The Effect of Institutions, Geography, Development Assistance and Debt Crises on Public-Debt Management

Melecky, Martin

World Bank, Technical University of Ostrava

July 2009

The Effect of Institutions, Geography, Development Assistance and Debt Crises on Public-Debt Management Strategies*

Martin Melecky†
World Bank

July 17, 2009

Abstract

Using survey data on debt management strategies, this paper studies whether the probability that a country has a debt management strategy, publishes its debt strategy, and uses a benchmark-based strategy is affected by democratic accountability, institutional quality, past debt crises/defaults, IFIs development assistance, and participation in debt management programs. We find that countries located in Latin America and Caribbean are less likely to have developed a debt management strategy and, if they have, they are less likely to publish it. In contrast, countries located in Middle East and North Africa are less likely to use quantitative benchmarks in formulation of their debt management strategy. A country is more likely to have developed a debt management strategy if it has an experience of a past debt crisis, but not of repeated debt crises. Institutional quality and democratic accountability could significantly contribute to emergence of more transparent and accountable debt management strategies in developing countries. IFIs' technical assistance on public debt management could be enhanced by IFIs conducting their own, prior diagnostic reviews.

Keywords: Public Debt Management Strategy; Cross-Country Survey; Institutional Factors; Regional Location; Debt Crises; Development Assistance.

JEL Classification: H63, H74, O50

---

*The opinions expressed in this work are those of the author and should not be attributed to the World Bank, affiliated organizations, or members of its Board of Directors or the countries they represent. I am grateful to Marianne Sarkis and Armando Rosselli for research assistance. I thank Phillip Anderson, Elizabeth Currie, Lars Jessen, Tomas Magnusson, Eriko Togo, and Antonio Velandia for their comments and suggestions. All remaining errors are mine.

†Mailstop H4-410, World Bank, 1818H Street NW, DC 20433, USA, email: mmelecky@worldbank.org

1 Introduction

Governments have to often borrow in order to finance expenditures on public goods and services that promote growth and increase nations' welfare. The government not only aims to raise funding at low cost but also to structure the composition of its debt portfolio in such a way as to minimize the impact of relevant shocks on its budget and medium-term expenditure plan (see e.g. Gill and Pinto, 2005). Public debt managers are responsible for choosing the appropriate borrowing instrument to raise the needed funds for the government, based on the delegated authority from the government.[1] The fundamental document that guides debt managers in their decisions and operations is the public debt management *strategy*. The strategy is built upon goals stated in the government's debt management *objectives*.[2]

If a given country has developed a debt management strategy, it may decide to publish it. The debt management strategy is considered as public if it is published either in the annual report of the debt management authority, or made available on its website. Further, a formal debt management strategy, not necessarily published, can take two basic forms. Either be presented in terms of *guidelines* or quantitative *benchmarks* for the optimal government debt portfolio. The former relates to a document which guides the debt managers on types of risks that should be considered as relatively more important, and thus indirectly points to the desired structure of a debt portfolio. Therefore, the guidelines provide directions for future debt management operations rather than quantitative targets. On the other hand, strategic benchmarks state explicitly what are the desired risk characteristics of the optimal debt portfolio in a quantitative manner.

This paper analyzes data from a survey on debt management strategies conducted by the World Bank. The analysis focuses on three main aspects of debt management strategies in surveyed countries. Namely, (i) whether a public debt management strategy has been developed by a given country, (ii) whether it is published, and (iii) whether it is formulated in terms of guidelines or quantitative benchmarks. First, we describe the survey, summarize the survey data statistics based on selected country group characteristics. Then, we investigate whether the probability of having (i) a debt management strategy, (ii) a publicly disclosed debt strategy, and (iii) a quantitative-benchmark strategy is affected by democratic account-

[1] The process underlying delegation of authority to the debt management office to borrow and execute related transactions in financial markets on behalf of the state is described in more detail in IMF and WB (2001) and Wheeler (2004).

[2] The debt management objectives are usually expressed along the following lines, see IMF and WB (2001): *The main objective of public debt management is to ensure that the government's financing needs and its payment obligations are met at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk.* The debt management objectives also typically contain sections addressing the government's involvement in domestic bond market development and coordination of its actions with fiscal and monetary policies. The latter relates to the fact that the objectives of fiscal policy, monetary policy, and public debt management differ but there are various interdependencies among their policy instruments, see e.g. Wheeler (2004) or Togo (2007).

ability, institutional quality, past debt crises/defaults, IMF and World Bank development assistance, and participation in debt management programs. We find that the probability that a country has developed a debt management strategy is decreased significantly if the country is located in Latin America and Caribbean, and increased significantly if a country has benefited from specific debt-management assistance from the IMF – including an initial diagnostic and follow-up technical assistance – had an experience of a past debt crisis (but not of *repeated* debt crises), and its overall institutional quality has improved. Further, we find that the probability that a country publishes its debt management strategy is negatively correlated with its location in Latin America and Caribbean and its participation in the DMFAS[3] program, and that the major positive effect on the choice to publish the strategy comes from enhanced democratic accountability in the country. Finally, the probability that a country uses quantitative benchmarks in formulation of its debt management strategy is significantly decreased if it is located in the Middle East and North Africa region, or have received IMF technical assistance on public debt management. However, the most economically significant negative effects appears to be due to increasing income beyond the thresholds for upper-middle income and high income countries, while the most economically significant positive effects are due to improved democratic accountability and specific development assistance from the World Bank.

