A Test for the Bank Lending Channel of Monetary Policy in an Open Economy

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Abstract

This paper studies a plausible role of the bank lending channel in the monetary transmission process in Taiwan. Particularly, we provide a theoretical framework in an open economy to describe the effects of monetary policy on banks' behaviors. The theoretical findings are that the effect of a monetary policy on bank loans is indeterminate. The flows of funds internationally induce adjustments in both of foreign assets and foreign debts in bank's balance sheet after monetary shocks. Such adjustments not only provide buffers for banks to insulate their loan levels from monetary disturbance, but also create counter effects such that the effect of a monetary policy on bank loans is ambiguous. In the empirical study, we perform cointegrated relation to analyze the effects of monetary policy on bank loans, foreign assets and foreign debts. The empirical evidences with aggregate data of depository banks in Taiwan indicate that bank loans are not necessarily increasing with a monetary expansion. However, the positions of banks' foreign assets and foreign debts change as predicated by theories. Hence, the aggregate data show that bank lending channel is not likely to be an effective monetary transmission mechanism in Taiwan.

Key words: Bank lending channel; Monetary transmission; Capital flows
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1. Introduction

In the traditional money view, the interest rate plays a pivotal role in the monetary transmission mechanism. An expansionary monetary policy would increase the money supply and then lead to a decline in the interest rate. The lower interest rate thereby causes an increase in investment spending and then a rise in both aggregate demand and output.[1] The financial intermediaries are only the institutions to create money deposits and play no special role in this monetary transmission process.

However, by the credit view, the role of financial intermediaries is essential in the transmission of a monetary policy. This interest can be traced back to Bernanke and Blinder (1988). Bernanke and Blinder (1992) further found that a contractive monetary policy leads to a decline in both aggregate loans and economic activity with U.S. data. However, they also observed a considerable reduction in banks' securities holdings after the monetary contraction. This kind of bank behavior may help them elude the restriction on the credit supply, so the subsequent decrease in bank credit may possibly be attributed to credit demand.

In order to address the identification problem, Kashyap et al. (1993) found that firms attempt to avoid financial restrictions by issuing commercial papers after a monetary tightening. The responses of bank loans and commercial papers indicated that a bank lending channel exists since firms attempt to avoid financial restriction by issuing commercial papers. However, Kakes (2000) questioned that studies based on aggregate data suffer from an identification problem: the inability to identify whether the decrease in loans after a contractionary policy is induced by bank policy or by loan demand. With disaggregate data, he found that banks hold a buffer stock of bonds to offset monetary shocks. Therefore, the bank lending channel was not an important monetary transmission mechanism.

Kashyap and Stein (2000) also coped with the identification problem by moving from aggregate to disaggregate data. They separated banks by asset size and liquidity, and the empirical results provided evidence for the existence of a banking channel in the U.S. Kishan and Opiela (2000) further argued that bank asset size and bank capital can affect the ability of banks to raise funds and maintain loan growth during contractionary monetary policies. They tested for bank loan supply shifts after a tight monetary policy by categorizing banks with capital leverage ratio. They found that the loans of small banks were more responsive to monetary tightening policies.

Hülsewig, Winker and Worms (2002) further suggested two alternative ways to tackle the identification problem: either using disaggregate data to exploit the heterogeneity across agents or sticking to aggregate data, but putting more structure

[1] Please see Mishkin (1995)

on the estimations in order to identify the loan supply and loan demand. The aggregate data of Germany show the long-run effect of monetary policy on bank loans is comparatively weak.

