

Government Deficit and Substitutability between Debt Instruments

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This paper provides theoretical and empirical analysis for the issue of crowding out when a distinction is noted between bonds and loans as debt instrument. It turns out that there exists additional crowding out with the introduction of loans, which are not perfect substitutes of bonds. It is shown that the differential impact on asset returns of the fiscal policy depends upon the degree of substitutability between the financial assets. Namely, the higher the degree of substitutability between money and bonds is and the lower the degree of substitutability between loans and bonds is, the greater the level of crowding out is.

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1. INTRODUCTION

Recent research has focused on explicitly recognizing and analyzing the operation of a credit or lending channel in the transmission of monetary policy.¹⁾

Appreciation of the intricacy of monetary effects has its basic recognition on the limitation of assuming perfect substitutability of a multitude of debt instruments. The standard textbook IS/LM model of the aggregate economy that groups together bank loans and government and corporate bonds without

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¹⁾ For broader descriptions of the credit channel analysis, see Bernanke (1993), Friedman and Kuttner (1993), Gertler (1993), Gertler and Gilchrist (1993), and Kashyap, Stein, and Wilcox (1993).

regard to maturity or risk status has provided the starting-off point for a number of investigations of the role of credit markets in the conduct of monetary policy. Bernanke and Blinder (1988) have emphasized the need to explicitly model the distinction between the loan and bond markets. This stress on the implicit assumptions in standard models concerning asset substitutability has been made over the years by Brunner and Friedman (1983) and Stiglitz and Weiss (1981).

The impact of the government budget deficit on interest rates and aggregate output has also been the focus of many researchers in recent years. However, there seems to be lack of theoretical work or empirical consensus on the effects of fiscal policy when a distinction is noted between loans and bonds as debt instruments. Consequently, there has not been much work on the theoretical issue of crowding out with the introduction of loans. Thus the purpose of this paper is to develop a theoretical framework for the issue of crowding out of private spending by government borrowing within a model that recognizes the lack of perfect substitutability of debt instruments.²⁾

Furthermore, empirical analysis between the government budget deficit and the difference between the loan rate and the bond rate is provided.

One of the major findings of this research is that there is the additional crowding out when loans and bonds are considered to be imperfect substitutes as debt instruments through the credit channel. Section 2 provides the theoretical analysis of the effect of the government deficit when a distinction is noted between bonds and loans as debt instruments. Section 3 shows the empirical analysis and section 4 concludes.

2. THE EFFECT OF FISCAL POLICY AND ADDITIONAL CROWING OUT

In the conventional IS/LM model, there exist only two assets: money and bonds. The equilibrium conditions for the money and goods markets can be

²⁾ Refer to Bernanke and Blinder (1988), Romer and Romer (1990), and Miron, Romer, and Weil (1993).

expressed as, respectively:

$$D(i, y) - m(i)R = 0,$$

$$D_i < 0; D_y > 0, m' > 0, \quad (1)$$

$$y = A(i, F), F = G - T,$$

$$A_i < 0, A_F > 0, \quad (2)$$

where $D(i, y)$ is money demand which is equal to bank deposits, i the interest rates on bonds, y aggregate output, $m(i)$ money multiplier, R bank reserves, $m(i)R$ money supply, G government expenditure, T taxes, and F government deficit. The above conventional IS/LM model assumes that all markets clear only by price and thus that there is no price distortion in the underlying markets. We consider the price level and inflation as given for a certain time period and hence use the nominal interest rates instead of real rates. Taking the total differentials of the above equations yields:

$$\frac{\partial i}{\partial F} = \frac{D_y A_F}{m'R - D_i D_y} > 0 \quad (3)$$

$$\frac{\partial y}{\partial F} = \frac{(m'R - D_i) A_F}{m'R - D_i D_y} > 0 \quad (4)$$

The results show that with a rise in deficit finance, the interest rate rises and aggregate output increases. In this case, with a rise in the bond interest rate, there is crowding out of private spending when there is a rise in deficit finance. The magnitude of the effect depends upon the elasticities of various structural relationships. If the money and bonds are perfect substitutes ($D_i \rightarrow -\infty$), the LM curve will be horizontal. In this case, a fiscal expansion does not result in a rise in the bond rate and hence there is no crowding out $\left(\frac{\partial i}{\partial F} \rightarrow 0 \text{ and } \frac{\partial y}{\partial F} \rightarrow A_F \right)$.

