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A Short-Run Variable Adjustment Model for Bank Loans*

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The intent of this paper is to address an empirical evidence which is consistent with the post-Keynesian proposition of the endogeneity of the money supply. The purpose of such an exercise is two-fold. First, on the theoretical level, an endogeneity of the money supply depends, in part, on a better understanding of the causal link between the money wage rates and bank loans. Second, on a more practical level, changes in bank lending practices have been jointly investigated by developing a variable speed of adjustment model within the context of the short-run disequilibrium frameworks.

I. Introduction

Although it is viewed, by both monetarists and non-monetarists alike, that commercial bank lending behavior plays the central role in the deposit-creating process in monetary and macroeconomics, voluminous studies have focused on the interest rate sensitivity of the money supply and thus the stability of the money multiplier to identify determinants of the stock of money in conjunction with the endogeneity-exogeneity issue of the money supply. In contrast, one of the key features that post-Keynesian have regarded the stock of money as being essentially endogenous is the short-run disequilibrium adjustment of commercial bank loans in responding and

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accommodating to changes in the level of money wages.[1]

According to the post-Keynesian monetary analysis, in a world of uncertainty in which production takes time and production costs are usually incurred and paid before the receipts of sales proceeds, money comes into existence partly as a result of business firms' demand for money balances to meet disbursement of their expenditures due to an imperfect synchronization of the flow of expenditures and the flow of receipts. For business firms, the maintenance of compensating balances with commercial banks will assure themselves future availability of loans as well as financing working capital needs, at least temporarily until they have arranged sufficient sources of longer-term financing.[2] From the banks' point of view, these balances generate their own deposits, raise the bank yields, enable them to make income-earning loans, and establish long-term bank-customer relationships in the competitive market for business loans, so that commercial banks endeavor to accommodate business loans demanded by business firms by providing multidimensional short-term commercial and industrial loan agreements.[3]

Under such circumstances, an increase in the money wage rate, determined as a result of the collective bargaining process, results in a higher wage bill and thus increases production costs at the given level of employment determined at the beginning of the production period. The resulting increase in the wage bill and production costs require firms to finance the increased working capital needs by means of business loans at commercial banks.[4] In order to accommodate the increased loans demanded by business firms under the line of credit agreements, commercial banks

1 For the post-Keynesian monetary theory, see Davidson, ch. 6; Weintraub, ch. 5; and Moore (1979a), pp. 120-138.

2 The working capital needs may also be financed by increases in nonbank borrowings or long-term debt issues. Since arrangements for these sources of financing take longer time, firms will increase their short-term borrowings from banks until these longer-term arrangements are completed. See Moore (1983), pp. 545-547.

3 Boltz and Campbell concluded from the study of the Survey of Terms of Bank Lending data that commitments are very widely used by commercial banks by providing heterogeneous loan products since the early 1970s. See Boltz and Campbell, pp. 29-30.

4 This is also true for nonbank financial institutions. But, since the primary concern of this study is commercial bank lending behavior, the discussion is limited to commercial banks.

change their portfolio compositions by reducing government securities holdings and the level of excess reserves and by increasing borrowings from nondeposit sources of funds. In the portfolio adjustment process, short-term interest rates will be increased. The central bank thus passively permits the expansion of the money supply by supplying additional reserves through its open market operations to validate contract-binding money wage increases and to keep interest rates at their desired level which are consistent with the central bank's goal of achieving its projected levels of prices, output, and employment.[5] If not accommodated, an increase in the money wage might result in financial chaos and rising unemployment rates.[6] Bank reserves and the monetary base thus become more the consequence, than the determinant, of the demand-determined money supply in the short run.

Although this post-Keynesian proposition has long been argued in the literatures and many empirical evidences have been available on the commercial bank lending behavior, most of empirical evidences have been conducted within the traditional equilibrium approach of the nominal interest rates charged at commercial banks as being a dominant explanatory variable. Thus, the purpose of this paper is to address an empirical evidence which is consistent with the post-Keynesian proposition of the endogeneity of the money supply by establishing the relationship between money wages and bank loans. To meet this end, the changing pattern of commercial bank lending practices has been jointly investigated by developing a variable speed of adjustment model within the short-run disequilibrium frameworks.