Development aspects concerning policy formulation of public debt management strategies have not received much attention in the literature. This paper thus provides preliminary insights in this area by using a new and unique data set. While development and formulation of public debt management strategies has close ties to medium-term public expenditure frameworks and fiscal sustainability (see e.g. Missale, 1999; and Burnside, 2004), the associated literature has not paid a detailed attention to the role of debt management strategy formulation. The academic literature has mostly focused on the tax-smoothing aspect (Sargent and Wallace, 1981), and hedging of real and financial shocks affecting government finances (Bohn, 1990a and 1990b). Hence, the formulation of public debt management strategies has been mostly addressed by practitioners and IFIs (e.g. Wheeler, 2004; IMF &WB 2001 and 2004), however, a quantitative cross-country analysis of public debt management strategies and links of their characteristics to country specifics has been missing in the literature.

The remainder of the paper is organized as follows. Section 2 describes the survey design, the survey data collection and the data itself through the incidence of the surveyed characteristics of debt management strategies conditional on selected country group characteristics. Section 3 then carries out regression analysis to investigate the effect of institutional development, geographic location, past debt crises experience and development assistance on the surveyed attributes of public debt management strategies across countries. Section 4 concludes.

[3]UNCTAD's Debt Management Financial and Analysis System.

2 The Survey Data

Progressing in the efforts to better understand the development economics of public debt management strategies across different country groups and individual countries, the Banking and Debt Management Department of the World Bank conducted a survey on public debt management strategies. The survey was carried out during the period from August 2006 to February 2007 and covers OECD, IBRD and *Blend* countries.[4] The questionnaire was sent out to and completed by national authorities responsible for public debt management, or if not feasible the questionnaire was completed by the relevant country economist based on discussions with the relevant national government authorities. The information from the questionnaire was supplemented by a search through websites of institutions responsible for central government's debt management. The questionnaire asked the following questions[5]

(i) *Has the government established a debt management strategy for the total central government debt portfolio?*

(ii) *Is the debt management strategy document published?*

(iii) *Have you established a strategic target/benchmark for the total debt portfolio?*

The questions were answered in a Yes/No manner and converted to 1/0 entries for each country, respectively. Regarding point (i), due to the formulation of the question the positive answers may include implicit strategies. After acquiring all observation, the data were reviewed and some adjustments made to ensure their consistency across countries.[6] The latter pertains to ensuring that the unobserved quality of debt management strategies which are not made public meets certain criteria. Namely, the emphasis was placed on the fact that a debt management strategy has to address the cost-risk trade-off, not only the cost of fiscal financing. This requirement thus excludes references to purely fiscal expenditure frameworks or frameworks addressing fiscal sustainability. Concerning point (ii) the questionnaire was supplemented by website search to obtain the strategy documents. In point (iii) all countries that appeared to have at least one benchmark target or targeted range for one of the three risks below qualified for a positive answer.

If countries have established a strategic target/benchmark for their public debt portfolio they were asked which types of risks the strategic target/benchmark addresses. Namely, they were asked

[4] The applied classification into country groups is that of the World Bank and is available at `http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20421402~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html`

[5] The survey was made confidential regarding the aswers of individual countries so that no country examples appear in the text.

[6] I am grateful to Lars Jessen and Antonio Velandia for their help in this process and Phillip Anderson, Elizabeth Currie and Tomas Magnusson for their expert inputs.

(iii.a) *Have you established a strategic target/benchmark for currency risk (% domestic vs. % foreign)?*

(iii.b) *Have you established a strategic target/benchmark for interest rate risk (% fixed vs. % floating; average time to refixing (months); or modified or Macaulay duration (years))?*

(iii.c) *Have you established a strategic target/benchmark for refinancing risk (ceiling on debt maturing within one year (% of total outstanding); or average time to maturity (years))?*

The Yes/No answers to the latter questions were also converted into 1/0 entries.

The entire data set covers 107 countries (see Table (7) in the Appendix) where the analysis of question (i) is based on all 107 observations, and analyses of questions (ii) and (iii) on 68 observations on strategies. To broadly characterize our sample, the data shows that out of the total of 107 countries, 68 countries have developed a sovereign debt management strategy; out of the 68 countries with debt management strategies, 51 publish their public debt management strategies. Furthermore, out of the 68 countries with debt management strategies, 39 formulate their strategies in terms of guidelines, and 29 in terms of quantitative benchmarks.[7] Out of the 29 countries which formulate their debt management strategies using quantitative benchmarks, 22 set benchmarks for refinancing risk, 27 set benchmarks for interest rate risk, and 19 set benchmarks for foreign currency risk. Furthermore, out of the 29 countries with benchmark strategies, 14 set benchmarks for all three risk (refinancing, interest rate and foreign currency), 11 set benchmarks for two of the risks, and 4 set a benchmark only for one of the risks.

