not contract as much external debt, since they can sustain themselves without further aid. Our underlying assumptions are that the country should not bring itself in a difficult position by issuing unnecessary debt, given the projected economic evolution.

As regards the exports variable, it carries a positive coefficient, indicating that an increase in exports is correlated with an increase in debt. This is obvious because rich developing countries survive off exports, as they bring the highest revenue to the state and ensure the sustainability of the debt level. This relationship between debt and exports has also been investigated by Reise and van Trotsenburg (1988), whose work claimed that exports are the primary means of bearing the debt obligations of developing countries.

Another important variable chosen for our model is inflation. According to the regression coefficient, as inflation increases, total external debt goes down, which is a logical relationship, considering that higher inflation leads to a devaluation of the currency, thus implying relatively more costly debt payments. This relationship goes both ways: higher debt causes foreigners to refrain from investing in the country, funds flow out of the country and the government still has debt obligations it needs to meet by printing out money, and consequently, causing inflation (Van Bergen, 2010).

The last explanatory variable, population, carries a positive coefficient which infers that higher population requires higher external debt levels. This makes sense because a developing country in expansion, such as Mongolia, needs external support to meet its growth needs.

Statistical tests on the validity of the model

Autocorrelation can be checked with the Durbin-Watson test, and the coefficient is already stated in the estimation output. For the model we have selected, the statistical value is 2.075. The result of the test can be assessed by finding the critical values for the upper (d_U) and lower (d_L) bounds and checking whether 2.075 can be found in the interval (d_U, 4-d_U). In our case, for 17 observations and 4 explanatory variables, d_U=1.63 (Brooks, 2008). Therefore the DW statistic of 2.075 indicates that there is no autocorrelation in the variables.

Multicollinearity can be tested with simple series statistics on the regressors (Appendix 2.3.f) Three strongly correlated pairs of variables are: Ln(EXPORTS) – Ln(GNI), Ln(GNI)-Ln(POPULATION) and LN(POPULATION) – Ln(EXPORTS). The Ramsey RESET test, however, concludes that this model does not exhibit any non-linearity in the regression (Appendix 2.3.g).

Heteroskedasticity (White Test). In order to detect any sign of heteroskedasticity, one should start from plotting the residuals of the regression (Appendix 2.3.h) The figure indicates inexistence of heteroskedasticity, the residual variance seems to be fairly stable (one exception – 1999). Nevertheless, the White test can be conducted to reaffirm this inference. (Appendix 2.3.i) Since the data is already in natural logs, the probability of time varying error terms is minimal, as one of the measures to get rid of heteroskedasticity is to transform the series into logs. With the White test there is a choice whether or not to include a cross-

product term, which stands for each variable multiplied by each other variable. Since there are not many variables in the regression, it is more sensible to include the term. The p-values are a lot higher than 0.05 and the test suggests no sign of heteroskedasticity.

Unit root tests: To check for stationarity of the variables the ADF (augmented Dickey-Fuller) test has been implemented on each case (Appendix 2.3.j). According to the test results, all of the variables exhibit non-stationarity. The total external debt and inflation may be seen as trend-stationary, as their unit root is reduced with the addition of the trend term. Also, all variables appear to be integrated of order I (Appendix 2.3.k).

In search for cointegration: "A set of variables is defined as cointegrated if a linear combination of them is stationary. Many time series are non-stationary but 'move together' over time - that is, there exist some influences on the series (for example, market forces), which imply that the two series are bound by some relationship in the long run" (Brooks, 2008).

In order to search for any long-term relationships between the variables of the selected model, one should check if those are cointegrated in the first place. If we can find a subtle proof that the total external debt moves together with the rest of the macroeconomic factors over time, this would provide sufficient motive for the future sustainable debt levels to be estimated based on the forecasted values of the macro variables. The first prerequisite for the existence of a cointegrating relationship is that the factors must be integrated of the same order. As was previously noted, the ADF test results indicate that all of our variables are integrated of order one. Second, the residuals of the regression should be stationary. At this stage one should perform and ADF test on the residuals (Appendix 2.3.l) The normal DF and ADF critical values cannot be used, Engle and Granger (1987) have constructed a new series of critical values. Our ADF test statistics is -5.52, therefore, in comparison to the EG critical values, we may conclude that the residuals are stationary and that our series are cointegrated. This means that there is a long-run relationship between the variables in the selected model.

Following such a conclusion an ECM (error-correction model) can be constructed:

$$\Delta Ln(DEBT) = \underset{(-4.85)}{-0.37}\,\Delta Ln(GNI) + \underset{(1.8)}{0.20}\,\Delta Ln(EXPORTS) - \underset{(-5.05)}{0.002}\,\Delta INFL +$$
$$\underset{(5.25)}{9.6}\Delta Ln(POPULATION) - \underset{(-3.87)}{1.04} q_t(-1) + v_t$$

R-squared	0.664981
Adjusted R-squared	0.543156

where $q_t(-1)$ contains the lagged value of the saved residuals already proven to be stationary. The regression results are much better without the intercept term. The cointegrating vector is [$\mathbf{1- b_1 - b_2 - b_3 - b_4}$]. This is our final model, which will be used for the estimation of the optimal (sustainable) debt levels for Mongolia in the upcoming 4-10 years.

As was explained in the section III, Erce (2008) derives the political risk factor. The author sees the residual term from the OLS regression of the sovereign credit ratings on a set of macroeconomic factors as a measure of political risk. The interpretation is certainly intuitive. We may apply the same viewpoint to the above ECM case: whatever is not captured by the model, including political instability, should be detained within the residuals. But since the lagged values of the error terms have already been included in our ECM model, we may think of it as if we have captured the effects from the political instability, strongly attributable to the case of Mongolia.

V. MODEL SPECIFICATIONS FOR THE FORECAST (FOLLOWING RAMSEY, GRITZ & HACKBART (1988))

In order to estimate the future debt servicing capability of Kentucky, Ramsey, Gritz and Hackbart (1988) regress each independent variable on time, prove that the time series is significant in explaining the changes in the values of the Xs, forecast the future values of all four with the obtained regression coefficients and insert those into the main formula. The authors' previous work was about making predictions based on autoregressive processes, such as ARMA and ARIMA. However, they concluded that a simple framework bears more explanatory power. Therefore, in the present paper, following their suggestion, the selected independent variables of both the normal log-linear model and the ECM have been sequentially regressed upon time for forecasting purposes. (Appendix 3a and 3b). The results are compressed into the following table:

	Log-linear model			ECM	
Dependent variable	Independent variables		Dependent variable	Independent variables	
	Intercept	**Time coef**		**Intercept**	**Time coef**
X_1 = Ln(GNI)	20.19	0.11	**X_1= ΔLn(GNI)**		0.01
p-values	0.00	0.00	p-values		0.05
t-ratios	143.30	7.08	t-ratios		2.17
Adjusted R^2	75%		Adjusted R^2	14%	
X_2= Ln(EXPORTS)	19.44	0.11	**X_2=ΔLn(EXPORTS)**		0.02
p-values	0.00	0.00	p-values		0.00
t-ratios	151.55	7.88	t-ratios		4.29
Adjusted R^2	79%		Adjusted R^2	28%	
X_3= INFL	121.02	-9.66	**X_3= Δ INFL**		-0.21
p-values	0.00	0.01	p-values		0.89
t-ratios	4.30	-3.22	t-ratios		-0.15
Adjusted R^2	37%		Adjusted R^2		-0.04
X_4=Ln(POPULATION)	14.61	0.01	**X_4=ΔLn(POPULATION)**		0.00
p-values	0.00	0.00	p-values		0.001
t-ratios	3483.46	24.05	t-ratios		12.65
Adjusted R^2	97%		Adjusted R^2	42%	
X_5			**X_5= RESID(-1)**	0.005	0.00
p-values			p-values	0.88	0.77
t-ratios			t-ratios	0.15	-0.30
Adjusted R^2			Adjusted R^2	6%	

By looking at the table one should note that the explanatory variables of the log-linear model have been regressed on time with an intercept term, whereas those of the ECM have been estimated merely with the time series, except the lagged residuals. The p-values indicate about the significance of almost all of the coefficients.