The next section of this paper derives a simple stock adjustment model for commercial bank loan outstandings based on the conceptual framework provided by the existing literatures and extended to include a variable speed of adjustment in the model to reflect bank credit rationing behavior. Section III contains the results of estimating the model developed in the preceeding section, and followed by conclusions in Section IV.

[5] When the central bank finds that the money stock is expanding more rapidly than desired and it is impossible to moderate the large changes in the interest rates necessary to offset past excessive growth of the money stock, the central bank might amend its target values of reserves as well as interest rates. See Lombra and Torto.

[6] Moore (1979b), p. 65.

II. The Variable Adjustment Model

Moore (1983) estimated a single-equation reduced form of demand for business loans to identifing the relationship between bank lending and the working capital needs to investigate the role of the money wage rate in determining bank loan demand.[7] His empirical study concluded that the money wage plays a dominant role in determining private demand for bank credit and thus the money supply is in fact endogenous. Although Moore defined explicitly the estimated equation as the demand for business loans, the actual level of bank loans made available to commercial and industrial corporations has been used to measure business loans demanded in the estimating procedures. This is only possible under the assumption that commercial banks perfectly anticipated and fully accommodated changes in the business loan demand, i.e., the perfectly elastic supply of bank credit. If commercial banks' expectations are wrong and/or the banks' willingness to extend the business loans has been changed, the money stock will not be expanded enough so that the equilibrating adjustment could be partly explained by fluctuations in interest rates. Expectations are surprisingly ignored, so that no distinction between notional and effective functions has been made in his study. Thus, even though Moore implicitly assumed that "banks set their lending rates and attempt to meet the demand for loans that results"[8] in order to be consistent with the Keynesian analytical context of the quantity-adjustment rather than the price-adjustment frameworks, his study did not capture the fundamental characteristics of the post-Keynesian disequilibrium analysis in which the distinction between the expected and the actual levels of business loans is made.

Moore also mentioned that changes in the degree of banks' credit rationing may affect bank lending of short-term commercial loans, but this variable never appeared in the final estimated equation because it was insignificant.[9] This contradictory result to

7 Moore decomposed the working capital needs into four components as: employment costs measured by the wage bill, material costs, stock-building costs measured by current price value of stock levels, and corporate tax payments. See Moore (1983), pp. 547-548.

8 *Ibid.*, p. 553.

9 Moore used proxy dummies for Federal Reserve engineered period of "credit crunch" to investigate changes in the degree of credit rationing. *Ibid.*, p. 547.

other studies on bank lending practices (D. Harris 1973; Campbell 1978; and Boltz and Campbell 1979) stems from the fact that the demand equation for business loan is formulated to include loans made available under the lines of credit so that only the working capital needs are entered as an element of determination of the business loan demand, leaving the effects of other variables on the short-term commercial and industrial loan demand.

On the contrary, an equation for business loan demand has been estimated by M. Harris. Her measure of the business loans made by commercial banks is more close to the loans made available to finance short-term expenditures other than the working capital needs, because the change in business loans was expressed as a function of such explanatory demand variables as the change in business inventories, the change in business fixed investment, the change in corporate cash flows, and the change in the differential between the prime rate and the commercial paper rate.[10]

A. The Stock Adjustment Model for Bank Loans

According to the study of the Survey of Terms of Bank Lending Data (Boltz and Campbell), it is common in bank lending pratices that commitments are very widely used by commercial banks to secure compensating balances and to establish long-term customer relationships in the profit-maximizing process. The short-run choice problem of commercial banks is then to select the optimal combination of commercial and industrial loan outstanding and security holdings to maximize their expected profit, subject to the bank balance sheet constraint. Thus, it is assumed that the profit-maximizing optimal level of commercial and industrial loan outstandings (CBL_t) at the end of a given period of time is positively related to the expected level of business loans demanded by business firms (BL_t) during a given period of time, i.e.,

$$(1)\ CBL_t^* = a_0 + a_1 BL_t^d\ ;\ a_1 > 0.$$

[10] Each variable can be entered separately as explanatory variables. But, in order to avoid the possible multicollinearity problem, a new variable, financial gap (FGAP), is generated as FGAP = INVT + BFI-CF, where INVT is inventories, BFI is business fixed investments, and CF is corporate cash flows.