Regarding the source of information that provided the basis for our classification 40% of countries responded to the questionnaire either by themselves or via the WB's country office. In the case of 9% of the countries, the information from diagnostic assessments conducted by the Banking and Debt Management Department was used and updated by means of a website search. Finally, 51% of countries were classified based on information from the relevant websites, 46% of those are OECD countries and the remainder are countries for which a response either to the questionnaire sent out directly to the relevant debt management authorities,

[7] The strategic benchmarks can quantify the targeted risk characteristics of the optimal debt portfolio either in terms of specific magnitudes or more often specific ranges. For the purpose of this paper we consider three basic types of risks: (i) foreign currency (FX) risk, (ii) refinancing (roll-over) risk, and (iii) interest rate risk. A benchmark for foreign currency risk specifies the desired currency composition of a debt portfolio, i.e. the targeted shares of the debt denominated in domestic currency versus foreign currency. This benchmark could be also specific on the targeted allocations of foreign currency debt across different currencies. A benchmark for refinancing risk includes the targeted maturity structure and redemption profile of the debt. And, a bechmark for interest rate risk states the desired proportion of floating relative to fixed interest rate debt or, in some cases, the price-indexed debt.

or to WB's country offices[8] was not recovered. If none of the applied information channels worked out the country was assigned a response of "No" to question (i), which excluded it from the analysis of questions (ii) and (iii). There are 21 non-OECD countries that were assigned a response of "No" in such a manner.

Next, we describe the survey data in more detail by focusing on selected country-group characteristics. The latter include the income level classification, regional location, participation in assistance programs regarding sovereign debt management and past experience of sovereign debt crises. We use the World Bank's methodology to classify countries into groups with high income, upper-middle income, lower-middle income and low income. Similarly, we determine a country's regional affiliation based on the classification used by the World Bank by considering the regions of Europe and Central Asia (ECA), Latin America and Caribbean (LAC), East Asia and Pacific (EAP), South Asia (SAR), Middle East and North Africa (MNA), and Subsaharan Africa (AFR). In terms of development assistance in the area of sovereign debt management, we consider involvements of four providers: UNCTAD's Debt Management Financial and Analysis System (DMFAS)[9], COMSEC[10], the World Bank's Diagnostics and Technical Assistance (WB-D, WB-TA)[11] and the IMF's Diagnostics and Technical Assistance (IMF-D, IMF-TA)[12]. For the World Bank and IMF assistance, we thus distinguish between whether the institutions provided diagnostic or technical assistance. Finally, we classify countries into groups which have experienced sovereign debt crisis in the past and those who have not, and into groups that have experienced repeated sovereign crises and others. To determine whether a country has experienced a sovereign debt crisis, we use the dataset compiled by Laeven and Valencia (2008). When we condition on selected country characteristics, we interpret the results as association not necessarily causality.

[8] The WB's country offices were asked to respond after a dialog with the relevant country's authorities or after a thorough assessment of the subject matter.

[9] UNCTAD project activities cover the provision of a specialized debt management software, the Debt Management Financial and Analysis System (DMFAS), training and assistance in its effective use, in particular to enable debt officers to establish a complete and up-to-date debt database and to provide timely and accurate debt statistics. They also cover maintenance and system support, the procurement of appropriate equipment where necessary, advice on institutional and procedural issues, participation of government officials in DMFAS training seminars, study tours for government officials to other DMFAS user countries, and support for debt analysis and the development of debt management strategies.

[10] The Debt Management Section (DMS) of the Commonwealth Secreteriat implements the capacity building programme in debt management in its member countries, as an arm of the Special Advisory Services Division of the Secretariat. The main objective of the debt programme is to assist countries in ensuring sustainable debt management. In providing technical assistance on debt and development resource management the DMS is focused on provision of the CS-DRMS software; assistance in data compilation; dissemination in debt data methodology standards; software maintenance and support; training in debt and aid management; and provision of policy advise on debt strategies and institutional structure for debt management.

[11] These are specific products and services provided by the Banking and Debt Management Department of the World Bank.

[12] This is specific assistance provided by the Money and Capital Markets Department of the IMF.

2.1 Incidence of Debt Management Strategies

Table (1) shows, in the first column, the considered group characteristics. The second column shows the difference between the probability, **Prob**(.), that a country *with* a given group characteristic, displayed in the corresponding row of column one, has a debt management strategy, and the probability that a country *without* this group characteristic has a debt management strategy, i.e. **Prob**(**1**) and **Prob**(**0**) respectively. For instance, the first row shows the difference between the probability that a country located in the ECA region has a debt management strategy, **Prob**(**1**), and the probability that a country outside of the ECA region has a debt management strategy, **Prob**(**0**). The third column shows the Z-statistic corresponding to this difference, and column four shows the significance level associated with the Z-statistic. If the **Prob**(**1**) − **Prob**(**0**) difference is positive and the significance level low (e.g. below 5%), one can infer that there is a significantly higher probability that a country with the given group characteristic has a debt management strategy.

Table 1: Conditional Probability of Debt Management Strategy Incidence Based on Group Characteristics

Group	**Prob(1)-Prob(0)**	**Z-statistic**	**Significance Level**
ECA	0.1602	1.4199	0.1556
LAC	−0.2742	−2.4970	0.0125
EAP	−0.2521	−1.5664	0.1172
SAR	*na*	*na*	*na*
MNA	−0.0919	−0.5955	0.5515
AFR	−0.1382	−0.7766	0.4373
High Income	0.3555	3.2767	0.0010
Upper-Middle	−0.1287	−1.2771	0.2015
Lower-Middle	−0.1685	−1.7189	0.0856
Low Income	*na*	*na*	*na*
DMFAS	−0.0316	−0.3090	0.0757
COMSEC	−0.3183	−2.5888	0.0096
WB	0.0419	0.4067	0.6841
WB-D&TA	0.0404	0.1426	0.8866
WB-D	0.0050	0.0412	0.9670
WB-TA	0.0712	0.5410	0.5884
IMF	−0.1135	−1.0913	0.2751
IMF-D&TA	−0.3030	−1.0695	0.2848
IMF-D	−0.2135	−1.1277	0.2594
IMF-TA	−0.0977	−0.9010	0.3675
Debt Crisis =1	0.1330	−1.2894	0.1972
Debt Crisis >1	−0.2391	1.0787	0.2807

The test results presented in Table (1) suggest that if a country is located in the LAC region there is significantly (at 5% level) lower probability that it will have a debt management strategy. On the other hand, if a country belongs to the high income group there is significantly (at 1% level) higher probability that it will have a debt management strategy. Countries belonging to the lower-middle income group have significantly (at 10% level) lower probability

of having a debt management strategy. In addition, countries that have taken part in the COMSEC program have significantly lower probability of having a debt management strategy.