The two exceptions are ΔINFL and RESID(-1). The irrelevance of the annual change in inflation is explainable considering the sudden jumps in the price levels, especially in the beginning of the observation period. The residual term, or the error correction term, whose coefficient represents the speed of adjustment to the long-run equilibrium, appeared to be significant in the general ECM model. It is not common to use this term to make forecasts. RGH (1988) relies on a simple model. Here, however, it is reasonable to continue on with the analysis, predicting the future lagged residuals in the same way as with the other variables, because the proven significance of the error correction model is non-negligible.

Finally, the R-squared values with the log-linear model far exceed those of the error correction model. This is also explainable considering the magnitude of the values we are dealing with in the latter case. For instance, the value of ΔLn(GNI) in a given period can be as small as 0.01. Apart from these considerations, the results are satisfactory, the majority of

the coefficients are significant and the R-squared values are suitable. Hence, relying on these coefficients we may forecast the future values of each single regressor in order to predict the sustainable debt levels for Mongolia in the upcoming years.

VI. FORECASTING THE SUSTAINABLE DEBT LEVEL

Based on the model specifications and coefficients obtained in section V, the future values of total external debt have been forecasted first with the log-linear model and afterwards with the ECM (Appendix 4a). The future values of the explanatory variables are obtained by replacing *t*, the time series, with the values ranging from 0 to 6. *t* equals to 0 in year 2008, making it the present period. Correspondingly, the *t* value for 2014 is 6.

The amount of total external debt that harmonizes with the macroeconomic factors and shares with them a long-run equilibrium trend, can be seen as the optimum or sustainable debt level for Mongolia in the short- or medium- term future. The 2008 sustainable debt level from the log-linear model has been adopted in the ECM case as the starting value for the forecasts, since both models are based on the same data and similar principles. We see that the error correction model suggests lower optimal debt levels for the following 6 years counting from 2008. For instance, it implies that Mongolia should not raise more than 401.8 million USD in 2013 through external financing.

The predicted inflation rates exceed the intuitive range. This can also be explained by the extreme instability of the price levels throughout 1992-2008. The intercept term was highly significant, therefore, was included in the regression upon time. Since the constant itself equals to 121, the starting inflation value for 2008 also starts from 121. Without the intercept the results did not alter much, thus, it was decided to keep the term in.

Following this, the rest of macroeconomic factors have been forecasted over the given period and the growth rates have been computed respectively (Appendix 4b). The log-linear model suggests exactly the same growth rates for GNI, Sustainable Debt and Export figures. The ECM predicts a lot lower but gradually increasing growth in GNI. One must bear in mind that the error correction model takes account of long-term relationships while fixing the errors from short-term deviations. In the latter case the Debt and GNI figures grow at different rates, which is more intuitive.

VII. THE MONGOLIAN GOVERNMENT'S INTENTIONS

In February 2010 Mongolia has announced about its plans to raise around 1 billion USD by issuing sovereign bonds for the first time in Oct 2010. Shortly afterwards, the intended amount has risen to 1.2 billion USD. "Investment banks are advising Mongolia to issue debt with maturities of between five and ten years, Bayartsogt said in an interview in Ulan Bator, the Mongolian capital. The securities may offer a yield of between 8 percent and 11 percent, he said. That compares with 6 percent offered this year by Indonesia, which carries a similar debt rating from Standard & Poor's" (Emerging Sovereign Bond Markets News, 2010).

VIII. DISCUSSION OF THE CURRENCY, MATURITY AND COUPON RATE OF THE MONGOLIAN SOVEREIGN BOND ISSUE

The upcoming sovereign bond issue has to be assessed not only in terms of size but also of denomination, maturity and interest rate spread. As regards the currency, it should be the reference against which the Mongolian togrog's strength is evaluated. As presented previously in the background introduction about Mongolia, the country is very dependent on copper and gold exports, and the prices and ensuing revenues from these goods are quoted in US dollars. This implies a strong direct relationship between the togrog and the USD. Moreover, the Mongolian central bank has been encouraging a peg of the Mongolian currency to the dollar in the last few years, which highlights the importance of mineral trades as well as explains the vulnerability of the local currency when the crisis hit the commodity market (WB: Mongolia January Economic Update, 2010).

The maturity of the bond depends, of course, on the country's ability to repay and the predictions regarding its future sovereign revenues. The start of Oyu Tolgoi production in 2013 is a milestone which needs to be taken into consideration. According to the study conducted by IMF and World Bank, the inflows from the Oyu Tolgoi mine will considerably improve Mongolia's debt position and spike up the real GDP growth to 13% in 2013 (Mongolia: Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009). Therefore, a suggestion would be to contract debt with a maturity of four to five years, which could be repaid in full already in 2013.

However, it should be noted that maturity and interest rates are strongly interrelated, and this has a crucial effect especially on emerging countries. According to Arellano and Ramanarayanan (2010), short-term debt could prove to be more beneficial for countries like Mongolia, since it does not involve building up savings for future repayments. However, there is empirical evidence that short-term debt may expose countries to financing crises when the debt needs to be rolled over. In the case of Mongolia, there is an international consensus that 2013 will bring the country's national accounts back on track and sustained growth will be achieved after that point. Hence, a ten-year bond issue could attract lower spreads as confidence of repayment is strong and the long-term prospects of the country as a whole are rather positive.

Regarding the interest rate to be expected from the bond in the form of regular coupon payments, it is difficult to provide a clear-cut suggestion. Therefore, it is sensible to analyze the characteristics of previous bond issues and paint a picture of the desirable range for the coupon rate and the maturity. The countries chosen for the comparative analysis, Indonesia and Chile, both issued bonds with a ten-year maturity and coupons slightly below 7% (Appendix 5). As a consequence of the different ratings assigned to these two countries, the spreads and prices are not the same, that is, Indonesia had to sell the bonds at a higher discount than Chile because of its implicitly lower repayment probability. At the time of the issue, Indonesia was rated BB-, at the same level as Vietnam, Peru and Gabon, all of which issued 10-year bonds with coupon rates of 6.875%, 9.125% and 8.2% respectively (Das, Papaioannou & Polan, 2008, p. 5). There is a quite significant variance in these rates, which is affected by country-specific factors hard to quantify.

Nevertheless, an important aspect is that Moody's last review of Mongolia awarded it the rating Ba2, the equivalent of BB under Standard & Poor's scale. This is a better rating than what Indonesia had at the time of issuing sovereign bonds, however still in the speculative grade. On the basis of these comparisons, a possible range for the coupon rate of a ten-year sovereign bond would be 6.75% to 9%.

As regards the spread of the bond, a 2009 IMF report states that under the given circumstances, the first-issuer spread could rise to 15% over US treasury bonds, thus making the issue unattractive to investors. However, backup from trustworthy institutions could capture overall confidence in this financing instrument, and thus lower the spread (Mongolia:

Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009). In any case, the projected spread of 1500 bps, even if lowered through institutional guarantees, is much higher than any comparable country's first-issue spread. Indonesia, the closest comparison, exhibited a 277 bps spread, Chile 175 bps and Ukraine 328 bps, for the 1997 issue (Appendix 5). The high spread suggested in the IMF report could be primarily caused by a high discount applied to the bond price, in order to increase its appeal to the investors. The sum of $1.2 billion is the highest yet to be recorded as a one-time sovereign bond issue and this might raise concerns regarding the repayment possibilities of the country.