It is also assumed that a simple stock adjustment model which exhibits the relationship between the actual and the desired level of commercial and industrial loan outstandings can be expressed as:

$$(2)\ CBL_t - CBL_{t-1} = \theta\,(CBL_t^* - CBL_{t-1}),$$

where CBL_t is the actual level of commercial and industrial loan outstandings at the end of time t, and θ is the adjustment coefficient. Since, by definition, the change in the stock variable of the actual level of commercial and industrial loan outstandings is equal to the volume of the flow variable of business loans actually supplied by commercial banks during a given period of time, equation (2) can be rewritten as:

$$(2a)\ BL_t = CBL_t - CBL_{t-1} = \theta\,(CBL_t^* - CBL_{t-1}),$$

where BL_t is the actual volume of business loans supplied by commercial banks during a given period of time t. Substitution for CBL_t^* from equation (1) into equation (2a) gives

$$(3)\ BL_t = \theta\,(a_0 + a_1\,BL_t^d - CBL_{t-1}),$$

where BL_t and BL_t^d and the actual volume of business loans supplied and the expected amount of business loan demand estimated by commercial banks, respectively.

Now, turning to the expected bank loan demand, business firms can be viewed as financing positions to meet their unsynchronized short-term expenditure schedules in the working capital needs, inventories and fixed capital investments by means of loans from commercial banks and other liabilities (Hicks). Thus, the banks' expected demand for business loans can be expressed as a function of the working capital needs, the financial gap defined as an excess of capital expenditures for both fixed capital and inventory investments over cash flows, and the rate differential between the commercial paper rate and the prime rate. For the working capital needs in which the wage bill (WBILL) is the single most important factor cost, increases in the money wage rate, with given production flows, will require additional working capital and will thus lead directly to an increase in bank credit demand and so to corresponding increase in bank loans (Moore 1983). The financial gap (FGAP) will also directly lead to an increase in the

bank loan demand. Finally, the interest rate differential (RDIF) will help firms determine whether they borrow from banks or issue new short-term securities to finance the needs for funds (M. Harris 1976).

Thus, in a linear equation form, the expected demand for short-term business loans can be written as:

$$(4)\ BL_t^d = b_0 + b_1\ WBILL_t + b_2\ FGAP_t + b_3\ RDIF_t;\quad b_1, b_2, b_3 > 0.$$

Substitution for BL_t^d from equation (4) into equation (3) leads to express the reduced form equation for fixed coefficient business loans as:

$$(5)\ BL_t = \theta\ (c_0 + c_1\ WBILL_t + c_2\ FGAP_t + c_3\ RDIF_t - CBL_{t-1}),$$

where $c_0 = (a_0 + a_1 b_0)$, $c_1 = a_1 b_1 > 0$, $c_2 = a_1 b_2 > 0$, and $c_3 = a_1 b_3 > 0$.

In order to reflect the changing pattern of bank lending practices, the model will be extended to include the determinants of the speed of adjustment.

B. A Variable Speed of Adjustment Model

Within the traditional equilibrium context of the business loan market model, Hicks attempted to reflect the bank lending practices in the model. Hicks included the past level of bank loans in the demand equation to represent the partial adjustment of bank loans as well as the bank-customer relationship, whereas the reserve adjustment magnitude and portfolio constraint variables were included in the supply equation to reflect the banks' allocation of total earning assets between business loans and other investments. Within the dynamic stock adjustment frameworks, Grieves extended the stock adjustment model to include a variable speed of adjustment and a variable replacement rate, based on the postulates that timing decisions and liquidity availability affect the household demand for consumer durables.