There is also some indication that there is a lower probability that countries located in the EAP region will have a debt management strategy but the significance level of this difference still does not reach the conventional levels of significance. The development assistance from the World Bank, IMF or DMFAS does not seem to play a significant role in affecting the probability that a country has developed a sovereign debt management strategy. Similarly, a past debt crisis or repeated debt crises do not seem to coincide with the probability of a country having developed a debt management strategy.

2.2 Incidence of Publicized Debt Management Strategies

Table (2) shows the considered group characteristics, similar to those in Table (1), in the first column. The second column shows the difference in probabilities that a country *with* the respective characteristic in column one publicizes its sovereign debt management strategy, **Prob(1),** and the probability that a country *without* this group characteristic publicizes its debt management strategy, **Prob(0)**. If the difference is positive country with the corresponding characteristic is more likely to publish its debt management strategy. In column three and four, one can find the Z-statistic and significance level, corresponding to the difference in probabilities shown in column one.

Table 2: Conditional Probabilities of Published Debt Management Strategies Based on Group Characteristics

Group	**Prob(1)-Prob(0)**	**Z-statistic**	**Significance Level**
ECA	0.1594	1.2753	0.2021
LAC	−0.2092	−1.4047	0.1600
EAP	0.0333	0.1435	0.8858
SAR	*na*	*na*	*na*
MNA	−0.2413	−1.2518	0.2106
AFR	0.0333	0.1435	0.8858
High Income	0.0500	0.4307	0.6666
Upper-Middle	0.0257	0.2091	0.8343
Lower-Middle	−0.0775	−0.6476	0.5172
Lower Income	*na*	*na*	*na*
DMFAS	−0.2454	−2.0243	0.0429
COMSEC	0.1553	0.8629	0.3881
WB	0.0642	0.5366	0.5915
WB-D&TA	0.2903	0.8988	0.3687
WB-D	−0.0641	−0.4451	0.6561
WB-TA	0.2298	1.5429	0.1228
IMF	0.0625	0.4917	0.6228
IMF-D&TA	0.2857	0.6304	0.5283
IMF-D	0.2950	1.1097	0.2670
IMF-TA	0.0190	0.1435	0.8858
Debt Crisis =1	−0.1039	−0.8872	0.3749
Debt Crisis >1	−0.2258	0.6990	0.4845

The results in Table (2) suggest that the probability that a country, which has participated in the DMFAS program, publishes its debt management strategy is significantly lower than the similar probability for remaining countries. This result appears to be significant at the 5% level. Although the results for the LAC and MNA regions show lower probability that the respective countries publish their debt management strategies, the results are not significant at common levels. Similarly, the income-group affiliation also does not seem to be associated with the probability that a country publishes its debt management strategy. The development assistance does not appear to play a role either. In addition, the experience of a past debt crisis or repeated debt crisis does not indicate any association with the probability that a given country would be more likely to publish its debt management strategy.

2.3 Incidence of Debt Management Strategies Formulated as Quantitative Benchmarks

Table (3) shows considered group characteristic in column one, and the difference between the probability that a country with the given group characteristic has developed a benchmark strategy, **Prob(1),** and the probability that a country without this group characteristic has developed a benchmark strategy, **Prob(0)**. Columns three and four then provide the corresponding Z-statistic and significant level for such a difference. A significantly positive difference would imply that a country with a given group characteristic has significantly higher probability of having developed a benchmark-based sovereign debt management strategy.

The results shown in Table (3) imply that no considered group characteristic seems to be significantly associated with the probability that a country have developed a benchmark strategy. Although there appears to be a lower probability that countries in MNA region have developed a benchmark debt-management strategy, this result is not statistically significant at common levels. Similarly, countries that have received IMF technical assistance on public debt management could show lower probability of having a benchmark strategy, but this result is significant at no less than the 13% level.

While the intention of this section has been to describe the survey data conditional on selected country characteristics, the next section will investigate the marginal effects of a broader set of country characteristics on the probability that a country has a debt management strategy, that it publishes its strategy, and that the strategy is formulated in terms of quantitative benchmarks. This investigation will be carried out by means of a regression analysis.