All the above literature investigated the credit channel in a closed-economy framework and the importance of bank lending channels is not conclusive. Kashap and Stein (1995a) proposed three conditions for the existence of the credit channel in a closed economy. First, price stickiness must exist. Second, some of private sectors must be dependent on bank loans as a source of external finance. Third, monetary policy alters banks' ability to supply loans. Pill (1997) extended their model with additional non-deposit financial source from foreign markets. He found that the credit channel works in an opposite direction to offset the effect of monetary shocks in a small open economy. However, Chiades and Gambacorta (2004) modified the Bernanke and Blinder (1988) model into the case under a quasi-fixed exchange rate regime. By means of a structural VECM analysis and Johansen FIML methodology, the evidences show that under a quasi-fixed exchange rate regime, the relative efficacy of credit channel had permitted Italian monetary policy to maintain some level of effectiveness on domestic prices and income.[2]

Since studies on the existence of a bank lending channel are not fully conclusive, we wonder if there is a bank lending channel of monetary transmission in Taiwan. As to empirical studies on Taiwan, Lee (1989) found that monetary quantity is a better intermediate target than credit quantity in a monetary policy.[3] However, Chuang and Cheng (1991) pointed that both monetary quantity and bank credit are regarded as intermediate targets and none of them can be neglected.[4] Wang (1994) followed the concept in Kashyap et al. (1993) to examine whether banks loans and commercial papers as substitutes. He found that both are substitutes, but not perfect substitutes. In addition, Wu (2004) evaluated the effectiveness of monetary policy and concluded that banks play an important role in the transmission of monetary policy in Taiwan.

In addition, Cheng (2004) modified the model of Kishan and Opiela (2000) to test for the bank loan supply shifting by banks asset size with the fully modified ordinary least square (FMOLS). The empirical results indicated that the responses of large banks to monetary policy were not statistically significant, but both business banks and primary financial institutions responded to monetary policy statistically significantly. Sun (2005) detected that banks respond to a monetary tightening by decreasing their securities holdings and at the same time, banks look for other ways to

[2] Although Chiades and Gambacorta (2004) find that the credit channel exists under a quasi-fixed exchange rate regime, a quasi-fixed exchange rate regime can be maintained just in the short run. Besides, this paper ignores the effect of exchange rate changes on the flows of international capital.
[3] Lee (1989) uses the traditional VAR to test the role of credit channel in monetary policy in Taiwan.
[4] Chuang and Cheng (1991) investigate bank credit in Taiwan with the structural VAR.

fill up credit supply by raising the bank debentures issued.

Most empirical studies conducted in a closed-economy framework indicate the existence of the credit channel in Taiwan. However, as Taiwan becomes more financially integrated with the rest of the world, non-deposit sources of external finance from foreign markets are prevailing. This might provide buffers to offset the effect of monetary policies. Therefore, there is a need to consider the influence of the increasing capital mobility on the effect of banks lending channel.

However, little literature has investigated this issue in an open economy model so far. Wu (2005) first studied the bank lending channel to let bank have access to foreign financial markets with Taiwan data. Yet, he did not clearly identify and analyze the buffer behaviors of banks. Therefore, the purpose of this paper is to analyze whether the bank lending channel exists in Taiwan by including both foreign assets and foreign debts in banks' balance sheet. This paper attempts to investigate the idea whether banks use foreign assets as buffers against monetary shocks and whether banks look for the foreign sources of external finance to fill up the credit supply.

There are four sections in this paper. In addition to the introduction, we develop and solve a theoretical model based on Kishan and Opiela (2000) in section 2, but further include both foreign assets and foreign debts in banks' balance sheet. Then, the empirical studies are carried out with cointegration analysis in section 3. Differing from Kishan and Opiela (2000), this study does not aim at disaggregate bank level. As monetary policy restrictions target at aggregate variables rather individual bank data, this paper focuses on the effects on the aggregate loan volume. On the other hand, we don't distinguish between loans to the corporate sector and loans to the household sector because the information asymmetries between banks and borrowers are not the issue we concerned about here. Section 4 concludes the findings.