The above approach assumes perfect substitutability of a multitude of debt instruments. When a distinction is noted between loans and bonds as debt instruments, the equilibrium conditions for the goods and loan markets may be expressed as, respectively:

$$y = A(\mathbf{r}, i, F),$$

$$A_r < 0, \quad A_i < 0, \quad A_F > 0, \quad (5)$$

$$L(\mathbf{r}, i, y) - \mathbf{q}(\mathbf{r}, i)D(1 - \mathbf{t}) = 0,$$

$$L_r < 0, \quad L_i > 0, \quad L_y > 0, \quad \mathbf{q}_r > 0, \quad \mathbf{q}_i < 0 \quad (6)$$

where \mathbf{r} is the loan rate, $L(\mathbf{r}, i, y)$ loan demand, $\mathbf{q}(\mathbf{r}, i)$ is the ratio of loans to bank deposits, $\hat{\delta}$ the required ratio of reserves, and $\mathbf{q}(\mathbf{r}, i)D(1 - \mathbf{t})$ loan supply. Loan supply is defined according to a bank balance sheet ignoring net worth and excess reserves. For simplicity we assume that only i , not \tilde{n} , influences money demand and money supply and hence the condition for clearing the money market remains the same with the introduction of loans. Taking the total differentials of the conditions for clearing the three markets yields the following system:

$$\begin{bmatrix} 0 & m'R - D_i & -D_y \\ -A_r & -A_i & 1 \\ EDL_r & EDL_i & EDL_y \end{bmatrix} \times \begin{bmatrix} \partial \mathbf{r} \\ \partial i \\ \partial y \end{bmatrix} = \begin{bmatrix} -m\partial R \\ A_F \partial F \\ 0 \end{bmatrix}$$

where $EDL_i = L_i - \mathbf{q}_i D(1 - \mathbf{t}) - \mathbf{q} D_i(1 - \mathbf{t}) > 0$,

$$EDL_r = L_r - \mathbf{q}_r D(1 - \mathbf{t}) < 0, \quad \text{and}$$

$$EDL_y = L_y - \mathbf{q}_y(1 - \mathbf{t}) \geq 0.$$

EDL_i , EDL_r , and EDL_y denote the changes in excess demand of loan with respect to the changes in the bond rate, the loan rate, and income,

respectively. $EDL_y \geq 0$ implies that a change in loan demand is at least as great as that in loan supply when there is a rise in income associated with the fiscal expansion. When there is a change in deficit finance, we obtain the following comparative static results [we use * to refer to the case in which we assume that there is a distinction between bonds and loans as debt instruments]:

$$\frac{\partial i^*}{\partial F} = \frac{D_y A_F EDL_r}{\Delta A_r} > 0, \quad (7)$$

$$\frac{\partial \mathbf{r}^*}{\partial F} = \frac{[D_y EDL_i + (m'R - D_i) EDL_y] A_F}{\Delta A_r} > 0, \quad (8)$$

$$\frac{\partial y^*}{\partial F} = \frac{(m'R - D_i) EDL_r A_F}{\Delta A_r} > 0,$$

$$\Delta = \frac{(m'R - D_i - D_y A_i) EDL_r}{A_r} + (m'R - D_i) EDL_y + D_y EDL_i > 0. \quad (9)$$