Table 3: Conditional Probability of a Debt Management Strategy Beign in the Form of a Benchmark Based on Group Characteristics

Group	Prob(1)-Prob(0)	Z-statistic	Significance Level
ECA	0.0869	0.6304	0.5283
LAC	0.0205	0.1252	0.9003
EAP	−0.2000	−0.7807	0.4349
SAR	*na*	*na*	*na*
MNA	−0.2988	−1.4047	0.1600
AFR	−0.2000	−0.7807	0.4349
High Income	0.0333	0.2602	0.7946
Upper-Middle	−0.0233	−0.1723	0.8631
Lower-Middle	−0.0132	−0.1006	0.9198
Low Income	*na*	*na*	*na*
DMFAS	−0.1272	−0.9513	0.3414
COMSEC	−0.0100	−0.0504	0.9597
WB	0.0575	0.4360	0.6628
WB-D&TA	0.0645	0.1810	0.8563
WB-D	0.0769	0.4841	0.6282
WB-TA	0.0205	0.1252	0.9003
IMF	−0.1151	−0.8201	0.4121
IMF-D&TA	−0.4444	−0.8888	0.3740
IMF-D	0.2404	0.8195	0.4124
IMF-TA	−0.2231	−1.5242	0.1274
Debt Crisis =1	−0.1399	−1.0831	0.2787
Debt Crisis >1	−0.4516	1.2671	0.2050

3 Regression Analysis

In order to estimate the marginal effects of democratic accountability, institutional quality, experience of past debt crises, development assistance (IMF; WB) and participation in debt management programs (DMFAS; COMSEC) on the probability that a country has developed a sovereign debt management strategy, we resort to regression analysis. Namely, we try to estimate the probability of a country having a debt management strategy, a published debt management strategy and a benchmark-based debt management strategy, respectively, using a logit model for the respective probabilities.

Let y_i denote a dummy variable that takes the value of one when a country i has developed a debt management strategy. We estimate y_i as a function of selected variables X_i. If we assume that $F(X_i\prime\beta)$ is the cumulative probability distribution function evaluated at $X_i\prime\beta$, where β is a vector of coefficients to be estimated, then the likelihood function of the model could be written as:

$$\log L = \sum_{i=1}^{N} \{y_i [\log F(X_i\prime\beta_i)] + (1 - y_i) [1 - \log F(X_i\prime\beta_i)]\} \tag{1}$$

where the vector X_i includes binary variables to indicate whether a country i is classified as high income (HIC), upper-middle income (UMIC), lower-middle income (LMIC) or low income (LIC) according to the World Bank classification; whether a country i is located in

Europe and Central Asia (ECA), Latin America and Caribbean (LAC), East Asia and Pacific (EAP), South Asia (SAR), Middle East and North Africa (MNA), and Subsaharan Africa (AFR); whether a country i is involved with UNCTAD's Debt Management Financial and Analysis System (DMFAS), COMSEC (COMSEC); or whether or not it has received development assistance from the World Bank, in the form of Diagnostics and/or Technical Assistance (WB-D, WB-TA), or from the IMF either in the form of Diagnostics and/or Technical Assistance (IMF-D, IMF-TA). In addition to these variables, that we have utilized in Section 2 to assess bivariate conditional probabilities, we include several other which are discrete random variables. Namely, we include the Index of Institutional Quality (InstQuality) and Democratic Accountability (DemoAccount) due to Kaufmann et al. (2008), and log of GDP per capita in constant international dollars (logGDPpc; Central WB Database).

The slope coefficients β_k,where k is the number of explanatory variables in the logit regression, measure the linear impact of the k-th explanatory variable on the log odd's ratio:

$$\log \frac{P_i}{(1-P_i)} = \sum\nolimits_{k=1}^{K} \beta_k X_{k,i} \tag{2}$$

where $P_i = Prob(y_i = 1|X_i)$ is the probability that a given country has a debt management strategy, publishes it debt management strategy and has a benchmark-based debt management strategy, respectively, while conditioning on the vector of k explanatory variables. We are more interested in the impact of the explanatory variables on P_i which depends on the initial values of the explanatory variables X_i and their β_k coefficients. Therefore, to assess the economic magnitude of the relationship between explanatory variables and the P_i, we will evaluate the marginal impact at the sample mean as it is a common approach in the literature.

While the simplest logit model assumes *iid* disturbances, in practice, this assumption is likely to be violated, for instance, due to possible omitted variables. Thus possible dependence and heteroscedasticity of disturbances could lead to downward biased estimates of standard errors of the coefficients. To correct for the violation of the *iid* assumption, we compute the coefficient standard errors using a heteroscedasticity and autocorrelation robust variance-covariance (HAC) matrix.

It is assumed for the purpose of the regression estimation that all the explanatory variables are weakly exogenous. In particular, the variables describing the geographic location of a country are assumed to be strictly exogenous with respect to the characteristics of sovereign debt management strategies. Further, the income level of a given country is assumed to be weakly exogenous as cost-effective and prudent public debt management would be one of many potential factors effecting the countries' income level so that by principle of aggregation there should be stronger causality from the income level variable to the debt management variable rather than the other way around. We assume the same degree of weak exogeneity for the variables characterizing overall Institutional Quality and Democratic Accountability

of the country since public debt management quality or accountability would be one of many aspects potentially affecting those two ratings.

A question arises of whether the assumption of weak exogeneity is a reasonable one in the case of debt management crises and development assistance. This is because one can argue that the weaker the public debt management the more likely the occurrence of a debt crisis or the more likely that a country would ask for a development assistance in this area. Although we made an attempt to adjust for this possible bias in the estimation, we were not able to find suitable instruments to tackle this potential problem effectively. Therefore, the presented estimation results should be approached with this caveat in mind.

