

Does the Medium-Term Expenditure Framework Work for the Constraint of Debt Scale?

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Due to the need of debt constraint and the fiscal policies issued, it's possible that China will focus on the adoption of the MTEF (Medium-Term Expenditure Framework) and the MTEF will be one key reform field. Based on the data of 178 counties or regions from 1991 to 2008 published by the World Bank, this paper verifies the effectiveness of the MTEF adoption to the debt scale constraint and finds that the MTEF adoption can help reduce the government debt scale and the two basic levels of MTEF can play this role. What's more, we conduct another empirical research to find out which factors can influence the MTEF upgrade (upgrade means developing from nonperformance of the MTEF to performance or from the initial stage of the MTEF to the advanced one), finding that the debt scale, the executing time of the MTEF, the regional influence, the support from some international organizations and the development degree have obvious effect on upgrade. Meanwhile, there are opposite effect direction in different debt scale. If the debt scale is above the International Warning Line of 60%, larger scale of debt will lead to MTEF level maintenance (no upgrade). Otherwise, if below the International Warning Line of 60%, larger scale of debt will help the MTEF to upgrade.

Keywords: upgrade of the MTEF, constraint of the debt scale, debt risk

1. Introduction

Since the 21st century, the frequent occurrence of sovereign debt crisis has caused great concern among the major economies in the world. For example, the Greek government in the Euro area has adopted proactive fiscal policy such as expanding fiscal expenditures to stimulate its economy so as to save its economy and avoid recession, resulting in a year-on-year increase in the deficit scale, eventually the government's balance sheet has suffered serious problems. As for China, its debt scale has been expanding in recent years and the government is actively carrying out quota control. According to the auditing results of the National Audit Office of PRC in 2013, the total government debts of China amounted to about 30.27 trillion yuan by the end

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of June 2013.¹ According to the *Report on the Budget Implementation of the Central and Local Governments in 2016 and the Draft of the Central and Local Governments' Budget for 2017*, the balance limit of the central government bonds was 14.14 trillion yuan and the balance limit of local governments debt was 18.82 billion yuan by the end of 2017. It is noteworthy that, on the one hand, the debt scale constraint is persistent, so it is necessary to objectively reflect and plan the mid and long-term government revenue and expenditure while preventing the risks of remaining old debts and borrowing new debts. On the other hand, as China has entered into a period of financial difficulties when fiscal revenue growth has slowed down.² The demand for effective allocation of increasingly limited financial resources has become even more pressing. Hence China started to implement the medium-term fiscal plan in 2015, which led to the subsequent medium-term budget reform.

The medium-term budget³ is a system in which a country's government formulates the budget proposals for the next 3-5 years (Ljungman, 2007; World Bank, 2013) according to the current economic situation at home and abroad, national financial forecasts and social conditions yearly. The medium-term budget consists of three stages: the Medium Term Fiscal Framework (MTFF, hereinafter referred to as "stage 1"), Medium Term Budget Framework (MTBF, hereinafter referred to as "stage 2") and Medium Term Performance Framework (MTPF, hereinafter referred to as "stage 3"), they represent the level of execution of the medium-term budget respectively (Castro and Dorotinsky, 2008). The three stages represent the development from the initial stage to the advanced stage. In this paper, "upgrade" refers to the development from the non-performance of the MTEF to the performance of the MTEF or from initial stage of the MTEF to advanced stage.

From the perspective of the MTEF execution in various countries, many countries have been adopting the MTEF due to the imbalance of fiscal discipline and the soaring debt scale since the 1980s. There are more than 70% of all countries has adopted the MTEF at the end of 2008, among them, nearly all developed countries⁴ have not

¹ According to the data released by the National Audit Office of PRC, the total amount of debt that the central government is responsible to pay, guarantee or salvage is 12.38 trillion yuan and the total amount of the above three items by local governments is 17.89 trillion yuan at the end of June 2013, accounting for 51.49% of GDP of 2013.

² In 2015, the growth rate of China's fiscal revenue was below 5.9% after adjusting for the same caliber and deducting the special revenue growth measures (Gao, 2016). China's general public budget revenue increased 4.5% in 2016 on year-on-year basis.

³ Medium-term budget, also known as the medium-term expenditure framework, multi-year rolling budget, medium-term fiscal plan, sustainable budget etc. The term "medium-term expenditure framework (MTEF)" is often used abroad and "the medium-term budget" is often used in China, but these two terms have the same connotation. In this paper, the medium-term budget and the medium-term expenditure framework are treated as synonyms, collectively referred to as the MTEF.

⁴ Among the developed countries, only Cyprus, the island nation at the crossroads of Europe and Asia, has yet to implement its MTEF. International organizations such as the IMF are conducting relevant projects to boost the MTEF reform in Cyprus.

only executed the MTEF, but also are at advanced stage (Grigoli, Mills, Verhoeven and Vlaicu, 2012). In the 1990s, the World Bank listed the execution of the MTEF as an additional condition for aid loans, resulting in the rapid adoption of the MTEF in low and middle-income countries. As early as 1998, China started to carry out the MTEF pilot projects in Hebei Province and other places (Hebei Provincial People's Government, 2008; Qi, 2014; Chang, 2009). Overall, pilot projects with small pilot areas and low depths (mostly concentrated in some project dimensions) have not achieved satisfactory results, the medium and long-term planning and forecasting capabilities are not strong and do not give full play to the macro-control of the MTEF (Bai *et al.*, 2013). In recent years, the *Budget Law of the People's Republic of China* (2015), the *Opinions of the State Council on Implementing Management of Medium-term Fiscal Planning and Management* (2015), and *Outline of the 13th Five-Year Plan for National Economic and Social Development of the People's Republic of China* (2016) all put the execution of "cross-annual budget balance mechanism" and "medium-term fiscal planning and management" as the focus of budget management reform.