From equations (4) and (9), we can see that

$$\frac{\partial y^*}{\partial F} = \frac{(m'R - D_i) EDL_r A_F}{\Delta A_r} < \frac{(m'R - D_i) A_F}{m'R - D_i D_y} = \frac{\partial y}{\partial F} \quad (10)$$

This implies that there always exists additional crowding out when bonds and loans are not perfect substitutes as debt instruments. If bonds and loans are perfect substitutes either to borrowers ($L_r \rightarrow -\infty$) or to lenders ($\mathbf{q}_r \rightarrow \infty$), then we can see that there is no additional crowding out

$\left(\frac{\partial y^*}{\partial F} \rightarrow \frac{\partial y}{\partial F} \text{ and } \frac{\partial y^*}{\partial F} \rightarrow \frac{\partial y}{\partial F} \right)$. Unless bonds and loans are perfect substitutes, crowding out may well be exacerbated.

The magnitude of the additional crowding out depends upon the elasticities

of various structural relationships such as EDL_i , EDL_y , EDL_r and A_r . Clearly we can see that

$$\text{Additional Crowding out} = f(EDL_i, EDL_y, |EDL_r|, A_r).$$

The more sensitive excess loan demand is to the bond rate, the more sensitive excess loan demand is to income, the less sensitive excess demand is to the loan rate, and the more sensitive is planned autonomous expenditure to the loan rate, the greater the level of the additional crowding out. The absolute value of EDL_r reflects the degree to which bonds and loans are substitutes on the finance of investment projects. Thus the degree of substitutability between bonds and loans as debt instruments is one of the crucial determinants of the level of the additional crowding out. The higher the degree of substitutability between bonds and loans as debt instruments, the lower the level of the additional crowding out is. By the same token, as the degree of substitutability between money and bonds becomes higher, EDL_i , takes a bigger value since D_i becomes bigger in an absolute term. Thus the higher the degree of substitutability between money and bonds is, the higher the level of the additional crowding out is. Consequently, the relative magnitude between EDL_r and EDL_i will mainly determine the level of the additional crowding out when other things being held constant. The determinants of the level of the additional crowding out may also be analyzed by looking at the differential impact on asset returns of the fiscal expansion.

$$\frac{\partial r^*}{\partial F} - \frac{\partial i^*}{\partial F} = - \frac{[(m'R - D_i)EDL_y + D_y A_F (EDL_i + EDL_r)]}{\Delta A_r} \quad (11)$$

The magnitude of the differential impact on asset returns will depend upon EDL_y , A_r , and $EDL_i + EDL_r$. Equation (11) also shows that the sign of the differential impact on asset returns will mainly depend upon the sign of

$EDL_i + EDL_r$. If $EDL_i + EDL_r > 0$, it guarantees that $\frac{\partial r^*}{\partial F} - \frac{\partial i^*}{\partial F} > 0$.

If loans and bonds are not specified as perfect substitutes as debt instruments

and furthermore if the degree of substitution between loans and bonds are relatively low, then L_r and q_r are relatively small, which makes EDL_r be very small and hence the sign of $EDL_i + EDL_r$ is likely to be positive. Thus in general when there is the positive government deficit shock, the difference between the loan rate and the bond rate is likely to increase and hence induce the additional crowding out if loans and bonds are not perfect substitutes as debt instruments.

In an extreme situation in which money and bonds are perfect substitutes ($D_i \rightarrow -\infty$), equations (7), (8), and (9) reduce to

$$\frac{\partial i^*}{\partial F} = 0, \quad (12)$$

$$\frac{\partial r^*}{\partial F} = -\frac{L_y A_F}{A_r L_y + EDL_r} > 0, \quad (13)$$

$$\frac{\partial y^*}{\partial F} = \frac{EDL_r A_F}{A_r L_y + EDL_r} > 0. \quad (14)$$

When money and bonds are perfect substitutes in the absence of loans, there is no crowding out since a fiscal expansion does not result in a rise the bond interest rate. In the presence of loans, however, the rise in income associated with the fiscal expansion will raise loan demand and hence the loan interest rate, and some planned autonomous spending will decline. Clearly, the more sensitive loan demand is to income, the less sensitive is loan demand to the interest rate on loans, and the more sensitive is planned autonomous expenditure to the loan rate, the greater the level of crowding out is even when money and bonds are perfect substitutes with the introduction of loans.