3.1 The Probability That a Country Has a Debt Management Strategy

In this section, we estimate the discussed logit model for a binary variables taking value of one when a given country has a sovereign-debt management strategy and zero otherwise. The estimation results are reported in Table (4). We report the parsimonious version of the estimation results based on the general-to-specific approach – maximizing the adjusted R squared. Namely, the first column shows the utilized explanatory variables, the second column shows the estimated $\boldsymbol{\beta}_k$ coefficients from equation (1), column three reports the $\boldsymbol{\beta}_k$-coefficients' robust standard errors estimated using the HAC matrix, column four reports the probability that a given coefficient is equal to zero, column five shows the estimated unconditional mean for a given variable, and column six shows the impact of a given explanatory variable at its sample mean.

Table 4: Logit for Debt Management Strategies - Parsimonious Estimation Results

Variable	$\boldsymbol{\beta}_k$	**Robust S.E.**	**Probab.**	$\overline{X}_{k,i}$	$\boldsymbol{\beta}_k\overline{X}_{k,i}$
ECA	1.683	0.745	0.024	0.281	0.473
LAC	−1.517	0.844	0.072	0.172	−0.261
HIC	1.397	0.932	0.134	0.375	0.524
DMFAS	1.300	0.728	0.074	0.313	0.407
IMF	3.904	1.899	0.040	0.266	1.038
IMF-D	−2.786	1.560	0.074	0.071	−0.198
IMF-TA	−4.275	1.791	0.017	0.276	−1.180
DebtCrisis1	2.638	1.021	0.010	0.327	0.863
DebtCrisis2	−1.577	1.137	0.165	0.051	−0.080
InstQuality	1.245	0.506	0.014	0.384	0.478
Intercept	−1.041	0.509	0.041	1.000	−1.041
Observations			98		
Pseudo R2			0.336		
LogLikelihood			−42.035		

The estimation results suggest that if a country is located in the ECA region then this increases the probability that the country has developed a sovereign-debt management strat-

egy, where the estimated coefficient at the sample mean equals 0.473 and is significant at the 5% level. On the other hand, if a country were to be located in the LAC region its probability of having a sovereign debt management strategy would decrease by 0.261, the coefficient estimate at the sample mean, significant at the 10% level.

Further, if a country were to reach the income level of HICs, its probability of having a debt management strategy would increase by 0.524, though this effect is not significant at common levels. The effect of participation in the DMFAS program increases the probability that a country has developed a debt management strategy by 0.407, an estimate significant at the 10% level. If a country were to benefit from an IMF program including debt management diagnostic and subsequent technical assistance, its probability of having a debt management strategy would increase by 1.038, an estimate significant at the 5% level. In this case, it is thus predicted that the country develops debt management strategy under such an IMF program, conditioning on other variables. Nevertheless, if the IMF program includes only a diagnostic of the country's debt management this could decrease this positive effect by -0.198, significant at the 10% level. Moreover, if the country were a subject to an IMF technical assistance in the area of debt management without prior relevant diagnostics conducted by the IMF, such assistance would decrease the probability that the country develops a debt management strategy by an estimated -1.180 – significant at the 5% level. The overall effect of such an IMF-TA would thus be negative.

Consider now the effect of past debt crises experience. The estimation results imply that if a country has experienced a debt crisis in the past, its probability of having a debt management strategy increases by estimated 0.836, significant at the 1% level. Nevertheless, if a country has experienced repeated debt crises in the past, i.e. more than one in our case, this could decrease the positive effect of crisis experience by an estimated -0.08. The latter is however not significant at common levels.

Finally, the estimated effect of institutional quality on the probability that a country has developed a debt management strategy appears to be significantly positive at the 5% level. Namely, if a country increases its rating on institutional quality by one, this would increase its chances for developing a debt management strategy by an estimated 0.478.

Overall the regression shows a reasonable fit with a pseudo R squared of 0.336 where the most influential variables to increase countries' probability of having a debt management strategy are: (i) specific debt-management IMF assistance including both diagnostic and technical assistance; (ii) experience of a past debt crisis, i.e. no experience of repeated debt crises; and (iii) increasing overall institutional quality in the country.

3.2 The Probability That a Country Publishes Its Debt Management Strategy

This section contains a discussion of the estimation results from a logit regression for published sovereign-debt management strategies. When estimating the regression, we start with the same baseline set of explanatory variables as in Subsection 3.1., and by applying the general-to-specific approach, we arrive at the parsimonious version of the estimated regression presented in Table (5).

Table 5: Logit Regression for Publicized Debt Management Strategies - Parsimonious Estimation Results

Variable	$\boldsymbol{\beta}_k$	**Robust S.E.**	**Signif. Level**	$\overline{X}_{k,i}$	$\boldsymbol{\beta}_k\overline{X}_{k,i}$
LAC	−1.480	0.924	0.109	0.172	−0.255
HIC	−1.652	1.086	0.128	0.375	−0.620
DMFAS	−1.198	0.734	0.103	0.313	−0.375
WB	1.126	0.743	0.130	0.328	0.369
DemoAccount	1.013	0.543	0.062	0.535	0.542
Intercept	1.439	0.698	0.039	1.000	1.439
Observations			64		
Pseudo R2			0.143		
LogLikelihood			−32.603		

The estimation results suggest that when a country is located in the LAC region this could significantly decrease, by −0.255, the probability that it publishes its debt management strategy. In other words, countries in LAC appear to be significantly less transparent regarding their applied public debt management strategies than other countries in our sample. In addition, if a country were to increase its income level to that of HICs, it would decrease the probability of publishing its debt management strategy by −0.620. This suggests that HICs could be generally less transparent in their public debt management than countries with lower income levels. The latter effect is however not significant at common levels.