Is the MTEF effective for controlling the debt scale? If the development and perfection of the MTEF can effectively constrain debt scale, how to deepen the reform of the MTEF so as to achieve long-term governance? This paper attempts to refer to Grigoli *et al.* (2012) and other studies to combine the MTEF upgrade with debt-scale constraint to verify the interaction between the two variables and to conduct a more in-depth empirical study based on the global data on the factors affecting the MTEF upgrade.

2. Theoretical Basis and Hypothesis

2.1. Related Concepts of the MTEF

2.1.1. Definition and Stages of the MTEF

The International Monetary Fund summarizes the characteristics of the MTEF: It is an illustration of fiscal policy objectives, it is a comprehensive medium-term macroeconomic and fiscal projections, it needs to estimate the revenue and expenditure of various ministries and agencies in 2-4 years after the budget year, it is a hard budget constraint in the form of budget appropriations of various ministries and agencies (IMF, 2007). The definition of the MTEF by the Ministry of Finance of the PRC is: "It is a fiscal policy and financial management tool of annual budgeting based on medium-term fiscal policy and government's mid-term expenditure level and structure determined properly according to policy objectives and priorities of economic and social development based on medium-term forecasts in order to achieve sustainable

economic and financial development. It is usually a three-year, rolling or continuously updated framework of fiscal expenditures with a binding mandate (Budget Division, Ministry of Finance, 2011; Bai *et al.*, 2015). The MTEF can make up for the short-sightedness of the traditional annual budget by helping to allocate resources for a longer period of time (Wildavsky, 1986) and establish a tight connection among the “policy-planning-budget” at the same time (Wang, 2008).

Different agencies and scholars have different definitions of the stages of the MTEF (IMF, 2007). As mentioned above, the most widely spread are the three-stage methodologies proposed by Muggeridge (1997), Castro and Dorotinsky (2008).¹

2.1.2. MTEF and the Debt Scale

The positive role of the MTEF in debt scale constraints is shown in many studies. For example, Gleich (2003), Ylaoutinen (2004), Wang (2008) and Xiao (2007) argued that the MTEF can control the growth of deficit and prevent debt crisis to a certain extent and identify financial risks as early as possible, which is one of the most basic and important functions of the MTEF. Similarly, some scholars thought that an effective government should set up a set of cross-annual budget constraint mechanism that not only strictly control the deficit and debt scale in medium and long-term but also make scientific projections and allocations of limited financial resources, only in this way can ensure policy sustainability (Uctum and Wickens, 2000). Constraining the debt scale is only the basic effect of the MTEF, it can further promote the overall optimization of the budget system (Grigoli *et al.*, 2012). Therefore, accelerating the MTEF reform has more direct policy significance and is conducive to enhancing long-term governance of the government.

Empirical studies in the MTEF are rarely used for normative studies, this is due to the difficulty of collecting data on the MTEF situation of each country,² as well as the lack of sources of exogenous variables of national budgetary systems (Acemoglu, 2005).³

2.2. Hypotheses

“The Debt scale” refers to the ratio of general government gross debt to gross domestic product (GDP). The impact of the execution of the MTEF on the debt scale

¹ Due to the space limitation, we made some deletion here. The reform priorities of the three stages were concluded by Castro and Dorotinsky (2008).

² Fortunately, the World Bank published survey and grading data on the MTEF for 1990-2008 in 181 countries around the world in 2013. The most famous paper of Grigoli *et al.* (2012) in the mid-term empirical research field is based on the above data.

³ Due to the space limitation, we made some deletion here.

mainly includes the following viewpoints:

First, the policy background of the execution of the MTEF in many countries are mostly due to government imbalances, the surge of debt scale¹ and other circumstances. By systematically setting income limits, expenditure limits and debt limits, the MTEF have plans on the medium and long-term financial revenue and expenditure, which can effectively improve the government's debt-scale constraint (Wang, 2008; Bai *et al.*, 2011; Grigoli *et al.*, 2012). According to the above related theories and existing literature, this paper proposes hypothesis 1:

Hypothesis 1: The MTEF will effectively constrain the government debt scale.

Second, there are two different effects of debt scale on upgrade decisions (Bai *et al.*, 2011). The first is that the larger the debt scale, the poorer the foundation of the country's fiscal reform is, and the more difficult it is to reform the MTEF, so to inhibit the country's MTEF upgrade (negative effects). Besides, larger debt scale may indicate that the country's financial resources are limited, and the MTEF reform will require a huge reform cost, which will be detrimental to the MTEF reform. The second is that the larger the debt scale, the more motivated it will be for the MTEF upgrade (positive effects). Its main logic is: to further curb and ease the fiscal deficit by implementing MTEF reform to control government revenue and expenditure more effectively. Thus this paper proposes hypothesis 2:

Hypothesis 2: There are positive and negative effects of the debt scale on the MTEF upgrade. The overall effect direction depends on the debt scale.

3. Research Design and Data Description

Based on the existing achievements and the problems to be solved, as well as a large number of country case studies of the MTEF, combined with the debt scale, the upgrade of the previous period, the expenditure scale, the executing time of the MTEF, the regional influence, the support from some international organization, the financial crisis and the development degree, this paper attempts to use empirical method to analyze the MTEF constraining on debt scale and the MTEF upgrade factors, trying to put forward the upgrade requirements of MTEF in line with China's national conditions.