3. EMPIRICAL ANALYSIS

The crowding out, the impact of the government budget deficit on interest rates, has de-emphasized the importance of expansionary fiscal policy. In general, empirical evidence for crowding out is mixed as we can see from Table 1. Furthermore, most studies of crowding out assume that loans and bonds are perfect substitutes as debt instruments. Thus there is no theoretical and empirical consensus on the impact of relaxing the perfect substitutability between bonds and loans as debt instruments.

3.1. Data Description

The following five variables will always appear in this analysis: the real growth rate of GDP (*GDPR*), the CPI inflation (*INF*), the government deficit (*DEF*), the M2 growth rate (*M2R*), and the difference between the loan and bond rates (*SPREAD*). A monetary policy variable is included since this is the primary means by which macroeconomic policy is conducted. Its inclusion is necessary to reduce a possible problem with omitted variables. All data are quarterly from the first quarter of 1987 to the first quarter of 2000. M2 (BBAA21) and GDP (HLHB10208) are obtained from Bank of Korea, whereas *CPI*, *DEF*, and the loan and bond rates are obtained from National Statistical Office.

3.2. Measurement of Deficit Shocks

In resource allocation during recessions. On the other hand, Barro (1974) models the idea of the Ricardian equivalence proposition. He argues that if current generation cares about the next generation, then in absence of capital market imperfection government debt has no real effect on resource allocations and prices. Evans (1987) explains that according to the Ricardian equivalence proposition, households anticipate future tax liabilities from increases in government budget deficit and hence do not raise consumption. Therefore, either nominal or real variables are not affected. As far as empirical method is concerned, dynamic analysis for the effect of

Table 1 A Summary of Empirical Results of the Crowding Out

Authors	Dependent Variables	Fiscal Policy Variables	Empirical Method	Result
Boweles, Ulbrich, & Wallace(1988)	Spread (Baa bond rate-T Bond rate)	Ratio of Government Expenditure to GDP	OLS	Fall in Spread (Crowding in)
Beladi & Lyon(1989)	Private Consumption	Government Expenditure	Simultaneous Equation	Crowding Out
Chan & Gustafsan(1991)	Private Consumption	Government Expenditure	Government Expenditure	No Crowding Out
Darrat (1989)	10 year T-bond rate	Federal Deficit(FD)	Granger causality	No Granger Causality
Darrat (1990)	AAA rate	Federal Deficit(FD)	Cointegration	No Cointegration
Cebula(1991)	(20y T bondrate) - (3m T bill rate)	Federal Deficit(FD)	2 Stage LS	FD raises the slope of the yield curve.
Karras(1994)	Private Consumption	Government Consumption	Cointegration	No Cointegration
Raynold(1994)	CPR(or BAA) rate	Government Deficit	VAR	Crowding out

fiscal policy has not been used a lot. In order to obtain the reliable fiscal policy shock, isolating the exogenous component of changes in the fiscal policy variables is crucial. This is the component that cannot be explained by the economic variables appearing in the analysis. Once identified, examination of the impact of the exogenous part of the deficit (or expenditures and taxes) will provide some indication of the effect that sharply curtailing the government expenditures and/or the deficit relative the level of other aggregate variables might have on the macroeconomy.

Much of the variation that occurs in fiscal policy measures such as the deficit, the level of taxes, or the level of the government expenditures, is endogenously induced by change in the state of the economy. The reaction of these variables to change in the economy is determined by application of rules and regulations concerning particular government tax and expenditure programs.