Further, if a country were to join the DMFAS program, the probability that it will publish its debt management strategy is predicted to decrease by −0.375. However, if a country were to benefit from specific WB assistance focused on public debt management, which would have to include both initial diagnostic and subsequent technical assistance, the probability that it will publish its debt management strategy is predicted to increase by 0.369. Although this effect is not significant at the common levels, it significantly improves the regression's fit to the data.

Finally, if overall democratic accountability were to improve in a given country the probability that this country will publish its debt management strategy will significantly increase by an estimated 0.542. Overall the model is only marginally successful in fitting the data with pseudo R squared of 0.143 where the major effect on the choice of a country to publish

its debt management strategy comes from an increase in overall democratic accountability in the country.

3.3 The Probability That a Country Formulates Its Debt Management Strategy Using Quantitative Benchmarks

In this section, we estimate the logit regression for a binary dependent variable taking the value of one when a country has a debt management strategy expressed in terms of quantitative benchmarks and zero otherwise. We start with the same set of explanatory variables as in subsections 3.1. and 3.2. We have obtained the parsimonious estimation results shown in Table (6) by applying the general-to-specific approach – using the maximization of the adjusted R squared as the selection criterion.

Table 6: Logistic Regression for Benchmark-Based Debt Management Strategies - Parsimonious Estimation Results

Variable	$\boldsymbol{\beta}_k$	**Robust S.E.**	**Signif. Level**	$\overline{X}_{k,i}$	$\boldsymbol{\beta}_k\overline{X}_{k,i}$
ECA	−3.520	1.838	0.056	0.281	−0.989
LAC	−4.620	2.140	0.031	0.172	−0.795
MNA	−4.322	2.088	0.038	0.094	−0.406
HIC	−11.11	3.833	0.004	0.375	−4.166
UMIC	−4.339	1.686	0.010	0.297	−1.289
COMSEC	−5.411	2.341	0.021	0.109	−0.590
WB	3.295	1.224	0.007	0.328	1.081
IMF	−2.925	0.947	0.002	0.266	−0.778
DemoAccount	4.857	1.570	0.002	0.535	2.598
Intercept	4.425	2.070	0.033	1.000	4.425
Observations			64		
Pseudo R2			0.285		
LogLikelihood			−31.359		

We find that the location of a country in the ECA region significantly decreases the probability that the country expresses its debt management strategy using quantitative benchmarks by −0.989, significant at the 10% level. Similarly, the geographic location of countries in the LAC and MNA regions also predicts decreased probability that a country expresses its strategy in terms of quantitative benchmarks by −0.795 and −0.406, respectively, both significant at the 5% level. It appears that the potential higher transparency and accountability associated with benchmark debt management strategies is not favored by HICs. Namely, the estimation results imply that as a country increases its income level the probability that it would opt for a benchmark debt management strategy decreases by −4.166, an estimate significant at the 1% level. Furthermore, this effect appears to start at the level of upper MICs where countries reaching the corresponding level of income significantly (at the 1% level) decrease their probability of adopting benchmark strategy, by −1.289.

What concerns the development assistance effect on the character of debt management strategies, the results appear to be mixed. On one hand, if a country participated in the COMSEC program or benefited from an IMF assistance, either a specific debt management diagnostic review or technical assistance, its probability of opting for a debt management strategy based on quantitative benchmarks would decrease by -0.590 and -0.778, respectively, estimates significant at the 5% and 1% level. On the other hand, if a country were to benefit from either a diagnostic review or technical assistance from the World Bank the estimation results predict an increase in probability of that country developing a benchmark-based debt management strategy by 1.081, significant at the 1% level.

Moreover, the results suggest that there is a strong effect of the overall Democratic Accountability in the country on the choice between guidelines-based and benchmark-based debt management strategies. Namely, the estimated regression predicts that as a country improves its Democratic Accountability rating, it is significantly more likely to opt for a debt management strategy based on quantitative benchmarks rather than (more general) guidelines, *ceteris paribus*. This implies that benchmark debt-management strategies could also increase the transparency and accountability of sovereign debt managers.

Overall, the regression shows a data fit characterized by an R squared of 0.285, where the most economically significant negative effects on the probability that a country would adopt a benchmark-based debt management strategy appear to come from increasing income beyond the thresholds of upper-MICs and HICs, respectively. And, where the most economically significant positive effects appear to come from the improvement in overall democratic accountability in the country and the development assistance from the World Bank targeting public-debt management.

4 Conclusion

This paper described and analyzed data from a survey on public debt management strategies conducted by the World Bank. Namely, the paper focused on characterizing and estimating the probability that a country has a debt management strategy, that a country publishes its debt strategy, and that a country formulates its debt management strategy using quantitative benchmarks. We attempted, in particular, to estimate how the aforementioned attributes of sovereign debt management strategies vary with respect to countries' ratings on democratic accountability, institutional quality, experience of past debt crises, experience with drawing on IMF or World Bank assistance, and participation in debt management programs, such as DMFAS and COMSEC. These estimations were undertaken in an attempt to acquire some understanding of the development aspects of public debt management strategies and their link to broader institutional development, and to help developing countries benchmark their position concerning the public debt management strategy to their peers and more effectively

demand respective development assistance.