On the other hand, recent studies provide evidences that commercial banks attempt to bring the actual level of bank loan outstandings to its desired level through the differential rationing of bank credit to large-versus-small, established-versus-new, and local-versus-nonlocal customers by providing multidimensional loan agreements in the profit-maximizing process (D. Harris; Campbell; and Boltz and Campbell). These discriminatory bank lending practices depend mainly on the money market conditions effected by the monetary policy through interest rates and credit availability. Easy monetary policy would give commercial banks greater liquidity and thus might stimulate the banks' willingness to extend business loans by loosening their lending standard, while tightening the credit condition might have the opposite effects (Grieves). Consequently, the speed of adjustment is positively related to the money market credit conditions affected by the monetary policy.

Thus, the linear functional form for a variable speed of adjustment can be expressed as:

$$(6)\ \theta_t = d_0 + d_1\ \text{CREDIT}_t + d_2\ \text{MBASE}_{t-1}\ ;\ d_1, d_2 > 0,$$

where θ is the speed of adjustment, CREDIT is a measure of credit market conditions, and MBASE is the monetary base reflecting the monetary policy. An inclusion of the lagged term of monetary base is based on the following two reasons; First, the volume of business loans supplied by commercial banks during a given period of time can be decomposed into the amount of loans supplied under the pre-arranged loan commitments and the loans made available to the new applications during the current period of time. The loan supplied under the pre-arranged commitments were determined by the previous period money market credit conditions. Second and more importantly, as post-Keynesian claimed, if the monetary base is in fact endogenous, an inclusion of the current period monetary base as an explanatory variable causes simultaneous-equation bias problem. Thus, in order to avoid the possible simultaneous-equation bias problem in the estimating procedures, the lagged monetary base is included as predetermined explanatory variable in the model.

Even though appropriate data for the money market credit conditions are not available, an index measure of credit condi-

tions in this study is constructed by utilizing the information available from the Quarterly Survey of Changes in Bank Lending Practices conducted by the Federal Reserves Board of Governors. The measure of the money market credit conditions has been constructed as a weighted average of questions asked to the bank senior loan officers about their willingness and policies to extend business loans:

$$\begin{aligned} \text{CREDIT}_t = & \sum_j w_{1j} \,(\% \text{ of considerably more willing}) \\ & + \sum_j w_{2j} \,(\% \text{ of moderately more willing}) \\ & + \sum_j w_{3j} \,(\% \text{ of essentially unchanged}) \\ & + \sum_j w_{4j} \,(\% \text{ of moderately less willing}) \\ & + \sum_j w_{5j} \,(\% \text{ of considerably less willing}) \end{aligned}$$

where weights are given as follows:

$$w_{ij} = w_{ik} \qquad \text{for all } j \text{ and } k,$$

$$w_{1j} = -w_{5j} = 2 \qquad \text{for all } j,$$

$$w_{2j} = -w_{4j} = 1 \qquad \text{for all } j,$$

$$w_{3j} = 0 \qquad \text{for all } j.$$

Substituting equation (6) into equation (5) and adding an error term yields the variable adjustment model for short-term business loans as:

$$(7)\ \text{BL}_t^s = (d_0 + d_1\,\text{CREDIT}_t + d_2\,\text{MBASE}_{t-1})\,(c_0 + c_1\,\text{WBILL}_t + c_2\,\text{FGAP}_t + c_3\,\text{RDIF}_t - \text{CBL}_{t-1}) + e_t,$$

where e_t is an error term. Equation (7) will be estimated to jointly test the validity of variable speed of adjustment as well as the relationship between the money wage and business loans.

III. The Empirical Estimation

A. Data Sources and Estimation Techniques

This study employs seasonally adjusted quarterly data from the CITIBANK Database,[11] except a measure of credit conditions, for the period of the first quarter of 1967 through the fouth quarter of 1979. Variables are measured as:

BL : Commercial and Industrial Business Loans, in billion dollar.

WBILL : Wage and Salary Disbursements in Manufacturing, in billion dollar.

FGAP = INVT + BFI - CF : Financial Gap, in billion dollar

where

INVT : Inventories in Manufacturing, in billion dollar,

BFI : Nonresidential Gross Private Domestic Fixed Investments, in billion dollar,

CF : Corporate Net Cash Flow defined as the sum of undistributed corporate profits, inventory valuation adjustment, and depreciation, in billion dollar.