IX. SUSTAINABILITY ASSESSMENT FOR ANNOUNCED BOND CHARACTERISTICS

The Joint IMF/World Bank debt sustainability analysis (2009) also predicts the total external debt levels for Mongolia over the period 2009 – 2014. (Appendix 6a). We may compare our forecasted debt levels with those suggested by the IMF. Also it is possible to analyze whether or not the 1.2 billion planned issue of sovereign debt really will be sustainable in the mid-term future.

The reasonable starting point is to assume that the debt will mature in 5 years, bearing an interest between 6.75% - 9%, in line with our previous inferences. We analyze both the best and worst case scenarios (6.75% and 9% of coupon payments). The results are displayed in the (Appendix 6b). Our predictions give lower values to the sustainable debt levels, than the IMF forecasts. The IMF baseline scenario considers impact of sustainable adjustments of fiscal policies and the success of Oyu Tolgoi project. Giving so much value to probable debt increase in the future, IMF suggests only 200 million USD for the first-time issue, which alerts about the possible debt overhang. The negative numbers in bold (-643 million USD and -616 million USD) indicate about Mongolia's difficulties in meeting the repayment of the principal in 2014, irrespective of the coupon rate. That is, Mongolia will fall short of funds equivalent to these amounts, if it issues 1.2 billion USD of sovereign bonds in Oct 2010.

The ECM model suggests even worse outcome (Appendix 6c). The expected shortfall from the debt servicing capability is even greater: (-886 million USD or -859 million USD). And since the ECM has been reckoned to be the best suitable model, which corrects for the short-

term deviations and represents the long-run common trend, one should rely on its implications more.

Similar analysis can be repeated replacing the term to maturity with 10 years. (Appendix 6d) The log-linear model, once again, suggests the possibility of default in 2019. Nevertheless, the shortfalls are a lot lower than the previous case with 5 years to maturity. The ECM also indicates about a probable default, with debt overhang of 687 or 660 million USD. The fact that ECM indications have not transformed much reconfirms its ability to take account of long-term relationships and reasserts its statistical significance.

X. CONCLUSION

The newly constructed ECM model suggests an average GNI and exports growth of 5% and 9% for Mongolia in the next 5 and 10 years respectively. As was repeatedly noted throughout the analysis, the Error Correction Model takes account of long-term equilibrium between the selected variables.

In any case with either five- or ten-year maturity, with both the best and the worst case scenarios of coupon payments, the ECM specification suggests a high probability that Mongolia may default at the repayment period, if the government issues $1.2 billion sovereign bonds in USD in October 2010. We must bear in mind that the data covers pre-crisis period and the estimated coupon rates are based on comparative analyses of countries in similar situations. Any negative effects from the recent global financial turmoil are not incorporated into the model. Thus, the ECM should represent times of healthy economic performance.

Predicting higher export growth, the IMF suggests an amount of only 200 million USD for the first time issue. However, the real impact generated by starting production at Oyu Tolgoi is difficult to fully quantify and may affect the conclusions of our analysis. Apart from that, the actual value of future exports may significantly fluctuate as copper prices could increase or decrease throughout the next years. Therefore, this analysis still contains unknowns which cannot be estimated at this point with the currently available information.

Moreover, although steps have been taken towards reforming the economic system of Mongolia, this endeavour is still in an incipient stage. The high dependency on trade with neighbouring countries and high sensitivity to copper prices should prompt the introduction of a risk management system as seen in the case of Chile. This would bring Mongolia closer to achieving its growth objectives and would shelter it in macroeconomic meltdowns.

In any case, according to the current predictions of GNI growth and taking into account the current economic situation, the 1.2 billion USD debt which Mongolia is planning to issue could become a non-repayable burden at maturity date.

APPENDIX 1

List of variables considered:

1. Goods exports (BoP, current US$)
2. Cross-currency valuation (current US$)
3. External debt stocks, total (DOD, current US$)
4. External debt stocks, short-term (DOD, current US$)
5. External debt stocks, long-term (DOD, current US$)
6. Use of IMF credit (DOD, current US$)
7. Total debt service (% of GNI)
8. Debt service on external debt, total (TDS, current US$)
9. Multilateral debt service (TDS, current US$)
10. IMF repurchases and charges (TDS, current US$)
11. IMF charges (INT, current US$)
12. Interest payments on external debt, total (INT, current US$)
13. GNI per capita, Atlas method (current US$)
14. GDP per capita growth (annual %)
15. GDP growth (annual %)
16. GDP (current US$)
17. GDP per capita (current US$)
18. GNI (current US$)
19. Inflation, consumer prices (annual %)
20. Inflation, GDP deflator (annual %)
21. Real interest rate (%)
22. Lending interest rate (%)
23. Population, total
24. Population growth (annual %)

	Goods exports (BoP, current US$)	Cross-currency valuation (current US$)	External debt stocks, total (DOD, current US$)	External debt stocks, short-term (DOD, current US$)	External debt stocks, long-term (DOD, current US$)	Use of IMF credit (DOD, current US$)	Total debt service (% of GNI)	Debt service on external debt, total (TDS, current US$)
1992	**355,800,000**	..	297,267,000	1,661,000	276,700,000	18,906,000	7	**66,923,000**
1993	**365,800,000**	8,551,134	375,406,000	576,000	343,204,000	31,626,000	5	**23,347,000**
1994	**367,000,000**	22,611,700	461,446,000	519,000	405,650,000	55,277,000	7	**44,183,000**
1995	**451,000,000**	161,407	519,519,000	461,000	472,062,000	46,996,000	4	**51,635,000**
1996	**423,400,000**	-30,823,007	529,790,000	461,000	485,751,000	43,578,000	5	**52,605,000**
1997	**568,500,000**	-39,386,551	581,209,000	329,000	533,326,000	47,554,000	6	**62,335,000**
1998	**462,400,000**	38,004,205	698,608,000	250,000	650,037,000	48,321,000	3	**29,585,000**
1999	**454,300,000**	21,137,661	893,488,000	995,000	841,064,000	51,429,000	2	**20,170,000**
2000	**535,800,000**	-60,307,500	885,317,000	1,692,000	833,354,000	50,271,000	3	**37,843,000**
2001	**523,183,248**	-63,140,436	873,832,000	3,258,000	823,729,000	46,845,000	4	**44,941,000**
2002	**524,000,000**	74,527,922	994,621,000	3,014,000	949,001,000	42,606,000	4	**51,926,000**
2003	**627,300,000**	102,615,424	1,190,255,000	3,191,000	1,137,496,000	49,568,000	20	**286,263,000**
2004	**872,100,000**	50,546,992	1,350,894,000	0	1,306,638,000	44,256,000	2	**34,330,000**
2005	**1,068,620,000**	-117,231,622	1,301,681,000	0	1,266,678,000	35,003,000	2	**38,055,000**
2006	**1,545,200,000**	37,101,253	1,394,244,000	0	1,363,485,000	30,759,000	2	**46,587,000**
2007	**1,949,200,000**	77,940,836	1,596,177,000	0	1,570,664,000	25,513,000	1	**55,771,000**
2008	**2,539,300,000**	-10,097,854	1,721,353,000	0	1,701,397,000	19,956,000	1	**72,538,000**