Concerning the probability that a country has developed a debt management strategy, we find, that a location of a country in the LAC region significantly decreases its probability of having developed a debt management strategy – based on both the evidence from conditional bivariate analysis and regression analysis. Based on the performed regression analysis, we find that the most influential variables to increase countries probability of having a debt management strategy are: (i) specific debt-management assistance from the IMF including both initial a diagnostic and follow-up technical assistance; (ii) a country's experience of a past debt crisis, but not of *repeated* debt crises; and (iii) overall enhancement of institutional quality in the country.

Next, the probability that a country publishes its debt management strategy is significantly negatively correlated with its location in the LAC region and its participation in the DMFAS program - a result obtained from both the conditional bivariate analysis and regression analysis. The regression estimates further emphasize that a major positive effect on the probability that a country publishes its debt management strategy comes from an increase in overall democratic accountability in the country.

Furthermore, a location of a country in the MNA region appears to significantly lower its probability of using quantitative benchmarks to formulate its debt management strategy. Similarly, countries that have received IMF technical assistance on public debt management show lower probability of using benchmark-based debt management strategies. The latter two results came out significant in both the conditional bivariate analysis and regression analysis. The regression analysis further implies that the most economically significant negative effects on the probability that a country has developed a quantitative-benchmark strategy come from increasing income beyond the thresholds of upper-MICs and HICs, respectively. In contrast, the most economically significant positive effects appear to come from the improvement in overall democratic accountability in the country and specific development assistance from the World Bank focused on public-debt management.

Overall, we may infer that enhancement of institutional quality and democratic accountability in developing countries could significantly contribute to emergence of more transparent and accountable practices underlying the formulation of sovereign debt management strategies. In addition, the positive impact of development assistance from IFIs seems to be enhanced if the IFIs provide technical assistance based on their own, prior diagnostic reviews of sovereign debt management in a given country.

References

[1] Bohn, H. (1990a). Tax smoothing with financial instruments. *American Economic Review* 5, vol. 80, 1217-1230.

[2] Bohn, H. (1990b). A positive theory of foreign currency debt. *Journal of International Economics* 29, 273-292.

[3] Burnside, C. (2004). Assessing New Approaches to Fiscal Sustainability Analysis. Working Paper, Duke University. Durham.

[4] Gill, I., Pinto, B. (2005). Public Debt in Developing Countries: Has the Market-Based Model Worked? World Bank Research Working Paper 3674 (August). Washington, D.C.

[5] Laeven, L., Valencia, F. (2008). Systemic Banking Crises: A New Database. IMF Working Paper 08/224. Washington, D.C.

[6] Missale, A. (1999). *Public Debt Management*. Oxford Press. University of Oxford.

[7] Wheeler, G. (2004). *Sound Practice in Government Debt Management*. World Bank. Washington, D.C.

[8] IMF & WB (2004). Guidelines for Public Debt Management: Accompanying Document and Selected Case Studies. The International Monetary Fund and the World Bank. Washington, D.C.

[9] IMF & WB (2001). Guidelines for Public Debt Management. The International Monetary Fund and the World Bank. Washington, D.C.

[10] Togo, E. (2007). Coordinating Public Debt Management with Fiscal and Monetary Policies: An Analytical Framework. manuscript, Banking and Debt Management Department, World Bank. Washington, D.C.

[11] Sargent, T.J., Wallace, N. (1981). Some unpleasant monetarist arithmetic. *Federal Reserve Bank of Minneapolis Quarterly Review* 5, (Fall) 1-17.

5 Appendix

Table 7: Countries Included in Conditional Bivariate and Regression Analyses

ALBANIA	CZECH REPUBLIC	IRAQ	NAMIBIA	ST. LUCIA
ALGERIA	DENMARK	IRELAND	NETHERLANDS	ST. VINCENT&GRENAD.
ANTIGUA&BARBUDA	DOMINICA	ISRAEL	NEW ZEALAND	SURINAME
ARGENTINA	DOMINICAN REP.	ITALY	NORWAY	SWAZILAND
ARMENIA	ECUADOR	JAMAICA	PAKISTAN	SWEDEN
AUSTRALIA	EGYPT	JAPAN	PALAU	SWITZERLAND
AUSTRIA	EL SALVADOR	JORDAN	PANAMA	SYRIAN ARAB REPUBLIC
AZERBAIJAN	EQUAT. GUINEA	KAZAKHSTAN	PAPUA NEW GUINEA	THAILAND
BELARUS	ESTONIA	KOREA	PARAGUAY	TRINIDAD&TOBAGO
BELGIUM	FIJI	LATVIA	PERU	TUNISIA
BELIZE	FINLAND	LEBANON	PHILIPPINES	TURKEY
BOLIVIA	FRANCE	LIBYA	POLAND	TURKMENISTAN
BOSNIA&HERZ.	GABON	LITHUANIA	PORTUGAL	UK
BOTSWANA	GERMANY	LUXEMBOURG	ROMANIA	UKRAINE
BRAZIL	GREECE	MACEDONIA	RUSSIA	URUGUAY
BULGARIA	GRENADA	MALAYSIA	SERBIA	USA
CANADA	GUATEMALA	MARSHALL ISL.	SEYCHELLES	UZBEKISTAN
CHILE	HUNGARY	MAURITIUS	SLOVAK REPUBLIC	VENEZUELA
CHINA	ICELAND	MEXICO	SLOVENIA	ZIMBABWE
COLOMBIA	INDIA	MICRONESIA	SOUTH AFRICA	
COSTA RICA	INDONESIA	MONTENEGRO	SPAIN	
CROATIA	IRAN	MOROCCO	ST.KITTS&NEVIS	