2. The model

The model built in this section is modified from the framework in Kishan and Opiela (2000). The bank is assumed to have four assets: required reserves (RR), securities (SEC), loans (LN) and foreign assets (FA); and three liabilities: demand deposits (DD), bank debentures *(BD*) and foreign debt (FD). Therefore, the balance sheet constraint requires

$$RR + SEC + LN + FA = DD + BD + FD . \quad (1)$$

On the asset side, banks hold a fraction (α) of DD in required reserves, but they hold no excess reserve. To capture the motive for holding securities as buffer stock, securities are assumed to be a fixed proportion of DD . By assuming that the loan market is imperfectly competitive, banks can increase loans by lowering their

loan rates, r_{LN}. Therefore, we have the following equations:

$$RR = \alpha DD. \tag{2}$$

$$SEC = c_0 + (c_1)DD - RR, \text{ where } c_1 < 1 \text{ and } c_1 > \alpha. \tag{3}$$

$$LN = d_0 - (d_1)r_{LN}. \tag{4}$$

In an open economy with capital mobility, banks can hold foreign assets in their portfolios. The expected rate of returns on foreign assets (r^*) is the sum of foreign interest rate (r_f) plus the expected rate of change in the exchange rate ($\frac{(s^e - s)}{s}$).[5] An increase in r^* relative to the domestic rate will induce banks to raise the position of foreign assets:

$$FA = h_0 + h_1(r^* - r). \tag{5}$$

On the liability side, DD are assumed to be inversely related to a market interest rate (r) as shown in equation (6). We also assume that banks can raise funds by offering a higher interest on bank debentures issued (r_{BD}). Therefore,

$$DD = a_0 - (a_1)r. \tag{6}$$

$$BD = b_0 + (b_1)r_{BD}. \tag{7}$$

In addition, banks have access to raising funds abroad. The cost of raising foreign funds is assumed to be r^*. Following a rise in the domestic market rate relative to r^*, banks can increase their foreign debts to create the source for loans. Hence,

$$FD = j_0 + j_1(r - r^*). \tag{8}$$

Banks are assumed to maximize profits (π), where

$$\pi = (r_{LN} - \Phi)LN + r_{SEC}SEC + (r^*)FA - (r)DD - r_{BD}BD - (r^*)FD. \tag{9}$$

Profits include revenues from the interest income on loans ($r_{LN}LN$) net of loan losses (ΦLN), the interest on the securities ($r_{SEC}SEC$), and returns on the foreign

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[5] The return rate of investing one unit of domestic currency in foreign assets is

$$\frac{(1+r^*)s^e/s-1}{1} = r_f\frac{s^e}{s} + \frac{s^e - s}{s} = r_f\frac{s+(s^e-s)}{s} + \frac{s^e-s}{s}$$
$$= r_f + r_f\frac{s^e-s}{s} + \frac{s^e-s}{s}$$
$$\cong r_f + \frac{s^e-s}{s}$$

Since r_f and $\frac{s^e-s}{s}$ are percentage, their product ($r_f\frac{s^e-s}{s}$) can be ignored.

assets [$(r^*)FA$], minus the interest paid on demand deposits [$(r)DD$], bank debentures ($r_{BD}BD$) and foreign debt [$(r^*)FD$].

Equation (10) is maximized with respect to LN after eliminating RR, DD, BD, SEC, FA, FD, r_{BD}, and r_{LN}. The first-order necessary condition is used to solve for LN. The same process can be employed to solve for BD. Testable hypotheses can be derived by taking the derivatives of the LN and BD equations with respect to the market interest rate and the expected exchange rate. The response of loans to changes in the market interest rate is in the following:

$$\frac{\partial LN}{\partial r} = \frac{d_1[(c_1-1)a_1 + h_1 + j_1]}{2(b_1+d_1)} \quad \begin{matrix} > \\ = \\ < \end{matrix} \quad 0 \qquad (10)$$

In contrast to a closed economy model of Kishan and Opiela (2000), the response of bank loans to changes in the interest rate is indeterminate in an open economy, depending on the magnitude of the parameter of buffer portion in securities, c_1 , and the sensitivities of demand deposits, foreign assets and foreign debts to the market rate, a_1 , h_1 and j_1. This is inconsistent with the perspective of bank lending channel.

Furthermore, if h_1 and j_1 are large enough to make $(c_1-1)a_1 + h_1 + j_1 > 0$, bank loans will even decrease after an expansionary monetary policy. One of reasons is that a loose monetary policy decreases the domestic rate and increases banks' incentives to hold foreign assets. The other reason is that a lower domestic rate could amplify interest rate spreads and then decrease banks' position of foreign debts. Both of which reduce funds available for domestic lending even after a money increase. Therefore, the effect of the bank lending channel might be reduced or reversed..