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Source: World Bank

	Multilateral debt service (TDS, current US$)	IMF repurchases and charges (TDS, current US$)	IMF charges (INT, current US$)	Interest payments on external debt, total (INT, current US$)	GNI per capita, Atlas method (current US$)	GDP per capita growth (annual %)	GDP growth (annual %)	GDP (current US$)
1992	345,000	1,255,000	1,255,000	10,779,000	600	-10	**-9**	1,110,281,666
1993	523,000	1,155,000	1,155,000	8,460,000	340	-3	**-3**	657,562,646
1994	4,020,000	1,132,000	1,132,000	10,460,000	300	2	**2**	786,006,976
1995	1,147,000	10,594,000	1,111,000	9,719,000	400	6	**6**	1,226,574,748
1996	1,568,000	10,495,000	514,000	8,588,000	480	2	**2**	1,178,985,581
1997	2,021,000	1,102,000	242,000	11,875,000	510	3	**4**	1,053,982,436
1998	2,760,000	1,498,000	239,000	7,157,000	460	2	**4**	972,128,783
1999	3,529,000	4,055,000	250,000	9,639,000	420	2	**3**	905,543,385
2000	4,086,000	6,634,000	272,000	9,660,000	410	-1	**1**	1,089,190,224
2001	4,097,000	7,087,000	238,000	10,037,000	440	2	**3**	1,168,943,537
2002	5,957,000	7,911,000	225,000	12,013,000	490	3	**5**	1,272,646,664
2003	7,310,000	8,776,000	213,000	12,316,000	560	6	**7**	1,448,152,418
2004	10,913,000	7,431,000	228,000	14,180,000	680	9	**11**	1,815,684,667
2005	13,115,000	6,115,000	195,000	15,416,000	810	6	**7**	2,306,129,864
2006	15,563,000	6,113,000	163,000	15,478,000	1,010	7	**9**	3,132,338,007
2007	18,661,000	6,723,000	139,000	14,543,000	1,280	9	**10**	3,929,787,731
2008	24,911,000	5,156,000	117,000	22,951,000	1,670	8	**9**	5,257,569,042

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Source: World Bank

	GDP per capita (current US$)	GNI (current US$)	Inflation, consumer prices (annual %)	Inflation, GDP deflator (annual %)	Real interest rate (%)	Lending interest rate (%)	Population, total	Population growth (annual %)
1992	**492**	1,023,667,801	**203**	176	..	..	**2,255,816**	1
1993	**291**	503,356,092	**268**	325	-6	300	**2,259,130**	0
1994	**348**	621,218,818	**88**	63	133	279	**2,261,733**	0
1995	**540**	1,201,174,748	**0**	60	47	134	**2,269,832**	0
1996	**516**	1,165,685,653	**47**	15	64	88	**2,285,148**	1
1997	**457**	1,041,982,436	**37**	24	47	82	**2,306,139**	1
1998	**417**	972,528,783	**9**	-5	55	47	**2,331,793**	1
1999	**384**	905,643,385	**8**	10	31	44	**2,360,014**	1
2000	**456**	1,083,985,194	**12**	26	9	37	**2,389,197**	1
2001	**483**	1,172,843,333	**6**	6	29	37	**2,419,494**	1
2002	**519**	1,268,146,462	**1**	5	29	36	**2,451,494**	1
2003	**583**	1,436,652,719	**5**	10	20	32	**2,484,456**	1
2004	**721**	1,804,380,756	**8**	17	12	31	**2,517,448**	1
2005	**904**	2,254,340,765	**13**	20	8	31	**2,549,784**	1
2006	**1,214**	3,089,900,233	**5**	23	3	27	**2,581,092**	1
2007	**1,505**	3,832,248,365	**9**	12	8	22	**2,611,453**	1
2008	**1,991**	5,127,324,531	**25**	22	-2	21	**2,641,216**	1

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Source: World Bank

NOTE: THE MISSING VALUES WERE NOT FILLED IN BECAUSE THE CORRESPONDING VARIABLES WERE NOT INCLUDED IN THE REGRESSION

APPENDIX 2.1.a.

Correlation matrix, Trial No 1

	DEBT_SERVICE	GDP_PER_CAPITA	INFLATION	EXPORTS	GDP_GROWTH	POPULATION
DEBT_SERVICE	1.000000	0.060813	-0.138223	0.035113	0.149426	0.185290
GDP_PER_CAPITA	0.060813	1.000000	-0.287922	0.991515	0.591415	0.832454
INFLATION	-0.138223	-0.287922	1.000000	-0.289257	-0.767486	-0.518274
EXPORTS	0.035113	0.991515	-0.289257	1.000000	0.618730	0.851676
GDP_GROWTH	0.149426	0.591415	-0.767486	0.618730	1.000000	0.762057
POPULATION	0.185290	0.832454	-0.518274	0.851676	0.762057	1.000000

APPENDIX 2.1.b.

Raw regression

Dependent Variable: DEBT
Method: Least Squares
Date: 05/10/10 Time: 21:58
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.83E+08	6.80E+08	-1.004376	0.3368
GDP_PERCAP	306186.6	297067.3	1.030698	0.3248
INFL	173488.3	388666.5	0.446368	0.6640
EXPORTS	-0.282286	0.236100	-1.195621	0.2570
GDP_GROWTH	2932300.	7465193.	0.392796	0.7020
POPULATION	305.5297	294.6827	1.036809	0.3221

R-squared	0.170624	Mean dependent var	59943353
Adjusted R-squared	**-0.206365**	S.D. dependent var	60081441
S.E. of regression	65990243	Akaike info criterion	39.11848
Sum squared resid	4.79E+16	Schwarz criterion	39.41255
Log likelihood	-326.5070	**F-statistic**	**0.452597**
Durbin-Watson stat	2.578926	**Prob(F-statistic)**	**0.803178**

APPENDIX 2.1.c

Regression on natural logarithms

Dependent Variable: LNDEBT
Method: Least Squares
Date: 05/10/10 Time: 22:21
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-40.91686	102.6174	-0.398732	0.6977
LNGDPPERCAP	1.964453	1.171155	1.677364	0.1216
INFL	0.000915	0.003560	0.256881	0.8020
LNEXPORTS	-2.067197	1.388386	-1.488922	0.1646
GDP_GROWTH	0.026605	0.071784	0.370630	0.7180
LNPOPULATION	5.979251	7.898929	0.756970	0.4650

R-squared	0.257727	Mean dependent var	17.69437
Adjusted R-squared	**-0.079669**	S.D. dependent var	0.576608
S.E. of regression	0.599137	Akaike info criterion	2.083911
Sum squared resid	3.948617	Schwarz criterion	2.377987
Log likelihood	-11.71325	**F-statistic**	**0.763870**
Durbin-Watson stat	2.509427	**Prob(F-statistic)**	**0.594338**

APPENDIX 2.1.d

Wald Test on the joint significance of the coefficients

Wald Test:
Equation: REGRESSION_2

Test Statistic	Value	df	Probability
F-statistic	**0.280560**	**(3, 11)**	**0.8384**
Chi-square	0.841679	3	0.8395

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	0.000915	0.003560
C(5)	0.026605	0.071784
C(6)	5.979251	7.898929

Restrictions are linear in coefficients.