Fiscal policy shocks will be identified in analogous fashion to the method that has recently used by researchers to identify exogenous monetary policy

shocks within a VAR framework. In this setup a policy shock is identified with the disturbance in an equation of the form:

$$F_t = \mathbf{a}(I_t) + \mathbf{b}e_{ft}. \quad (15)$$

In equation (15) F_t is the policy instrument specified to be a linear function (\mathbf{a}) of information available, I_t , when F_t is determined. e_{ft} is a serially uncorrelated shock that is orthogonal to I_t and has unit variance. Hence, the fiscal shock e_{ft} at date t is assumed to not affect the elements of I_t at time t . \mathbf{b} is a positive constant.

In the focus here on fiscal effects, equation (15) is to be thought of as the government's reaction in terms of the deficit, tax receipts, or expenditures given the whole complex of rules and regulations concerning application of the government programs and tax structures and the state of the economy. When monetary policy is under consideration, an equation similar to equation (15) in which F_t is taken to be the M2 growth rate is viewed as the government's rule (or reaction function) for setting monetary policy. The objective will be to determine the response over in a variety of economic and financial variables including the difference between the loan rate and the bond rate to the three fiscal policy shocks measured by the residuals in equation (15). This dynamic response will be given by the coefficients obtained by regression of the variables of interest on the residuals from equation (15).

It is well known that this procedure is asymptotically equivalent to obtaining impulse responses to underlying economic shocks in an appropriately fitted VAR. Consider a VAR given by

$$W_t = \sum_{i=0}^a A_i W_{t-i} + u_t, \quad (16)$$

where W_t is a vector of economic and financial variables (including the variable F_t), and the disturbance u_t is assumed to be serially uncorrelated with a variance-covariance matrix V . It is assumed that u_t is related to the basic economic shocks, \mathbf{e}_t , in the model by $u_t = \mathbf{B}\mathbf{e}_t$, where \mathbf{B} is lower triangular ($V = \mathbf{B}\mathbf{B}'$). \mathbf{e}_t has the identity matrix for a covariance matrix. If

the fiscal policy variable F_t is the j^{th} element in W_t , then e_t is the j^{th} element in \mathbf{e}_t . Also, in equation (1) I_t includes the variables W_{t-1}, \dots, W_{t-q} , and the first $j-1$ elements of W_t . Application of ordinary least squares to equation (2) allows estimation of the A_i 's and B , and hence allows calculation of the impulse response of any of the variables in W_t to the \mathbf{e}_t including e_t .

It is not possible to include all of the large number of variables of interest in one VAR. If n variables are included with m lags, $(nm+1)n$ parameters will need to be estimated. To deal with this problem it is intended to estimate a basic VAR, that is large enough to mitigate a possible omitted variable problem, and then to add additional variables of interest one at a time and to estimate and perform inference tests on the new system. Christano, Eichenbaum, and Evans (1994) have suggested this method.