3.1. Model Setting

We build Model 1:

¹ Ma *et al.* (2007) and Bai *et al.* (2013) argue that many developed and developing countries have implemented many reforms in completing fiscal management system, improving financial transparency and achieving sustainable financial development to cope with financial crisis since the 1980s, the MTEF is one of the important measures. Wang (2008) argues that the main role of the MTEF is to establish a medium-term expenditure ceiling for the government and expenditure departments, which will control expenditures, deficits and total debt.

$$Debt_{it} = \alpha_0 + \alpha_1 MTEF_{it-1} + \alpha_2 X_{it} + \varepsilon_{it} \quad (1)$$

Among them, $Debt_{it}$ is the debt scale, subscript it represents the i th country in year t . $MTEF_{it-1}$ is the executing situation of the MTEF of the previous period. In Model 1-1 of Table 1, 0, 1, 2 or 3 represent in non-performing MTEF stage, stage 1, stage 2 or stage 3 in the previous period respectively. From Model 1-2 to Model 1-4, 0 and 1 represent non-performing stage 1, stage 2 and stage 3 or performing stage 1, stage 2 and stage 3 (see Table 1). Other explanatory variables are mainly in reference to the following scholars' research: Sun *et al.* (2015) and Huang *et al.* (2015) used the growth rate of GDP, inflation, fiscal balance and government revenue, and the ratio of deficit to GDP (fiscal equilibrium) and the rate of urbanization respectively as explanatory variables for debt scale. Mikesell (2002) and Ba *et al.* (2011) theoretically analyzed the impact of fiscal deficits and urbanization on debt scale. X_{it} is a set of control variables, which includes GDP growth rate, inflation rate, fiscal balance, expenditure scale and urbanization rate based on the above analysis. α_0 , α_1 and α_2 are constant, coefficient and coefficient matrices. ε_{it} is unobserved variable and random disturbance factor.

Table 1. Value of "Performance of the MTEF" in Model 1

Status	Model1-1	Model1-2	Model 1-3	Model 1-4
Nonperformance	0	0	0	0
Stage 1	1	1	0	0
Stage 2	2	-	1	0
Stage 3	3	-	-	1

Model 2 is constructed as follows:

$$Upgrade_{it} = \alpha_0 + \alpha_1 Debt_{it-1} + \alpha_2 X_{it-1} + \alpha_3 Z_{it} + \varepsilon_{it} \quad (2)$$

Among them, $Upgrade_{it}$ is the upgrade condition, Table 4, Table 5 and Table 6 examine the overall upgrade, upgrade of different stages and the overall upgrade under different debt scale respectively. $Debt_{it-1}$ is debt scale of the previous period, X_{it-1} is a group variables of lagged one period, including the previous upgrade,¹ expenditure

¹ In Model 2-4 to Model 2-6, the "previous upgrade" is not used as an explanatory variable because when considering a single stage of upgrade, all the samples taken into consideration are bound to be not qualified for upgrade, that is, the previous upgrade is 0, the explanatory variable is a constant 0, so it is eliminated.

scale, regional influence and the support from some international organizations, Z_{it} is a group of current variables, including the executing time of the MTEF, the financial crisis and the development degree. The setting of the above explanatory variables mainly refers to the main opinions and expositions of Zhang (2001), Wang (2011) and the World Bank (2013) on the establishment and execution motivation of the MTEF. Zhang (2001) argues: “The reason why the developed countries in Europe and the United States need to execute the MTEF is mainly to further improve the mechanism of fiscal planning and make up for the functional deficiencies of the annual budget in reflecting changes in revenue and expenditure, controlling of expenditure growth, adjustment of expenditure structure, coordination of revenue and expenditure and implementation of financial and economic policies and other aspects, in order to promote scientific decision-making in fiscal balance and strengthen the government’s macro-economic control.” In addition, the execution of the MTEF in economies is often driven by the World Bank, the OECD and other agencies or organizations (such as some developing countries) and the impact of the economic cycle (such as Germany and France after the economic crisis).

3.2. Data Description

The data on the execution and upgrade of the MTEF of 181 countries (regions) provided by the World Bank include three countries in which the MTEF downgrade occurred including the United States, Argentina and Estonia. Since this paper examines the upgrade of the MTEF, the three countries are excluded, which means this paper includes the data of 178 countries in the world from 1991 to 2008.¹ In addition, when analyzing the influencing factors of the overall MTEF upgrade, if a country has reached the highest stage of the MTEF, or when analyzing the influencing factors of the MTEF upgrade in each stage, if a country has already made the upgrade at this stage, then those countries are no longer qualified for upgrade, so the corresponding sample will be eliminated in the empirical research.

3.2.1. Upgrade Status

The variable of upgrade status is calculated based on the MTEF stage data of the World Bank. There are some differences in processing the value: (1) When considering the full stage upgrade, the overall upgrade (Model 2-1 to Model 2-3; Model 2-7 to Model 2-8) is a group of discrete , orderly data, the value is 0, 1, 2 or 3 respectively, representing the country’s current MTEF does not upgrade, advances to the stage

¹ Since the explained variables in this paper are summarized from the data of the mid-year national budgets provided by the World Bank from 1990 to 2008, meanwhile, the data for the upgrade should be compared with that of the previous time , so the data of this paper is from 1991 to 2008.