RDIF = CPRATE - PRATE, in percent per annum,

where

CPRATE : Commercial Paper Rate, 6 months, percent per annum,

PRATE : Prime Rate charged as Banks on Short-term Business Loans, percent per annum.

MBASE = the Monetary Base, adjusted for Reserve Requirement Changes, in billion dollar.

A variable measuring the money market credit conditions

11 The selection of the sample period from 1967: I through 1979: IV is mainly due to the difficulties to obtain consistent measure of money market credit conditions. The Federal Reserves has conducted a quarterly survey of changes in lending practices since 1964, but started to publish the survey results from February 1967. From 1978: I, the Federal Reserves revised the survey questions with 22 items asked to senior loan officers, and again re-revised the survey from February 1980 asking 6 core questions retained from the former 22 items.

(CREDIT) as described in the preceeding section is computed as a weighted average of 10 items related to short-term business loans from the Quarterly Survey of Changes in Bank Lending Practices published in the Federal Reserve Bulletin.[12] The range of index value of CREDIT is $-2 \leqslant \text{CREDIT} \leqslant 2$. The closer to the value of 2 indicated an easy credit conditions, whereas the closer to the value of -2 implies a tight credit conditions.

Equation (7) was estimated using a nonlinear least squres routine available in the Time Series Processor, LSQ from TSP (Hall). In the estimating procedures, all variables were entered as first difference in order to obtain unbiased estimates by eliminating possible autocorrelation problem.[13] Thus, the first-order difference form of equation (7) estimated in this study is[14]

$$(7a)\ \Delta BL_t = (g_0 + g_1 \Delta CREDIT_t + g_2 \Delta MBASE_{t-1})\ (h_0 + h_1 \Delta WBILL_t + h_2 \Delta FGAP_t + h_3 \Delta RDIF_t - BL_{t-1}) + u_t$$

where $u_t = e_t - \rho e_{t-1}$ is an error term which is assumed to be serially uncorrelated.

B. Estimation Results

The above nonlinear first-order difference equation (7a) was estimated under the different assumptions. Estimation results are presented in Table 1. Estimation 1 is the result of the assumption of a fixed speed of adjustment, i.e., $g_1 = g_2 = 0$, whereas Esti-

[12] Those 10 items in each subsample period are:

(1) From February 1967 through November 1977, all 10 items questioning willingness to make loans to nonfinancial businesses.

(2) From February 1978 through November 1979, to qualify for prime rate or spread above prime as standards of creditworthiness, willingness to make fixed-rate short-term loans, 5 items for reviewing credit lines or loan applications except loans to finance companies, and 2 items for willingness to make other types of commercial and industrial loans.

[13] An initial estimation of equation (7) was conducted to eliminate the autocorrelation problem using Cochrane-Orcutt Iterative routine. But Durbin-Watson statistic of 1.25 with the value -0.4793 for Rho indicates that the autocorrelation problem is not completely eliminated, so the a simple first difference of each variable is entered in the equation.

[14] Since $BL_{t-1} = CBL_t - CBL_{t-1}$, the past business loan was entered in the equation.

Table 1

CHANGES IN COMMERCIAL AND INDUSTRIAL LOANS AT COMMERCIAL BANKS (ΔBL), 1967:I-1979:IV

Variables	Estimation 1	Estimation 2	Estimation 3	Estimation 4
Constant	0.9494	0.9655	0.5653	0.4993
	(23.5815)	(22.2461)	(5.0520)	(4.2878)
ΔCREDIT		0.6616		1.3515
		(0.9029)		(1.9513)
$\Delta MBASE_{-1}$			0.0068	0.0086
			(3.7410)	(4.2686)
Constant	0.8047	1.0677	-0.6436	0.3085
	(1.6289)	(1.9679)	(0.6309)	(0.3618)
ΔWBILL	0.2761	0.2261	0.6768	0.4632
	(4.5823)	(3.0461)	(3.2064)	(2.9148)
ΔFGAP	0.4012	0.3755	0.3863	0.3839
	(5.6044)	(5.0138)	(3.6825)	(4.0222)
ΔRDIF	1.3932	0.7106	1.4472	0.2983
	(1.3975)	(0.7410)	(0.9878)	(0.3032)
D-W Stat.	1.3968	1.3449	1.8856	2.0494
R^2	0.9636	0.9641	0.9772	0.9742
Std. Error of Regression	2.8671	2.8795	2.5606	2.4671