APPENDIX 2.2.a

Correlation matrix, Trial No 2

	DEBT_SERVICE	GNI	EXPORTS	GNI_PC	IMF	INFL	POP
DEBT_SERVICE	1.000000	0.035113	0.081865	-0.138223	0.070770	0.185290	0.185290
GNI	0.035113	1.000000	-0.633185	-0.289257	0.982233	0.851676	0.851676
EXPORTS	0.081865	-0.633185	1.000000	-0.392835	-0.722384	-0.408516	-0.408516
GNI_PC	-0.138223	-0.289257	-0.392835	1.000000	-0.227856	-0.518274	-0.518274
IMF	0.070770	0.982233	-0.722384	-0.227856	1.000000	0.821603	0.821603
INFL	0.185290	0.851676	-0.408516	-0.518274	0.821603	1.000000	1.000000
POP	0.185290	0.851676	-0.408516	-0.518274	0.821603	1.000000	1.000000

APPENDIX 2.3.a

Correlation matrix, Trial No 3

	EXT_DEBT	GNI	EXPORTS	GNI_PC	IMF	INFL	POP
EXT_DEBT	1.000000	**0.848808**	**0.848826**	**0.809777**	-0.330741	-0.574779	**0.988011**
GNI	**0.848808**	1.000000	0.992207	0.988499	-0.648468	-0.323879	0.854515
EXPORTS	**0.848826**	0.992207	1.000000	0.982233	-0.633185	-0.289257	0.851676
GNI_PC	**0.809777**	0.988499	0.982233	1.000000	-0.722384	-0.227856	0.821603
IMF	-0.330741	-0.648468	-0.633185	-0.722384	1.000000	-0.392835	-0.408516
INFL	-0.574779	-0.323879	-0.289257	-0.227856	-0.392835	1.000000	-0.518274
POP	**0.988011**	0.854515	0.851676	0.821603	-0.408516	-0.518274	1.000000

APPENDIX 2.3.b

Raw regression

Dependent Variable: EXT_DEBT
Method: Least Squares
Date: 05/11/10 Time: 00:21
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	**-6.92E+09**	**7.23E+08**	**-9.573308**	**0.0000**
GNI	-0.006553	0.166444	-0.039372	0.9694
EXPORTS	-0.052199	0.263745	-0.197915	0.8471
GNI_PERCAP	407318.7	366465.3	1.111480	0.2924
IMF	**9.448263**	**4.449280**	**2.123549**	**0.0597**
INFL	241901.3	549899.3	0.439901	0.6694
POPULATION	**3004.222**	**251.4233**	**11.94886**	**0.0000**

R-squared	0.989935	Mean dependent var	9.21E+08
Adjusted R-squared	**0.983897**	S.D. dependent var	4.41E+08
S.E. of regression	55941288	Akaike info criterion	38.81040
Sum squared resid	3.13E+16	Schwarz criterion	39.15349

Log likelihood	-322.8884	F-statistic	163.9301
Durbin-Watson stat	2.347852	**Prob(F-statistic)**	**0.000000**

APPENDIX 2.3.c

Regression on natural logarithms

Dependent Variable: LNDEBT
Method: Least Squares
Date: 05/11/10 Time: 00:30
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	**-109.7375**	**13.02304**	**-8.426415**	**0.0000**
LNGNI	-0.335707	0.247656	-1.355537	0.2051
LNEXPORTS	0.156200	0.154826	1.008871	0.3368
LNGNIPERCAP	0.185304	0.258105	0.717940	0.4892
LNIMF_CREDIT	0.207714	0.242443	0.856755	0.4116
INFL	-0.001686	0.000957	-1.761222	0.1087
LNPOPULATION	**8.807886**	**0.917872**	**9.595987**	**0.0000**

R-squared	0.988855	Mean dependent var	20.52028
Adjusted R-squared	**0.982167**	S.D. dependent var	0.527074
S.E. of regression	0.070385	Akaike info criterion	-2.176775
Sum squared resid	0.049540	Schwarz criterion	-1.833688
Log likelihood	25.50259	F-statistic	147.8719
Durbin-Watson stat	2.061685	**Prob(F-statistic)**	**0.000000**

APPENDIX 2.3.d

Wald Test on the joint significance of the coefficients of Ln(GNI) and Ln(IMF_CREDIT)

Wald Test:
Equation: REGRESSION_1

Test Statistic	Value	df	Probability
F-statistic	**0.443109**	**(2, 10)**	**0.6541**
Chi-square	0.886219	2	0.6420

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.185304	0.258105
C(5)	0.207714	0.242443

Restrictions are linear in coefficients.

APPENDIX 2.3.e

The selected model

Dependent Variable: LND
Method: Least Squares
Date: 05/11/10 Time: 00:44
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-107.0364	11.41788	-9.374456	**0.0000**
LNGNI	-0.383180	0.101918	-3.759682	**0.0027**
LNEXPORTS	0.238967	0.119694	1.996484	**0.0691**
INFL	-0.002259	0.000285	-7.935884	**0.0000**
LNPOPULATION	8.906389	0.867446	10.26737	**0.0000**

R-squared	**0.987867**	Mean dependent var	20.52028
Adjusted R-squared	**0.983823**	S.D. dependent var	0.527074
S.E. of regression	0.067039	Akaike info criterion	-2.327157
Sum squared resid	0.053931	Schwarz criterion	-2.082094
Log likelihood	24.78083	F-statistic	244.2570
Durbin-Watson stat	2.075001	**Prob(F-statistic)**	**0.000000**

APPENDIX 2.3.f

Correlation between the independent variables, multicollinearity check

	LNGNI	LNEXPORTS	INFL	LNPOPULATION
LNGNI	1.000000	0.956514	-0.501480	**0.898590**
LNEXPORTS	**0.956514**	1.000000	-0.416577	0.922786
INFL	-0.501480	-0.416577	1.000000	-0.527985
LNPOPULATION	0.898590	**0.922786**	-0.527985	1.000000

APPENDIX 2.3.g

Ramsey RESET test

Ramsey RESET Test:

F-statistic	1.017609	Probability	**0.334762**
Log likelihood ratio	1.504121	Probability	**0.220038**

Test Equation:
Dependent Variable: LND
Method: Least Squares
Date: 05/11/10 Time: 10:11
Sample: 1992 2008

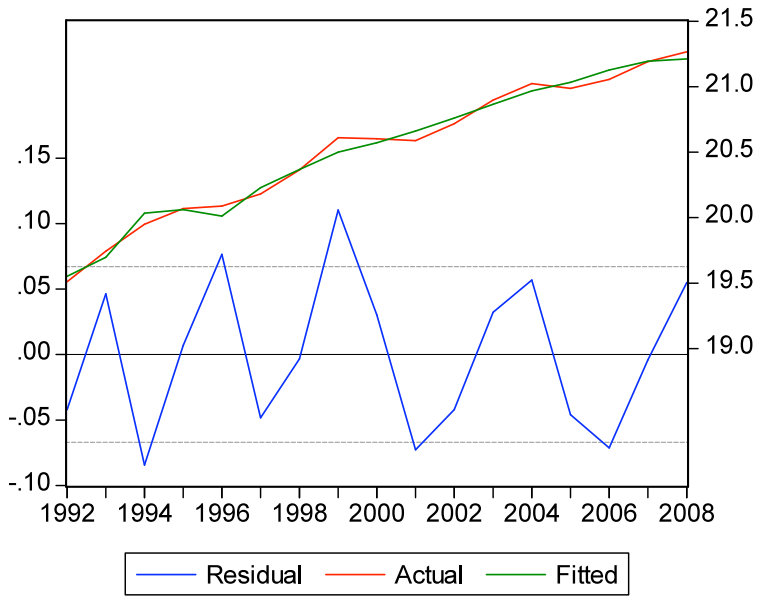
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1746.505	1625.260	-1.074600	0.3056
LNGNI	-5.542411	5.115407	-1.083474	0.3018
LNX	3.502817	3.237694	1.081886	0.3025
INFL	-0.032590	0.030069	-1.083858	0.3016
LNP	133.2338	123.2499	1.081005	0.3028
FITTED^2	-0.341113	0.338148	-1.008767	0.3348

R-squared	0.988894	Mean dependent var	20.52028
Adjusted R-squared	0.983846	S.D. dependent var	0.527074
S.E. of regression	0.066990	Akaike info criterion	-2.297988
Sum squared resid	0.049364	Schwarz criterion	-2.003912
Log likelihood	25.53290	F-statistic	195.8959
Durbin-Watson stat	2.068769	Prob(F-statistic)	0.000000

APPENDIX 2.3.h

Plotting the residuals



APPENDIX 2.3.i

White Heteroskedasticity Test:

F-statistic	0.230243	Probability	**0.979583**
Obs*R-squared	4.714442	Probability	**0.909419**

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/12/10 Time: 11:34
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.631701	3.375912	0.483336	0.6460
LNGNI	0.030294	2.415313	0.012542	0.9904
LNGNI^2	-0.006355	0.111403	-0.057044	0.9564
LNGNI*LNX	0.010050	0.110258	0.091154	0.9303
LNGNI*INFL	-5.02E-06	0.000302	-0.016611	0.9873
LNGNI*LNP	0.001763	0.004613	0.382077	0.7156
LNX	-0.211413	2.312456	-0.091424	0.9301
LNX*INFL	-0.000112	0.000585	-0.191321	0.8546
INFL	-0.015128	0.107330	-0.140953	0.8925
INFL^2	-2.39E-07	5.92E-07	-0.404215	0.7001
INFL*LNP	0.001195	0.008152	0.146571	0.8883

R-squared	0.277320	Mean dependent var	0.003172
Adjusted R-squared	-0.927146	S.D. dependent var	0.003141
S.E. of regression	0.004361	Akaike info criterion	-7.779599
Sum squared resid	0.000114	Schwarz criterion	-7.240461
Log likelihood	77.12659	F-statistic	0.230243
Durbin-Watson stat	3.176719	Prob(F-statistic)	0.979583

APPENDIX 2.3.j

Unit root tests

Null Hypothesis: **LNDEBT has a unit root**
Exogenous: None
Lag Length: 2 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		4.151478	**0.9998**
Test critical values:	1% level	-2.740613	
	5% level	-1.968430	
	10% level	-1.604392	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 14

Null Hypothesis: **LNGNI has a unit root**
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.416964	**0.9769**
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 16

Null Hypothesis: **LNEXPORTS has a unit root**
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.942296	**0.9995**
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 16

Null Hypothesis: **INFL has a unit root**
Exogenous: None
Lag Length: 3 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.403611	**0.5180**
Test critical values:	1% level	-2.754993	
	5% level	-1.970978	
	10% level	-1.603693	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 13

Null Hypothesis: **LNPOPULATION has a unit root**

Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.310762	**0.1811**
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15

APPENDIX 2.3.k

First-difference unit root tests

Null Hypothesis**: D(LNDEBT) has a unit root**
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.485637	**0.0008**
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Null Hypothesis: **D(LNGNI) has a unit root**
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.685739	0.0012
Test critical values:	1% level	-2.728252	
	5% level	-1.966270	
	10% level	-1.605026	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15

Null Hypothesis: **D(DLNEXPORTS) has a unit root**
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.749044	0.0000
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 14

Null Hypothesis: **D(INFL) has a unit root**
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.23276	0.0000
Test critical values:	1% level	-4.800080	
	5% level	-3.791172	
	10% level	-3.342253	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 14

Null Hypothesis: **D(LNPOPULATION) has a unit root**
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.85393	0.0000
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 14

APPENDIX 2.3.l

ADF test on the residuals of the regression

Null Hypothesis: **RESID_03 has a unit root**
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		**-5.529272**	**0.0000**
Test critical values:	1% level	-2.728252	
	5% level	-1.966270	
	10% level	-1.605026	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20
observations and may not be accurate for a sample size of 15

From the Engle-Granger table: 5 variables, sample size less than 50, the critical values are:
0.01% -5.41
0.05% -4.76
0.1% -4.42

APPENDIX 2.3.m

ECM model

Dependent Variable: DLNDEBT
Method: Least Squares
Date: 05/12/10 Time: 13:10
Sample (adjusted): 1993 2008
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNGNI	-0.365804	0.075472	-4.846865	0.0005
DLNEXPORTS	0.198470	0.109713	1.808997	0.0978
DINFL	-0.001718	0.000340	-5.058212	0.0004
DLNPOPULATION	9.597876	1.826001	5.256227	0.0003
RESID_03(-1)	-1.047748	0.270592	-3.872059	0.0026

R-squared	**0.664981**	Mean dependent var	0.109765
Adjusted R-squared	**0.543156**	S.D. dependent var	0.088338
S.E. of regression	0.059708	Akaike info criterion	-2.548388
Sum squared resid	0.039216	Schwarz criterion	-2.306954
Log likelihood	25.38710	Durbin-Watson stat	1.592999

APPENDIX 3a

Regression of the independent variables upon time, the selected log-linear model

Dependent Variable: LNGNI
Method: Least Squares
Date: 05/12/10 Time: 13:55
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.19405	0.140920	143.3010	**0.0000**
TIME	0.106305	0.015022	7.076553	**0.0000**

R-squared	0.769506	Mean dependent var	21.04449
Adjusted R-squared	0.754140	S.D. dependent var	0.611954
S.E. of regression	0.303433	Akaike info criterion	0.562819
Sum squared resid	1.381074	Schwarz criterion	0.660844
Log likelihood	-2.783962	F-statistic	50.07760
Durbin-Watson stat	0.895471	**Prob(F-statistic)**	**0.000004**

Dependent Variable: LNEXPORTS
Method: Least Squares
Date: 05/12/10 Time: 13:59
Sample: 1992 2008
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.43547	0.128247	151.5467	**0.0000**
TIME	0.107719	0.013671	7.879240	**0.0000**

R-squared	0.805403	Mean dependent var	20.29723
Adjusted R-squared	0.792430	S.D. dependent var	0.606115
S.E. of regression	0.276145	Akaike info criterion	0.374351
Sum squared resid	1.143842	Schwarz criterion	0.472376
Log likelihood	-1.181983	F-statistic	62.08242
Durbin-Watson stat	0.357785	Prob(F-statistic)	0.000001

Dependent Variable: INFL

Method: Least Squares

Date: 05/19/10 Time: 04:07

Sample: 1992 2008

Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	121.0196	28.13765	4.300986	**0.0006**
TIME	-9.656863	2.999483	-3.219509	**0.0057**

R-squared	0.408639	Mean dependent var	43.76471
Adjusted R-squared	0.369215	S.D. dependent var	76.28444
S.E. of regression	60.58659	Akaike info criterion	11.15616
Sum squared resid	55061.02	Schwarz criterion	11.25418
Log likelihood	-92.82732	F-statistic	10.36524
Durbin-Watson stat	0.835078	**Prob(F-statistic)**	**0.005730**

Dependent Variable: LNPOPULATION

Method: Least Squares

Date: 05/12/10 Time: 14:21

Sample: 1992 2008

Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.60783	0.004193	3483.460	**0.0000**
TIME	0.010750	0.000447	24.04787	**0.0000**

R-squared	0.974718	Mean dependent var	14.69384
Adjusted R-squared	0.973032	S.D. dependent var	0.054985
S.E. of regression	0.009030	Akaike info criterion	-6.466508
Sum squared resid	0.001223	Schwarz criterion	-6.368483
Log likelihood	56.96532	F-statistic	578.3002
Durbin-Watson stat	0.230543	**Prob(F-statistic)**	**0.000000**

APPENDIX 3b

Regression of the independent variables upon time, ECM

Dependent Variable: DLNGNI
Method: Least Squares
Date: 05/12/10 Time: 14:44
Sample (adjusted): 1993 2008
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TIME	0.014925	0.006890	2.166156	**0.0468**

R-squared	0.138306	Mean dependent var	0.100699
Adjusted R-squared	0.138306	S.D. dependent var	0.287078
S.E. of regression	0.266487	Akaike info criterion	0.253482
Sum squared resid	1.065233	Schwarz criterion	0.301769
Log likelihood	-1.027859	Durbin-Watson stat	1.517130

Dependent Variable: DLNEXPORTS
Method: Least Squares
Date: 05/12/10 Time: 14:49
Sample (adjusted): 1993 2008
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TIME	0.015431	0.003600	4.286790	**0.0006**