1, advances to stage 2 or advances to stage 3; (2) When considering the upgrade in different stages, the stage 1 upgrade (Model 2-4) is a dummy variable, the value is 0 or 1, 0 means that the country does not carry out the stage 1 upgrade in the current MTEF; 1 represents the stage 1 upgrade; stage 2 upgrade (Model 2 -5) and stage 3 upgrade (Models 2-6) are similar (see Table 2).

Table 2. Value of “Upgrade Status of the MTEF” in Model 2

Status	Model 2-1、Model 2-2、Model 2-3、Model 2-7、Model 2-8	Model 2-4	Model 2-5	Model 2-6
Nonperformance	0	0	0	0
Upgrade to Stage 1	1	1	-	-
Upgrade to Stage 2	2	-	1	-
Upgrade to Stage 3	3	-	-	1

3.2.2. Other Factors

In the analysis of the MTEF constraining debt scale (Model 1-1 to Model 1-4), the explained variable is the debt scale, the explanatory variables include the executing situation of the MTEF, GDP growth rate, inflation rate, fiscal balance, expenditure scale and the urbanization rate. Among them, the executing situation of the MTEF adopts the data from the World Bank and indicates whether the country executes the MTEF and in which stage it is. The fiscal balance is measured by the ratio of general government revenue to general government expenditure; the expenditure scale is measured by the ratio of general government expenditure to GDP; and the urbanization rate is measured by the ratio of urban population to the total population.

In the analysis of the MTEF upgrade conditions (Model 2-1 to Model 2-8), the explained variable is the upgrade situation, the explanatory variables include the debt scale, the previous upgrade, the expenditure scale, the executing time of the MTEF, the regional influence, the support from some international organizations and the development degree. Among them, the executing time of the MTEF refers to the length of time during which the country stays in all phases of the MTEF during the year and before (taking no account of pre-1990 periods);¹ the regional influence is based on the

¹ Since the data statistics of the World Bank's MTEF started from 1990, this paper does not take into account the duration of pre-1990 in calculating the executing time of the MTEF, even though it was at some stage in the medium-term budget by 1990, the explanatory variable remained at 1 in 1990, 2 in 1991, and so on.

ratio of countries with a higher MTEF stage to the number of countries in the region where the country is located;¹ the support from some international organizations is measured by the ratio of net value of received official development assistance and official aid to GDP; the financial crisis is a dummy variable: all countries in 2008 and Asian countries in 1997 and 1998 valued 1 and others is 0; the development degree is a dummy variable: 1 for developed countries and 0 for developing countries.

4. Empirical Results and Analysis

4.1. Analysis of the MTEF Constraints on Debt Scale

In order to verify the MTEF constraints on debt scale, this paper optimizes the method based on Grigoli *et al.* (2012), replacing the “deficit” with the “debt scale” as an indicator of fiscal discipline and considering factors that affect debt scale other than the MTEF, that is, the control variable X_{it} in Model 1.² Based on the traditional panel data fixed effect and random effect, this section also adopts feasible generalized least squares (FGLS) (see Table 3) to overcome heteroscedasticity and autocorrelation.

Table 3. Regression of the MTEF Constraint on the Debt Scale

Explanatory variables or test index of goodness of fit	Model 1-1 (Population)	Model 1-2 (Stage 1)	Model 1-3 (Stage 2)	Model 1-4 (Stage 3)
The performance of the MTEF	-0.0420*** (0.0144)	-0.0539** (0.0253)	-0.0750** (0.0360)	-0.0172 (0.0540)
GDP growth rate	-0.0030*** (0.0008)	-0.0032*** (0.0009)	-0.0031*** (0.0009)	-0.0031*** (0.0008)
Inflation rate	0.0031*** (0.0003)	0.0032*** (0.0003)	0.0032*** (0.0003)	0.0031*** (0.0003)
Fiscal balance	-0.1159*** (0.0246)	-0.1195*** (0.0273)	-0.1190*** (0.0258)	-0.1177*** (0.0246)

¹ The division of the region here is Southeast Asia, East Asia, South Asia, West Asia, Central Asia, Northern Europe, Eastern Europe, Southern Europe, Western Europe, Central Europe, North Africa, East Africa, South Africa, West Africa, Central Africa, North America, Caribbean, South America, Central America, Australia, New Zealand and Melanesia and other regions, Polynesia and other regions, Micronesia and other regions.

² We also performed Variance Inflation Factors (VIF) Test, White Test, Wooldridge Test, Hausman Specification Test on the data used in Model 1, there was no multicollinearity, no endogeneity, heteroscedasticity and autocorrelation. Therefore, based on the traditional panel data fixed effect and random effect, this study adopted a feasible generalized least squares (FGLS) method to overcome the heteroscedasticity and autocorrelation (see Table 4). In addition, in order to prevent the reverse causal endogeneity, the first-order lagged term of the endogenous explanatory variable is also used as an instrumental variable in Model 1, that is, using the previous executing situation $MTEF_{it-1}$ when setting the Model 1.

Explanatory variables or test index of goodness of fit	Model1-1 (Population)	Model1-2 (Stage 1)	Model1-3 (Stage 2)	Model1-4 (Stage 3)
Expenditure scale	0.0050*** (0.0014)	0.0054*** (0.0016)	0.0051*** (0.0015)	0.0049*** (0.0014)
Urbanization rate	-0.0044*** (0.0012)	-0.0047*** (0.0014)	-0.0045*** (0.0013)	-0.0046*** (0.0012)
Constant	0.8671*** (0.0815)	0.8919*** (0.0919)	0.8586*** (0.0856)	0.8549*** (0.0824)
R-square	0.2348	0.2362	0.2325	0.2303
F value or Wald value	91.23	77.64	84.21	88.95
Sample size	1791	1513	1675	1791

Notes: ***, ** and * represent significance at the level of 1%, 5% and 10%, respectively. The parentheses below the coefficient are standard deviations.