The response of loans to change in the expected exchange rate is negative:

$$\partial LN/\partial s^e = \partial LN/\partial r^* \times \partial r^*/\partial s^e = d_1[-h_1 - j_1]/2s(b_1+d_1) < 0 \qquad (11)$$

If the public anticipates depreciation in the domestic currency, both the expected rate of return on foreign assets and the cost of raising funds abroad would increase. Therefore banks increase their foreign assets and lower their foreign debt position, and vice versa. This is a counter effect to the bank lending channel. It is hard for the authority to affect real economic activity through the bank lending channel in an open economy.

3. Empirical studies

We conduct empirical analyses with the data of all deposit money banks in

Taiwan. The data are monthly data from January 1989 to December 2004, and the source comes from financial statistics databases of Taiwan in AREMOS. The variables include bank loans, foreign assets, foreign debts, and the interbank overnight call-loan rate of all deposit money banks.[6] The interbank overnight call-loan rate is chosen to represent the monetary policy of central banks. There are two reasons for choosing the interbank overnight call-loan rate to represent the monetary policy. First, the main market used by banks to adjust reserves is the call-loan rate market. Second, the central banks look this overnight call-loan rate as reference to the monetary policy.[7] The expected exchange rate is taken from the actual rate by the assuming perfect foresight. Except for the interbank overnight call-loan rate, all variables are in log form.

3.1. Unit Root Tests

Augmented Dickey-Fuller (ADF) tests and Phillips-Perron (PP) tests are applied to examine the null of the unit root in each variable.[8] Since all variables are time series, we examine the null of the unit root in each variable. Table 1 reports the test results for level and the first difference of data. By the results in table 1, the nonstationary null hypothesis of the unit roots cannot be rejected. However, all variables' first differences appear to be stationary with the rejection of the unit-root hypotheses.[9] Therefore, all data series in our sample are integrated of order one.

TABLE 1 Unit Root Tests

Variable	Level terms		First-order difference	
	ADF Statistic	PP Statistic	ADF Statistic	PP Statistic
LN	1.4090	5.0702	-2.2068*	-6.6759**
r	-0.7249	-0.9129	-5.8130**	-17.4585**
FA	2.3872	2.4438	-6.6796**	-14.1156**
FD	1.4463	1.5261	-3.5621**	-13.3064**
s^e	0.4216	0.6139	-5.1042**	-9.5731**

Notes:

1. * represents 5 percent level of significance.

[6] All deposit money banks in Taiwan include domestic banks, branches of foreign banks, business banks, credit cooperatives, and credit departments of farmers' and fishermen's associations.
[7] See Chen (2000).
[8] See Dickey and Fuller (1979, 1981); Phillips and Perron (1988).
[9] All variables are without a trend and their lag lengths are distributed from one to eleven.

** represents 1 percent level of significance.

3.2 Bank Loans, the Expected Exchange Rate, and the Interest Rate

Since the time series data is nonstationary, we solve this problem by utilizing the Johansen and Juselius cointegration technique.[10] With all variables in our sample integrated of order one, we first do residual misspecification tests for VAR models to find the most suitable lag order. Table 2 reports the results of residual misspecification tests for VAR models with the lag lengths as five. All of Ljung-Box[11], LM (1) and LM (4)[12] tests indicate that there is no serial correlation in the residuals under a 5 percent level of significance.[13]

TABLE 2 Residual Misspecification Tests for VAR Models

Statistic test method	Estimated of statistics	P-value
Ljung-Box	$\chi^2(567) = 606.593$	0.12
LM(1)	$\chi^2(9) = 7.707$	0.56
LM(4)	$\chi^2(9) = 16.554$	0.06

We further test the number of cointergrating vectors. The results in table 3 indicate one cointegrating relationship under a 5 percent level of significance.