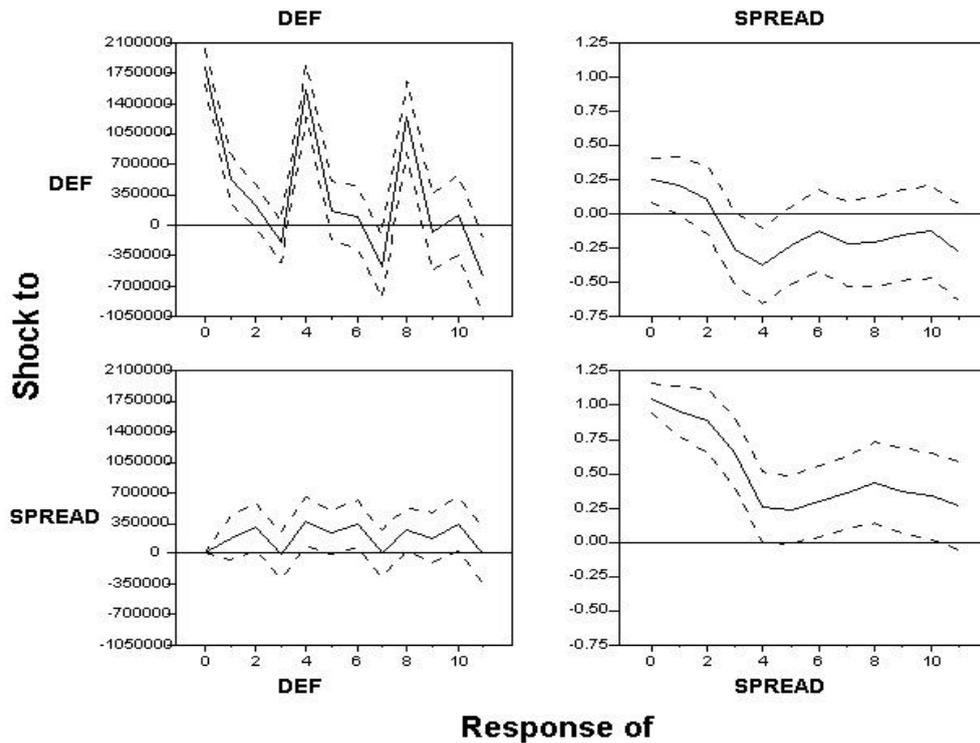
3.3. Effects of the Government Deficit Shocks

This section is concerned with obtaining estimates of the impact on the spread between the loan rate and the bond rate to the government deficit shocks. As we can see from equation (11), if loans and bonds are not perfect substitutes as debt instruments, the difference between the loan and bond rate (SPREAD) is likely to increase and hence cause the additional crowding out with the positive government deficit shock. Thus the VAR impulse response of SPREAD to the government deficit shock may identify the additional crowding out due to the imperfect substitutability between loans and bonds.

Figure 1 depicts the impulse responses with using the 2-variable VAR system, the government deficit and the difference between the loan and bond rates.³⁾ Unit shock in the government deficit induces positively significant increase of the difference between the loan and bond rates. Furthermore, in the 5-variable VAR system, a positive shock in the government deficit has significantly positive impact on the difference between the loan and bond

³⁾ Figures 1 and 2 show upper and lower one standard error bands which are obtained by Monte Carlo simulation. Refer to Kloek and Van Dijk (1978). The lag length of 4 is used for the bivariate VAR system.

Figure 1 Impulse Responses
(DEF and SPREAD)