Model 1-1 in Table 3 shows that the execution of the MTEF has a significant constraining effect on the debt scale, the more advanced the stage of the MTEF, the smaller the debt scale is, which confirms hypothesis one. In addition, higher GDP growth, fiscal balance and urbanization rate, as well as lower inflation and expenditure scale, have a positive constraining effect on debt scale. Model 1-2 to Model 1-4 show that the positive impact of the MTEF on debt-scale constraints is mainly reflected in stage 1 and stage 2, most likely due to the most advanced stage of the MTEF shifts its target to efficiency instead of debt issues that are manageable in the first two stages.

4.2. Analysis of the MTEF Upgrade Conditions

The above analysis illustrates that executing MTEF in different stages has significant constraints on the debt scale, the effects in stage 1 and stage 2 are particularly obvious. Meanwhile, this also poses a new challenge to the current reform of the MTEF in China, that is, how to effectively formulate a reform plan for the MTEF so that it can be upgraded to a more advanced stage so as to achieve long-term government governance? Based on this question, this study will further analyze the influencing factors of the MTEF upgrade in Model 2.¹

¹ In this paper, VIF test, Likelihood Ratio (LR) test and heteroscedasticity unit test are used to analyze the data used in Model 2. The results show that there is no multicollinearity and heteroscedasticity. However, the Wooldridge Test showed that there was autocorrelation, so we added the first-order lag term of the explained variable to the explanatory variable (i.e. adding the explanatory variable of “the previous upgrade”). Similar to the approach used in Model 1, this paper also overcomes endogeneity by using the first-order lagged term of endogenous explanatory variables as an instrumental variable.

4.2.1. Analysis of Conditions for the Overall Upgrade of MTEF

Combined with the discrete and orderly characteristics of the MTEF upgrade of the explained variables (values 0, 1, 2 or 3), an ordered Probit model is used in this section for empirical analysis. The regression results are shown in Table 4.

(1) From all sample countries and their overall stage of the execution of the MTEF (Model 2-1), an over-sized debt could inhibit the MTEF from reaching a more advanced stage. Combined with hypothesis 2, it can be seen that the negative effect is more profound when the debt scale affects the MTEF upgrading to a more advanced stage.

The empirical results also show that the longer the executing time of the MTEF, the more likely it is to upgrade. This represents a more adequate and solid foundation for further MTEF reform to some extent. The more advanced stage of the MTEF the neighboring countries in, the more likely to have a positive impact on the upgrade of the MTEF in the host country, which also verifies the applicability of the policy diffusion theory in budget reform. The aid of international organizations also has a much more obvious role in promoting the MTEF upgrade in the host country. The explanatory variable of the development degree also shows a significant positive effect on the debt scale constraint, indicating that the developed countries are more qualified to carry out the MTEF upgrade.

(2) From the perspective of developing countries (Model 2-2), the regression results are highly consistent with the overall (Model 2-1), so the conclusions are also similar to (1). This is mainly due to the fact that 1,411 out of 1,482 valid samples from all countries are developing countries, accounting for 95.21% of the total, so the tendency for developing countries to advance their options are highly consistent with that of all countries and regions.

(3) From the perspective of developed countries (Model 2-3), the explanatory variable of debt scale is no longer significant, i.e. the impact of debt scale on upgrade selection is not obvious in developed countries. This is because the financial foundation of the developed countries is relatively sound, even if the debt scale is large, it is still not enough to affect the MTEF upgrade, that is, the MTEF upgrade in developed countries is not sensitive to the debt scale.

It is worth noting that the above regression uses an ordered Probit model whose coefficients are not the marginal effects of the corresponding variables. Based on this, this paper lists the marginal effects of the corresponding variables in the table and separately calculates the marginal effects of the explanatory variables on the upgrade at different stages of the MTEF. In the meantime, the test indexes for judging the goodness of fit of each model are reported in table 4, including log likelihood, quasi-R-square and LR test.