TABLE 3 Tests for the Number of Cointegrating Vectors

$H_0 \mid H_1$	Maximum eigenvalue statistics	95% critical value	Trace statistics	95% critical value
$r \le 0 \mid r = 1$	36.31**	25.54	56.32**	42.44
$r \le 1 \mid r = 2$	15.32	18.96	20.00	25.32
$r \le 2 \mid r = 3$	4.68	12.25	4.68	12.25

We confirm that there is one cointegrating vector. This cointegrating relationship after normalization is shown in equation (12).

[10] See Johansen and Juselius (1988, 1990, 1991).
[11] See Ljung and Box (1978).
[12] This study adopts Godfrey's (1978) LM test, which are Lagrange Multiplier tests further modified by Godfrey to test whether there is serial correlation in the VAR model.
[13] Gonzalo (1994) finds that the testing result of cointegration is not affected by whether the residual is a normal distribution. Thus, this study does not test for normality.

$$LN = 0.026 - 2.922s^e + 0.325r \quad (12)$$

The test for cointegrating coefficients is shown in table 4. The relationship between bank loans and the expected exchange rate is significantly negative. However, bank loans and the interest rate is significantly positively related under a 1 percent level significance.

TABLE 4 Coefficient Tests

Variable	Coefficient	Chi-square statistic	p-value
LN	1.000		
constant	0.026	8.41E+18	0.00**
s^e	-2.922	6.84E+23	0.00**
r	0.325	1.88E+24	0.00**

This empirical study shows that a lower interbank overnight call-loan rate could lower bank loans. This empirical result is obviously different from the findings as suggested by most of previous studies on the bank lending channel.

Moreover, when we additionally include the variable of the expected exchange rate, an increase in the expected exchange rate due to an expansionary monetary policy would reduce bank loans at the same time. Previous literature ignored the effects of international capital flows from the anticipated change in the exchange rate on the bank lending channel. However, our model in an open economy framework attempts to catch such an impact, which can provide another interpretation for a decrease in bank loans after an expansionary monetary policy.

3.3 Foreign Assets, the Expected Exchange Rate and the Interest Rate

Table 5 reports the results of residual misspecification tests for VAR models when the lag order is chosen as six. All of Ljung-Box, LM (1) and LM (4) tests indicate that there is no serial correlation in the residuals of the VAR model under a 5 percent level of significance.

TABLE 5 Residual Misspecification Tests for VAR Models

Statistic test method	Estimated of statistics	P-value
Ljung-Box	$\chi^2(90)$=101.482	0.20
LM(1)	$\chi^2(9)$=7.317	0.60
LM(4)	$\chi^2(9)$=14.141	0.12

Table 6 presents the test results for the number of cointergrating vectors. Except for trace statistics, there is only one cointegrating relationship under a 5 percent level

of significance suggested by maximum eigenvalue statistics.

TABLE 6 Tests for the Number of Cointegrating Vectors

$H_0 \mid H_1$	Maximum eigenvalue statistics	95% critical value	Trace statistics	95% critical value
$r \le 0 \mid r = 1$	43.94**	25.54	58.60**	42.44
$r \le 1 \mid r = 2$	8.64	18.96	14.66	25.32
$r \le 2 \mid r = 3$	6.02	12.25	6.02	12.25

This cointegrating relationship after normalization is shown as below:

$$FA = -0.004 + 1.566 s^e - 0.340 r \quad (13)$$

Then we test for cointegrating coefficients. From table 7, we know that the relationship between foreign assets of deposit money banks and the interest rate is significantly negative. However, the relationship between foreign assets and the expected exchange rate is significantly positive.

TABLE 7 Coefficient Tests

Variable	Coefficient	Chi-square statistic	p-value
FA	1.000		
constant	-0.004	6.58E+18	0.00**
s^e	1.566	8.84E+24	0.00**
r	-0.340	7.24E+25	0.00**

Foreign assets increase after a lower interbank overnight call-loan rate by equation (13). Furthermore, an expectation to a depreciation of domestic currency increases leads to an increase in the holding of foreign assets. Such evidences are consistent with the structural setting in equation (7).