Absolute values of t-statistics are in parentheses.

mation 2 through Estimation 4 are the results of a variable speed of adjustment postulates, i.e., $g_1 \neq 0$, or $g_2 \neq 0$, or both.

The results of four estimations show that changes in the wage bill and changes in financial needs for capital expenditures have statistically significant effects on changes in business loans, while the change in rate differential is statistically insignificant. The statistically significant positive relationship between the wage bill and bank loans supports the post-Keynesian proposition. That is, an increase in the money wage rate and thus resulting increase in the working capital needs to finance higher wage bill result

ultimately in an expansion of the money stock through an accommodating commercial bank lending behavior.

The statistically significant coefficient of financial gap with expected positive sign implies that business firms utilize the prearranged loan commitments to finance their capital expenditure needs, at least temporarily until further arrangements for sources of financing are completed. In addition, the statistically insignificant coefficient of rate differential indicates that commercial and industrial loans are not homogeneous products.[15] Since many large banks in financial center compete with each other and with alternative sources such as the commercial paper market, commercial and industrial loans made as the prime rate generally of the type of floating-rates and no fixed maturity (Boltz and Campbell). Thus, the borrowers could liquidate the loan at any time if more attractive rates were available elsewhere, so that the rate differential has no significant influence determining the source of financing short-term needs for funds.

Turning to the speed of adjustment, Estimation 1 and Estimation 2 present the similar results. An inclusion of current money market credit condition alone as a determinant of the speed of adjustment does not support the postulated assumption of a variable speed of adjustment. The magnitude of constant term in both Estimation 1 and Estimation 2 is about the same, but the large value of t-statistics computed under the hypothesis, $H_0: g_0 = 0$ against $H_a: g_0 \neq 0$, implies that the constant term might be overestimated possibly due to the existence of misspecification and/or the simultaneous-equation bias problem. Thus, in order to avoid the possible misspecification and/or simultaneous-equation bias problem, the past credit condition affected by the monetary policy is included in Estimation 3 and Estimation 4.

When a comparison between the results of Estimation 1 and Estimation 2 and the results of Estimation 3 and Estimation 4 is made, it is clearly shown that the speed of adjustment depends on the current and the past credit conditions affected by the monetary policy. The comparison also indicates that large part of

[15] The traditional view of the prime rate assumed that loans carrying at the prime rate are basically a homogeneous product when made to the preferred customers. See Boltz and Campbell, p. 20.

business loans at commercial banks are made under the pre-arranged commitments to extend business loans. The current credit condition affects in determining whether to extend bank loans to new and nonlocal applications, that is, the current money market condition largely determines the degree of bank credit rationing for established-versus-new and local-versus-nonlocal customers.

IV. Conclusions

The empirical results of this study confirm jointly the post-Keynesian proposition and a variable speed of adjustment postulate. The behavior of money wage rates plays an important role in determining demand for bank credit. Commercial banks appear to accommodate to an increase in the demand for bank credit under the pre-arranged loan agreements to secure compensating balance and to establish long-term customer relationships by providing heterogeneous loan products in the competitive markets for business loans. The incidence of different lending practices at commercial banks responding to the monetary policy changes leads banks to alter their speed of adjustment to bring their actual level of loan outstandings to its desired level in the profit-maximizing process.

As a result, although evidence on the central bank's policy strategy is yet less than complete, evidence indicates that the money supply is in fact demand-determined endogenous. Consequently, the traditional view of casual relationship between the money stock and the monetary base is exactly reverse as long as the central bank allows the money stock to grow to keep interest rates at their desired level for orderly financial market.

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