Table 4. Regression of Analyzing Factors Influencing the MTEF Upgrade

Explanatory variables or test index of goodness of fit	Model 2-1(Overall)					Model 2-2(Developing countries)					Model 2-3(Developed countries)				
	Marginal effect					Marginal effect					Marginal effect				
	Coefficient (Standard deviation)	Y=0	Y=1	Y=2	Y=3	Coefficient (Standard deviation)	Y=0	Y=1	Y=2	Y=3	Coefficient (Standard deviation)	Y=0	Y=1	Y=2	Y=3
Debt scale	-0.2187* (0.1167)	0.0246	-0.015	-0.0076	-0.0020	-0.2348* (0.1203)	0.0256	-0.0159	-0.0079	-0.0017	0.6704 (0.9379)	-0.0230	0.0169	0.0050	0.0011
Previous upgrade status	-0.2225 (0.2092)	0.0250	-0.0153	-0.0077	-0.0020	-0.1807 (0.2116)	0.0197	-0.0123	-0.0061	-0.0013	-4.8684 (605.0871)	0.1672	-0.1229	-0.0362	-0.0081
Expenditure scale	-0.5563 (0.4982)	0.0626	-0.0382	-0.0193	-0.0050	-0.7446 (0.5298)	0.0811	-0.0505	-0.0250	-0.0055	3.6145 (2.5579)	-0.1241	0.0192	0.0269	0.0060
Executing time of the MTEF	0.047*** (0.0164)	-0.0053	0.0032	0.0016	0.0004	0.0418** (0.0178)	-0.0046	0.0028	0.0014	0.0003	0.2382*** (0.0778)	-0.0082	0.0060	0.0018	0.0004
Regional influence	1.2957*** (0.2329)	-0.01458	0.0891	0.0450	0.0117	1.255*** (0.2373)	-0.1366	0.0852	0.0421	0.0093	5.7057*** (2.0573)	-0.1959	0.1440	0.0424	0.0095
Support from international organizations	1.0777* (0.6076)	-0.1212	0.0741	0.0374	0.0097	1.1514* (0.6136)	0.1253	0.0781	0.0386	0.0086	177.8601* (94.888)	-6.1070	4.4898	1.3220	0.2960
The financial crisis	-0.0462 (0.1573)	0.0051	-0.0031	-0.0016	-0.0004	0.0067 (0.1593)	-0.0007	0.0005	0.0002	0.0005	-4.4356 (762.1619)	0.0329	-0.0241	-0.0071	-0.0017
Development degree	0.6254*** (0.2042)	-0.1072	0.0578	0.0366	0.0128	-	-	-	-	-	-	-	-	-	-
Log likelihood		-425.3396					-388.0006					-30.2144			
Quasi R-square		0.0596					0.0525					0.2284			
LR test		63.89					43.04					17.89			
Sample size		1482					1411					71			

Notes: (1) Since the regression in Table 3 adopts the Probit model, the coefficient is not the marginal effect of the corresponding variable. Therefore, this paper lists the marginal effect in the columns in the table.(2) Since Model 2-2 and Model 2-3 has already classified the sample according to the development degree, the explanatory variable of the underdevelopment degree is adopted in the regression of these two models.

4.2.2. Analysis of Upgrade Conditions of the MTEF in Different Stages

In order to further check the upgrade conditions of the MTEF reform, this section conducts an analysis of the factors influencing the MTEF upgrade in different stages. Since the explained variable is dummy variable, this section uses the Probit model for empirical research (see Table 5).

Table 5. Regression of Analyzing Factors Influencing the MTEF Upgrade of Each Stage

Explanatory variables or test index of goodness of fit	Model 2-4 (Upgrade to Stage 1)		Model 2-4 (Upgrade to Stage 2)		Model 2-4 (Upgrade to Stage 3)	
	Coefficient (Standard deviation)	Marginal effect	Coefficient (Standard deviation)	Marginal effect	Coefficient (Standard deviation)	Marginal effect
Debt scale	-0.176 (0.117)	-0.0168	-0.5356** (0.2649)	-0.0204	-0.4545 (0.6939)	-0.0001
Expenditure scale	-0.292 (0.584)	-0.0278	-0.8223 (0.8079)	-0.0314	-0.2673 (2.3135)	-0.0001
Executing time of the MTEF	-	-	0.072*** (0.0237)	0.0027	0.1558*** (0.0536)	0.0000
Regional influence	1.6518*** (0.2821)	0.1573	0.3094 (0.3876)	0.0118	-4.4879* (2.617)	-0.0010
Support from international organizations	1.3716** (0.6886)	0.1306	1.6181 (1.0128)	0.0617	-6.7548 (4.8546)	-0.0015
The financial crisis	-0.1555 (0.2327)	-0.0133	-0.1619 (0.2674)	-0.0054	0.4932 (0.3695)	0.0003
Development degree	0.8852*** (0.3024)	0.1597	0.1947 (0.3174)	0.0090	-0.3066 (0.6151)	0.0000
Constant	-1.9063*** (0.2023)	-	-1.763** (0.2767)	-	-2.5425*** (0.7851)	-
Log likelihood	-222.0744		-129.7566		-29.4036	
Quasi R-square	0.0974		0.0729		0.3387	
% of prediction accuracy	94.01%		97.84%		99.53%	
LR test	47.94		20.39		30.13	
Sample size	1086		1345		1482	

Notes: (1) Since the regression in this table adopts the Probit model, the coefficient is not the marginal effect of the corresponding variable. Therefore, this paper lists the marginal effect in the columns in the table. (2) Model 2-4 removed the explanatory variable of the executing time of the MTEF because there is only one possibility for the upgrade of stage 1—from stage 0 to stage 1. In this case, when the explained variable (whether or not to upgrade to stage 1) is 1, then the executing time of the MTEF must be equal to 1; when the explanatory variable is 0, the executing time of the MTEF must be 0. Therefore, there is a necessary one-to-one correspondence between the above explanatory variables and explained variables, so the executing time of the MTEF is eliminated in this model.

The regression results in Table 5 show that: (1) When upgrading to stage 2, the smaller the debt scale, the more conducive for the MTEF upgrading to the next stage,

while upgrading to stage 1 and stage 2, this effect is not obvious. (2) In the whole process of the MTEF upgrade, the executing time of the MTEF has a very significant impact on upgrading to more advanced stages. (3) The positive effect of the regional influence is mainly reflected in stage 1.¹ (4) Besides, the support from some international organizations and the development degree also has positive impact on the upgrade of stage 1. This is mainly due to the fact that most of the World Bank-financed projects (about 69%) promote the MTEF in a general sense and do not require the borrower upgrading to a more advanced stage. Meanwhile, most of the countries that accept loans are low-income and middle-income countries which have weak financial and economic foundation to execute a more advanced MTEF stage, therefore, they often fail to meet the upgrade condition of the MTEF after meeting the initial requirements of the World Bank.