3.4 Foreign Debts, the Expected Exchange Rate, and the Interest Rate

Table 8 reports the results of residual misspecification tests for VAR models when the lag order is chosen as eight. All of Ljung-Box, LM (1) and LM (4) tests indicate that there is no serial correlation in the residuals of the VAR model under a 5 percent level of significance.

TABLE 8 Residual Misspecification Tests for VAR Models

Statistic test method	Estimated of statistics	P-value
Ljung-Box	$\chi^2(45)$= 55.956	0.13
LM(1)	$\chi^2(9)$=9.447	0.40
LM(4)	$\chi^2(9)$=12.059	0.21

Table 9 presents the results. The results indicate one cointegrating relationship under a 5 percent level of significance.

TABLE 9 Tests for the Number of Cointegrating Vectors

$H_0 \mid H_1$	Maximum eigenvalue statistics	95% critical value	Trace statistics	95% critical value
$r \le 0 \mid r = 1$	30.73**	25.54	46.38*	42.44
$r \le 1 \mid r = 2$	9.13	18.96	15.65	25.32
$r \le 2 \mid r = 3$	6.52	12.25	6.52	12.25

This cointegrating relationship after normalization is shown in equation (14):

$$FD = 0.09 - 13.532 s^e + 1.655 r \quad (14)$$

Table 10 shows the results of coefficient tests. Foreign debts and the interbank overnight call-loan rate are significantly positively related. The relationship between foreign debts and the expected exchange rate is significantly negative.

TABLE 10 Coefficient Tests

Variable	Coefficient	Chi-square statistic	p-value
FD	1.000		
c	0.09	2.82E+18	0.00**
s^e	-13.532	8.19E+22	0.00**
r	1.655	7.88E+22	0.00**

The story for foreign debts here just goes into an opposite one compared to the change in foreign assets of depository banks. Taking the effect of lower rate and expected depreciation in the domestic currency into account, bank loans of depository

banks decrease after an expansionary monetary policy.

4. Conclusion

The credit channel, in general, or the bank lending channel, in particular, has important implications for the effect and transmission process of monetary policy. This paper examines whether the bank lending channel exists in Taiwan. Differing from the previous literature, this paper studies the effect of the bank lending channel in a framework of an open economy. The theoretical findings in this paper are that the effect of a monetary policy on bank loans is indeterminate. The literature in a closed economy considers securities as the buffers to offset the effect of a monetary policy on bank loans. However, the flows of funds internationally also induce further adjustments in both of foreign assets and foreign debts in bank's balance sheet position. Such adjustments not only can provide buffers for banks to insulate their loan level from monetary disturbance, but also can produce additional counter effects to make the effect of a monetary policy on bank loans ambiguous.

The empirical evidences with aggregate data of depository banks in Taiwan indicate that the effect of the bank lending channel could be fully offset. Under an open-economy framework, we put more structures on estimation. The empirical estimations on the holding of foreign assets and the position of foreign debts indicate that banks respond to a monetary expansion by increasing the holding of foreign assets and decreasing foreign liabilities at the same time. Hence, a bank lending channel is not likely to be an effective monetary transmission mechanism in Taiwan. Further investigation can try the disaggregate data to study the responses from different banks. Besides, the factors for loan demands can be included in the future study too.

References

Bernanke, B. S. and A. S. Blinder (1988), "Credit, Money, and Aggregate Demand," *American Economic Review*, 78, 435-439.

Bernanke, B. S. and A. S. Blinder (1992), "The Federal Funds Rate and the Channels of Monetary Transmission," *American Economic Review*, 82, 901-921.

Bernanke, B. S. and M. Gertler (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission," *Journal of Economic Perspective*, 9, 27-48.

Chen, Y. D. (2000), "A Brief Introduction to the Interest Rate Target Policy and Its Transmission Mechanism of Central Bank of China," *Central Bank of China Quarterly Bulletin*, 22, 81-94. (in Chinese)

Cheng, H. P. (2004), "A Study on the Credit Transmission Mechanism of the Monetary Policy in Taiwan," *Master Thesis, Graduate School of Economics National Cheng Chi University*. (in Chinese)

Chiades, P. and L. Gambacorta (2004), "The Bernanke and Blinder Model in an Open Economy: the Italian Case," *German Economic Review*, 5, 1-34.