R-squared	0.283108	Mean dependent var	0.122830
Adjusted R-squared	0.283108	S.D. dependent var	0.164438
S.E. of regression	0.139228	Akaike info criterion	-1.044940
Sum squared resid	0.290768	Schwarz criterion	-0.996654
Log likelihood	9.359523	Durbin-Watson stat	2.449950

Dependent Variable: DINFL

Method: Least Squares

Date: 05/12/10 Time: 16:00

Sample (adjusted): 1993 2008

Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TIME	-0.213235	1.460380	-0.146014	**0.8859**

R-squared	-0.041619	Mean dependent var	-11.12500
Adjusted R-squared	-0.041619	S.D. dependent var	55.34483
S.E. of regression	56.48479	Akaike info criterion	10.96628
Sum squared resid	47857.98	Schwarz criterion	11.01457
Log likelihood	-86.73025	Durbin-Watson stat	1.915350

Dependent Variable: DLNPOPULATION

Method: Least Squares

Date: 05/12/10 Time: 14:54

Sample (adjusted): 1993 2008

Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TIME	0.001056	8.35E-05	12.65026	**0.0000**

R-squared	0.419335	Mean dependent var	0.009858
Adjusted R-squared	0.419335	S.D. dependent var	0.004236
S.E. of regression	0.003228	Akaike info criterion	-8.573287
Sum squared resid	0.000156	Schwarz criterion	-8.525000
Log likelihood	69.58629	Durbin-Watson stat	0.151425

Dependent Variable: RESID_03(-1)

Method: Least Squares

Date: 05/12/10 Time: 14:57

Sample (adjusted): 1993 2008

Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004755	0.031468	0.151112	**0.8820**
TIME	-0.000963	0.003254	-0.295989	**0.7716**

R-squared	0.006219	Mean dependent var	-0.003432
Adjusted R-squared	-0.064765	S.D. dependent var	0.058153
S.E. of regression	0.060006	Akaike info criterion	-2.672263
Sum squared resid	0.050411	Schwarz criterion	-2.575689
Log likelihood	23.37810	F-statistic	0.087609
Durbin-Watson stat	2.152397	Prob(F-statistic)	0.771584

APPENDIX 4a.

Forecasting with the normal model
LnGNI = 20.19405 + 0.106305 t
LnEXPORTS = 19.43547 + 0.107719 t
INFL = 121.0196 - 9.656863 t
LnPOPULATION = 14.60783 + 0.010750 t
LnDEBT = -107.0364 - 0.383180 LnGNI + 0.238967 LnEXPORTS - 0.002259 INFL + 8.906389 LnPOPULATION

Year	t	LnGNI	LnEXPORTS	INFL	LnPOPULATION	LnDEBT	**How much total debt is sustainable**
2008	0	20.19405	19.43547	121.0196	14.60783	19.699713	**359316089**
2009	1	20.300355	19.543189	111.362737	14.61858	19.802279	**398125923**
2010	2	20.40666	19.650908	101.705874	14.62933	19.904845	**441127617**
2011	3	20.512965	19.758627	92.049011	14.64008	20.007411	**488773937**
2012	4	20.61927	19.866346	82.392148	14.65083	20.109977	**541566550**
2013	5	20.725575	19.974065	72.735285	14.66158	20.212542	**600061308**
2014	6	20.83188	20.081784	63.078422	14.67233	20.315108	**664874102**

Note: Sustainable debt = EXP(Ln(DEBT))

Forecasting with the ECM
ΔLnGNI = 0.014925 t
ΔLnEXPORTS= 0.015431 t
ΔINFL= -0.213235 t
ΔLnPOPULATION = 0.001056 t
q_t (-1) = 0.004755 - 0.000963 t
ΔLnDEBT = -0.365804 ΔLnGNI + 0.198470 ΔLnEXPORTS - 0.001718 ΔINFL + 9.597876 ΔLnPOPULATION -1.047748 q_t (-1)

Year	t	ΔLnGNI	ΔLnEXPORTS	ΔINFL	ΔLnPOPULATION	q_t (-1)	ΔLnDEBT	DEBT/ DEBT(-1)	**How much total debt is sustainable**
2008	0								**359316089**
2009	1	0.014925	0.015431	-0.213235	0.001056	0.003792	0.0041316	1.0041401	**360803711**
2010	2	0.02985	0.030862	-0.42647	0.002112	0.002829	0.013245242	1.0133333	**365614432**
2011	3	0.044775	0.046293	-0.639705	0.003168	0.001866	0.022358884	1.0226107	**373881237**
2012	4	0.0597	0.061724	-0.85294	0.004224	0.000903	0.031472526	1.031973	**385835350**
2013	5	0.074625	0.077155	-1.066175	0.00528	-6E-05	0.040586168	1.041421	**401817053**
2014	6	0.08955	0.092586	-1.27941	0.006336	-0.001023	0.04969981	1.0509556	**422291867**

Note: ΔLnDEBT = Ln(DEBT) - Ln(DEBT(-1))

ΔLnDEBT = Ln(DEBT/DEBT(-1))

DEBT/DEBT(-1) = EXP(ΔLnDEBT) – represents how much increase in debt is sustainable

Therefore, 2009 sustainable debt = 2008 sustainable debt x DEBT/DEBT(-1) in 2009

APPENDIX 4b

Forecasting with the normal model							
Year	t	GNI forecast	Sustainable DEBT as % of GNI	GNI growth	Export forecast	Export growth	Debt growth
2008	0	589066713	61%		275878194		
2009	1	655137045	61%	11%	307255129	11%	11%
2010	2	728617893	61%	11%	342200712	11%	11%
2011	3	810340429	60%	11%	381120822	11%	11%
2012	4	901229049	60%	11%	424467500	11%	11%
2013	5	1002311831	60%	11%	472744202	11%	11%
2014	6	1114732163	60%	11%	526511641	11%	11%

Note: GNI forecast = EXP(LnGNI), Export forecast = EXP(LnEXPORT), the growth rates are the annual percentage changes

Forecasting with the ECM									
Year	t	GNI/ GNI(-1)	GNI forecast	Sustainable DEBT as % of GNI	GNI growth	Export/ Export(-1)	Export forecast	Export Growth	Sustainable DEBT growth
2008	0		589066713	61%			275878194		
2009	1	1.02	597924470	60%	2%	1.02	280168285	2%	0%
2010	2	1.03	616041568	59%	3%	1.03	288949647	3%	1%
2011	3	1.05	644251670	58%	5%	1.05	302640442	5%	2%
2012	4	1.06	683884772	56%	6%	1.06	321909175	6%	3%
2013	5	1.08	736872178	55%	8%	1.08	347729348	8%	4%
2014	6	1.09	805903850	52%	9%	1.10	381461696	10%	5%

Note: GNI/GNI(-1) = EXP(ΔLnGNI) – yearly increase in GNI

2009 GNI = 2008 GNI x GNI/GNI(-1) in 2009

Export/Export(-1) = EXP(ΔLnEXPORT) – yearly increase in EXPORTS

2009 Exports = 2008 Exports x Export/Export(-1) in 2009

Grwoth rates are annual percentage changes

APPENDIX 5.