According to the analysis results in Table 5, this paper preliminarily argues that in the MTEF stage 1 (Model 2-4), the advanced MTEF system in the surrounding areas, preferential loans from international organizations and successful practices in other countries can create favorable conditions and environment for the initial establishment of a MTEF system in a country. In the process of upgrading from stage 1 to stage 2 (Model 2-5), it is necessary to combine the macroeconomic development with the aggregate social demand and other factors to moderately control the debt scale, supplemented by full time investment to strengthen the system construction and practical exploration, to actively create conditions for upgrading to a more advanced MTEF stage to ensure economic stability under the premise of ensuring the sustainable financial development.

4.2.3. Route Analysis of the Impact of Debt Scale on the MTEF Upgrade

In order to further analyze the correlation between the debt scale and the MTEF upgrade conditions, in accordance with the requirements of the “Maastricht Treaty” of 60% of the international warning line of public debt to GDP, the sample is divided into two parts with debt scale is above 60% and below 60% to regress separately in this section (see Table 6).

The regression results in Table 6 show that: (1) When debt scale is above 60% warning line, the more it exceeds 60%, the more likely to inhibit the MTEF from upgrading to a more advanced stage. (2) When debt scale fall below the 60% warning line, the closer to 60%, the more motivated to upgrade to a more advanced stage. In the preliminary findings of the previous study, no distinction and superposition was made between the samples of debt above and below the warning line of 60%, the

¹ But in the process of upgrading to stage 3, the regression results of the explanatory variable show a significant negative impact, which is not consistent with the actual situation and the overall regression results. This is probably due to the small number of samples upgrading to stage 3. Only 18 samples upgrade in the regression of Model 2-6, that is, only 18 countries upgraded to stage 3 during 1991-2008. And there are 100 upgrade samples in the upgrade of stage 1 (Model 2-4), and 48 samples in the upgrade of stage 2 (Model 2-5).

result shows that “excessive government debt can have an inhibitory effect on the MTEF upgrading to a more advanced stage” due to the relatively weak debt control of all countries to large extent: the average total government debt of all countries in the world during 1991-2008 accounted for 66.50% of GDP.

Table 6. Regression of Influence on the MTEF Upgrade When Debt Scale is Higher or Lower than 60%

Explanatory variables or test index of goodness of fit	Model 2-7 (Overall, debt scale is higher than 60%)					Model 2-8 (Overall, debt scale is lower than 60%)				
	Coefficient (Standard deviation)	Marginal effect				Coefficient (Standard deviation)	Marginal effect			
		Y=0	Y=1	Y=2	Y=3		Y=0	Y=1	Y=2	Y=3
Debt scale	-0.3705* (0.1993)	0.0315	-0.0257	-0.0051	-0.0008	1.0505** (0.4663)	-0.1402	0.0717	0.0530	0.0155
Previous upgrade status	-0.0559 (0.3976)	0.0048	-0.0039	-0.0008	-0.0001	-0.2746 (0.2504)	0.0367	-0.0188	-0.0139	-0.0040
Expenditure scale	-0.6215 (0.7741)	0.0529	-0.0430	-0.0085	-0.0013	-0.6086 (0.7227)	0.0813	-0.0416	-0.0307	-0.0090
Executing time of the MTEF	0.0673* (0.039)	-0.0057	0.0047	0.0009	0.0001	0.0498*** (0.0191)	-0.0067	0.0034	0.0025	0.0007
Regional influence	1.3345*** (0.438)	-0.1135	0.0924	0.0183	0.0028	1.3383*** (0.3039)	-0.1787	0.0914	0.0675	0.0197
Support from international organizations	2.1818*** (0.7873)	-0.1856	0.1511	0.0299	0.0046	-0.5915 (1.134)	0.0790	-0.0404	-0.0299	-0.0087
The financial crisis	0.0426 (0.3097)	-0.0037	0.0030	0.0006	0.0001	-0.0158 (0.1895)	0.0021	-0.0011	-0.0008	-0.0002
Development degree	0.5992 (0.405)	-0.0811	0.0616	0.0162	0.0033	0.649*** (0.2476)	-0.1281	0.0560	0.0515	0.0206
Log likelihood		-130.1679					-274.6796			
Quasi R-square		0.0849					0.0567			
LR test		24.15					33.00			
Sample size		585					798			

Note: Since the regression in this table adopts the Probit model, the coefficient is not the marginal effect of the corresponding variable. Therefore, this paper lists the marginal effect in the columns in the table.

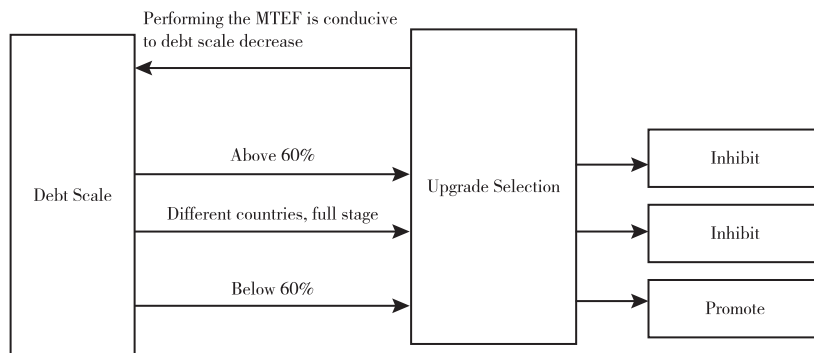


Figure. The Logical Relationship between Debt Scale and the MTED Upgrade Selection

The above Figure shows the logical relationship between debt scale and the MTED upgrade choice.