Chuang, W. R. and L. L. Cheng (1991), "An Empirical Study on Money, Credit, and Economic Activities in Taiwan," *Bank of Taiwan Quarterly Bulletin*, 42, 188-209. (in Chinese)

Dickey, D.A. and W. A. Fuller (1979) "Distribution of Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, 74, 427-431.

Dickey, D.A. and W. A. Fuller (1981) "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica*, 49, 1057-1072.

Hülsewig, O., P. Winker, and A. Worms (2002), "Bank Lending in the Transmission of Monetary Policy: A VECM Analysis for Germany," *International University in Germany Working Paper*, No. 08.

Godfrey, L. (1978), "Testing against General Autoregressive and Moving Average Error Models When the Regressors Include Lagged Dependent Variables,"

Econometrica, 46, 1293-1302.

Godfrey, L. (1978), "Testing for Higher Order Serial Correlation in Regression Equations When the Regressors Include Lagged Dependent Variables," *Econometrica*, 46, 1303-13102.

Gonzalo, J. (1994), "Five Alternative Methods of Estimating Long-run Equilibrium Relationships," *Journal of Econometrics*, 60, 203-233.

Johansen, S. (1988), "Statistical Analysis of Cointegation Vectors," *Journal of Economic Dynamics and Control*, 12, 231-254.

Johansen, S. and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration-with Applications to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, 52, 169-220.

Johansen, S. (1991), "Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models," *Economitrica*, 59, 1551-1580.

Kakes, J. (2000), "Identifying the Mechanism: Is There A Bank Lending Channel of Monetary Transmission in the Netherlands?" *Applied Economics Letters*,7, 63-67.

Kashyap, A. K. and J. C. Stein (1995), "The Impact of Monetary Policy on Bank Balance Sheets," *Carnegie-Rochester Conference Series on Public Policy*, 42, 151-195.

Kashyap, A. K. and J. C. Stein (2000), "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" *American Economic Review*, 90, 407-428.

Kashyap, A. K., J. C. Stein, and D. W. Wilcox (1993), "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance," *American Economic Review*, 83, 78-98.

Kishan, R. P. and T. P. Opiela (2000), "Bank Size, Bank Capital, and the Bank Lending Channel," *Journal of Money, Credit and Banking*, 32, 121-141.

Lee, R. C. (1989), "The Role of Money and Bank Credit in the Monetary Policy Target-with the Selective Credit Control," *Central Bank of China Quarterly Bulletin*, 11, 55-70. (in Chinese)

Ljung, G. M., and G. E. P. Box (1978), "On a Measure of Lack of Fit in Time Series Models," *Biometrika*, 65, 297-303.

Mishkin, F. S. (1995), “Symposium on the Monetary Transmission Mechanism,” *Journal of Economic Perspective*, 9, 3-10.

Phillips, P. C. B., and P. Perron (1988), “Testing for a Unit Root in Time Series Regression,” *Biometrika*, 75, 335-346.

Pill, H. (1997), “Bank Behaviour and Monetary Policy in a Small Open Economy: the Case of Spain,” *Graduate School of Business Administration Harvard University*.

Sun, S. M. (2005), “A Test for the Banking Lending Channel of Monetary Policy in Taiwan,” *Master Thesis, Graduate School of Economics, National Cheng Chi University*. (in Chinese)

Wang, S. W. (1994), “The Monetary Policy and the Credit Condition: An Empirical Study on Taiwan,” *Master Thesis, Graduate School of Finance Tam Kang University*. (in Chinese)

Wu, C. C. (2005), “Monetary Policy and the Banking Lending Channel in Taiwan,” *Master Thesis, Graduate School of Economics, National Cheng Chi University*. (in Chinese)

Wu, Y. J. (2004), “An Empirical Study on Transmission Mechanisms of Monetary Policy in Taiwan,” *Central Bank of China Quarterly Bulletin*, 26, 33-68. (in Chinese)