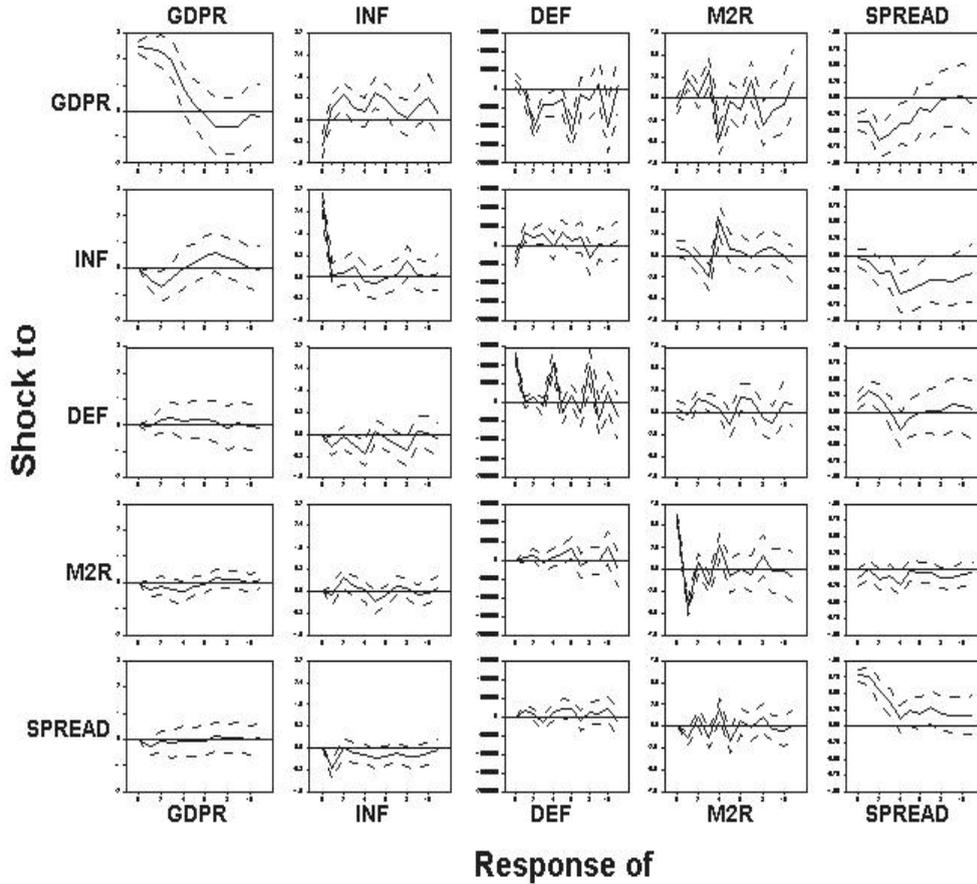
rates as we can see from Figure 2.⁴⁾ Although we change the ordering of the variables in the 5-variable VAR to (GDPR, INF, M2R, DEF, SPREAD), a shock in DEF still has a positively significant influence on SPREAD.⁵⁾ The impulse response of SPREAD to a shock in DEF still remains positively significant with other orderings of the variables in the VAR system: (INF,

⁴⁾ The ordering of the variables in the 5-variable VAR system is GDPR, INF, DEF, M2R, SPREAD. The lag length of 4 is used for the VAR system. The Impulse responses are not so different when the lag length changes to 5 or 6.

⁵⁾ The first row of the 5th column in Figure 2 also shows that a positive shock in GDPR has negatively significant impact on SPREAD. This means that the loan rate declines more than the bond rate in the boom period.

Figure 2 Impulse Responses

(GDPR, INF, DEF, M2R and SPREAD)



GDPR, DEF, M2R, SPREAD) and (INF, GDPR, M2R, DEF, SPREAD).

These results may support that there is additional crowding out if loans and bonds are noted as imperfect substitutes as debt instruments because the loan rate is likely to increase higher than the bond rate when there is a positive shock in the government deficit.

4. CONCLUDING REMARKS

This research is to evaluate the impact of the government budget deficit when a distinction is noted between loans and bonds as debt instruments through the credit or lending channel. Most previous studies have ignored the distinction between loans and bonds as debt

Instruments by assuming that they are perfect substitutes. This paper provides a theoretical framework and empirical analysis for the issue of crowding out when loans and bonds are not perfect substitutes. In this framework, it turns out that there exists additional crowding out with the introduction of loans and that the more sensitive excess loan demand is to income, the more sensitive excess loan demand to the bond rate, the less sensitive excess loan demand is to the loan rate, the more sensitive is planned autonomous expenditure to the loan rate, the greater the level of additional crowding out. Furthermore it is shown that the differential impact on the loan and bond rates of the fiscal policy depends upon the degree of substitutability between two assets.

In conclusion, the lower the degree of substitutability between loans and bonds is, the greater the level of additional crowding out is when there is a distinction between loans and bonds. Thus as far as the effect of the fiscal policy is concerned, it is desirable to raise the degree of the substitutability between loans and bonds. Namely, restructuring of the financial market to increase the degree of the substitutability between debt instruments is highly recommended for the effect of the fiscal policy.

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