4.3. Robustness Test

4.3.1. Robustness Test I: Instrumental Variable

We introduce the instrumental variable of the regional influence in Model 1 to overcome the endogeneity. The instrumental variable of the regional influence is highly correlated with the endogenous explanatory variable of the performance of the MTEF, but is not related to disturbance, that is, the impact of this variable on the explanatory variable of the debt scale is only generated through the endogenous explanatory variable of the performance of the MTEF, thus the regional influence is a valid instrumental variable.

Table 7. Regression of Instrumental Variable

Explanatory variables or test index of goodness of fit	Model1-5 (Overall)	Model1-6 (Stage 1)	Model1-7 (Stage 2)	Model1-8 (Stage 3)
Performance of the MTEF	−0.0914** (0.0429)	−0.1703*** (0.0596)	−0.3343*** (0.1097)	−0.5691*** (0.1116)
GDP growth rate	−0.0071*** (0.0024)	−0.0065** (0.0026)	−0.0069*** (0.0025)	−0.0079*** (0.0025)
Inflation rate	0.0055*** (0.0006)	0.0054*** (0.0007)	0.0056*** (0.0006)	0.0055*** (0.0006)
Fiscal balance	−0.3089*** (0.0636)	−0.3169*** (0.0693)	−0.3483*** (0.0649)	−0.3064*** (0.0636)
Expenditure scale	0.0030** (0.0014)	0.0045*** (0.0016)	0.0034** (0.0014)	0.0027* (0.0014)
Urbanization rate	−0.0026*** (0.0007)	−0.0032*** (0.0009)	−0.0039*** (0.0009)	−0.0014* (0.0008)
Constant	1.0713*** (0.0713)	1.0932*** (0.0827)	1.1493*** (0.0796)	0.9951*** (0.0751)
LM statistics	2513.90	1936.68	2097.44	2457.49
F statistics	252.47	871.30	391.90	614.25
Sargan test	-	-	-	-
Sample size	1830	1507	1697	1830

Notes: (1) The bracket below the coefficient is the standard deviation. (2) The LM statistics reports under identification test, and the results show that the instrumental variable was exogenous. (3) The F statistic reports a weak instrumental variable test, and the result shows rejection of original hypothesis of “weak instrumental variable”. (4) The Sargan test reports over identification. This paper uses single instrumental variable and single endogenous variable, so there is no over-identification.

The regression results in Table 7 show that the coefficients of the endogenous explanatory variable the performance of the MTEF of are still significantly negative in overall, stage 1 and stage 2 while the absolute values of the coefficients increase substantially. In stage 3, the coefficients of the endogenous explanatory variables increase significantly while the absolute value of the coefficients increase substantially. It indicates that the effect of the performance of the MTEF on the debt scale is more obvious when the instrumental variable is used to overcome the endogeneity while the symbols and significance of other explanatory variables basically keep consistent with the original regression. All statistical data have been tested, the instrumental variable is exogenous and is not a weak instrumental variable, and there is no over-identification.

4.3.2. Robustness Test II: Replace or Add Explanatory Variables

In the robustness test, first of all, this paper replaces “the proportion of general government expenditure to GDP” with “the ratio of general government revenue to GDP” in all the models. Secondly, this paper adds the explanatory variable of fiscal support pressure (the share of working population in the total population) (Jia *et al.*, 2002; Yang, 2009) in Model 1-1 to Model 1-4 which analyze the impact of the MTEF on debt scale. Besides, this paper also adds an explanatory variable of GDP growth rate¹ to measure the impact of economic growth on the upgrade selection of the MTEF, the results have not changed substantively, indicating that the empirical results of this paper is relatively robust.

5. Conclusions and Suggestions

The empirical analysis of the MTEF data of the period 1991–2008 of 178 countries shows that: First, the execution of the MTEF has a significant constraint on the debt scale, this effect is much more obvious in the MTEF stage 1 (medium-term fiscal framework) and stage 2 (medium-term budget framework). Second, the debt scale, the executing time of the MTEF, the development of the MTEF in neighboring countries, the support from some international organizations and the development degree are the main conditions for the upgrade of the MTEF. Among them, the debt scale has a two-way impact on the MTEF upgrade: when the debt scale is above 60% of the international warning line, the more it exceeds 60%, the more likely it is to curb the MTEF upgrading to a more advanced stage, when the debt scale is below 60%, the closer it is to 60%, the more likely to promote the MTEF to a more

¹ The Data of the proportion of the government's general income to GDP is from IMF, and the data of the financial support pressure is from the world bank. The growth rate of GDP is calculated from the data from the world bank and IMF.

advanced stage.

Based on the conclusion of this paper, we put forward the following policy recommendations: First, take precautions to actively promote the reform of the MTEF and establish a MTEF as soon as possible. In the absence of any further expansion of the debt scale, it is necessary to speed up the reform of the MTEF to enhance financial sustainability and allocation efficiency. Second, we draw lessons and learn from the experiences and practices of advanced international MTEF and explore the mode of localization of the MTEF. While introducing the MTEF and upgrading to a more advanced stage, we should fully absorb the successful practices promoted by international organizations and refer to the MTEF model adopted by other countries to establish an effective MTEF which can play an active role in sustainable development. Third, the MTEF reform needs to be carried out in parallel with the reform of the government accounting and budget system. Reform measures such as government accounting accrual basis and budget classification system can provide technical support for truly reflecting government assets and liabilities as well as the financial status of revenue and expenditure and lay scientific operation basis for information symmetry of the MTEF.

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