A list of USD-denominated sovereign bond issues and their characteristics
Sources: Das, Papaioannou & Polan (2008, p. 5), Grigorian (2003, p.19)

Issuer	Issue date	Size (mil USD)	Coupon (%)	Price	Spread (bps)	Maturity (yrs)
Argentina	Sep-91	300	11.00	99.50	508	2
Bahrain	Jan-03	500	4.00	99.31	75	5
Bulgaria	Mar-02	510	8.25	93.68	369	13
Chile	Apr-99	500	6.88	99.86	175	10
Costa Rica	Apr-98	200	8.00	100.00	250	5
Croatia	Feb-97	300	7.00	99.92	80	5
Dominican Rep.	Sep-01	500	9.50	100.00	566	5
Ecuador	Dec-05	650	9.38	91.69	623	10
Egypt (1)	Jun-01	500	7.63	99.63	275	5
Egypt (2)	Jun-01	1000	8.75	99.88	335	10
El Salvador	Aug-99	150	9.50	92.20	500	7
Fiji	Sep-06	150	7.00	99.48	225	5
Gabon	Dec-07	1000	8.20	100.00	426	10
Georgia	Apr-08	500	7.50	100.00	474	5
Ghana	Sep-07	750	8.50	100.00	387	10
Grenada	Jun-02	100	9.75	99.20	527	10
Guatemala	Jul-97	150	8.50	99.60	258	10
Indonesia	Mar-04	1000	6.75	99.29	277	10
Israel	Dec-95	250	6.38	99.20	88	10
Jamaica	Jun-97	200	9.63	99.80	356	5
Kazahstan	Dec-96	200	9.25	99.90	349	3
Lebanon	Sep-94	400	10.13	99.50	348	3
Lithuania	Dec-95	60	10.00	99.90	468	2
Moldova	Dec-96	30	9.88	99.80	713	3
Oman	Mar-97	225	7.13	99.80	88	5
Pakistan	Feb-04	500	6.75	100.00	370	5
Peru	Feb-02	500	9.13	97.73	455	10
Philippines	Feb-93	150	7.88	99.90	313	3
Poland	Jun-95	250	7.75	100.00	182	5
Qatar	May-99	1000	9.50	99.94	395	10
Russia	Nov-96	1000	9.25	99.60	364	5
Seychelles	Sep-06	200	9.13	99.51	470	5
Slovak Rep.	Jan-98	200	0.00	96.80	84	0.5
Slovenia	Jul-96	325	7.00	99.30	69	5
Sri Lanka	Oct-07	500	8.25	100.00	397	5
Ukraine	Aug-97	450	0.00	91.80	328	1
Uruguay	May-92	100	8.25	99.10	280	3
Vietnam	Oct-05	750	6.88	98.22	256	10

APPENDIX 6a

IMF forecast, Baseline scenario			
Year	GDP	External Debt, % of GDP	Total External Debt
2009	4000000000	58%	2324000000
2010	4300000000	67%	2859500000
2011	4800000000	74%	3556800000
2012	5600000000	64%	3578400000
2013	6600000000	49%	3253800000
2014	7200000000	39%	2772000000

Source: Mongolia: Joint IMF/World Bank debt sustainability analysis under the debt sustainability framework for low-income countries, 2009

APPENDIX 6b

1.2 billion Sovereign Bond, 5-year maturity		
	Worst case scenario	Best case scenario
	9% coupon	**6.75% coupon**
Year	Cash inflows/outflows from the bond issue	Cash inflows/outflows from the bond issue
2010	1200000000	1200000000
2011	-108000000	-81000000
2012	-108000000	-81000000
2013	-108000000	-81000000
2014	-1308000000	-1281000000

Forecasting with the log-linear model, considering 1.2 billion debt, in USD, 5-years to maturity								
Year	t	Sustainable Debt	IMF forecast	Difference in suggested debt	Cash outflow, worst case	Cash outflow, best case	Debt capacity, worst case	Debt capacity, best case
2008	0	359316089		359316089				
2009	1	398125923	2324000000	-1925874077				
2010	2	441127617	2859500000	-2418372383				
2011	3	488773937	3556800000	-3068026063	108000000	81000000	380773937	407773937
2012	4	541566550	3578400000	-3036833450	108000000	81000000	433566550	460566550
2013	5	600061308	3253800000	-2653738692	108000000	81000000	492061308	519061308
2014	6	664874102	2772000000	-2107125898	1308000000	1281000000	**-643125898**	**-616125898**

Note: the negative numbers in bold indicate about Mongolia's difficulties in meeting the repayment of the principal at the end of 2014, irrespective of the coupon rate

APPENDIX 6c

Forecasting with the ECM, considering 1.2 billion debt, in USD, 5-years to maturity from 2010								
Year	t	Sustainable Debt	IMF forecast	Difference in suggested debt	Cash outflow, worst case	Cash outflow, best case	Debt capacity, worst case	Debt capacity, best case
2008	0	359316089		359316089				
2009	1	360803711	2324000000	-1963196289				
2010	2	365614432	2859500000	-2493885568				
2011	3	373881237	3556800000	-3182918763	108000000	81000000	265881237	292881237
2012	4	385835350	3578400000	-3192564650	108000000	81000000	277835350	304835350
2013	5	401817053	3253800000	-2851982947	108000000	81000000	293817053	320817053
2014	6	422291867	2772000000	-2349708133	1308000000	1281000000	**-885708133**	**-858708133**

Note: the negative numbers in bold indicate about Mongolia's difficulties in meeting the repayment of the principal at the end of 2014, irrespective of the coupon rate. The outcome is worse from the previous case.

APPENDIX 6d

Forecasting with the log-linear model, considering 1.2 billion debt, in USD, 10-years to maturity from 2010								
Year	t	Sustainable Debt	IMF forecast	Difference in suggested debt	Cash outflow, worst case	Cash outflow, best case	Debt capacity, worst case	Debt capacity, best case
2008	0	359316089		359316089				
2009	1	398125923	2324000000	-1925874077				
2010	2	441127617	2859500000	-2418372383				
2011	3	488773937	3556800000	-3068026063	108000000	81000000	380773937	407773937
2012	4	541566550	3578400000	-3036833450	108000000	81000000	433566550	460566550
2013	5	600061308	3253800000	-2653738692	108000000	81000000	492061308	519061308
2014	6	664874102	2772000000	-2107125898	108000000	81000000	556874102	583874102
2015	7	736687343			108000000	81000000	628687343	655687343
2016	8	816257154			108000000	81000000	708257154	735257154
2017	9	904421323			108000000	81000000	796421323	823421323
2018	10	1002108128			108000000	81000000	894108128	921108128
2019	11	1110346114			1308000000	1281000000	**-197653886**	**-170653886**

Note: the negative numbers in bold indicate about Mongolia's difficulties in meeting the repayment of the principal at the end of 2019, in 10 years from 2010, irrespective of the coupon rate. But the shortfalls are not as high as with 5-years to maturity.

Forecasting with the ECM, considering 1.2 billion debt, in USD, 10-years to maturity from 2010								
Year	t	Sustainable Debt	IMF forecast	Difference in suggested debt	Cash outflow, worst case	Cash outflow, best case	Debt capacity, worst case	Debt capacity, best case
2008	0	359316089		359316089				
2009	1	360803711	2324000000	-1963196289				
2010	2	365614432	2859500000	-2493885568				
2011	3	373881237	3556800000	-3182918763	108000000	81000000	265881237	292881237
2012	4	385835350	3578400000	-3192564650	108000000	81000000	277835350	304835350
2013	5	401817053	3253800000	-2851982947	108000000	81000000	293817053	320817053
2014	6	422291867	2772000000	-2349708133	108000000	81000000	314291867	341291867
2015	7	447873199			108000000	81000000	339873199	366873199
2016	8	479352986			108000000	81000000	371352986	398352986
2017	9	517742485			108000000	81000000	409742485	436742485
2018	10	564326149			108000000	81000000	456326149	483326149
2019	11	620732594			1308000000	1281000000	**-687267406**	**-660267406**

Note: the negative numbers in bold indicate about Mongolia's difficulties in meeting the repayment of the principal at the end of 2019, irrespective of the coupon rate. The outcome is better than with 5-years to maturity but not significantly.

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