The Monetary Transmission Mechanism:

The influence of Policy Instruments and Banks' Liquidity Preference on the Elasticity of the Money Supply Function

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INTRODUCTION

The debate over the monetary transmission mechanism is a topic which has a long history in economics and remains to be one of the most controversial and perplexing issues to this day. In order to gain some insight into this matter, one must examine the roles played by both the monetary authority and the banking system in the determination of the money supply and the structure of interest rates. The quantity theory, revived by Friedman and the monetarists, hinges upon the exogeneity of the money supply, rendering the supply curve vertical. The Post Keynesian movement grew out of a reaction to Monetarism, recognizing the distinction between credit or "bank" money and commodity or "fiat" money, the former being endogenously demand-determined rather than controllable by the monetary authority. However, although all Post Keynesians prescribe to this interpretation of the money supply, there exists two distinct theories regarding the determination of interest rates.

Some Horizontalists such as Rousseas state that banks passively set rates as a stable markup over the "cost of funds", while others such as Lavoie recognize the discretionary powers of banks in determining the markup. Nevertheless, all Horizontalists agree that the central bank exogenously determines the bank rate - the "cost of funds" - rendering the money supply curve horizontal. Specifically, there is thought to be an absence of market forces in the setting of the Bank rate. In contrast, Structuralists such as Wray proclaim that, among other market forces, banks' liquidity preference influences interest rate determination independent of central bank behaviour, yielding an upward-sloping money supply curve.

In order to shed some light upon this issue, three opposing theories of the elasticity of the money supply function; Verticalist, Horizontalist, and Structuralist, shall be delineated. Additionally, the actual monetary policy instruments employed by the Bank of Canada shall be examined in order to determine which of these theories most closely characterizes the reality of Canada's financial system. Cash management - achieved largely via the drawdown-redeposit mechanism - may be a rather deceiving term for the main instrument of monetary policy for it suggests an exogenously determined money supply.

Finally, a series of empirical tests shall be conducted so as to quantitatively substantiate the influence of the monetary authority and the banking system upon interest rates. Specifically, Granger-Sims causality tests will exhibit evidence for or against the Bank of Canada's ability to independently determine the interest rate structure as prescribed by the Horizontalists. Also, the banks' prime lending rate shall be examined empirically. Specifically, the stability of the "markup" of the Prime rate over various interest rates, including the Bank rate, shall be analysed. In addition, an empirical model of the markup of the Prime rate over the Bank rate is developed in order to resolve whether banks' liquidity preference is significant. Finally, the cyclical pattern of banks' liquidity preference is examined in order to provide evidence for or against the influence of "market forces" upon the determination of interest rates. Having completed these empirical tests, it shall be possible to render a tentative conclusion regarding the slope of the money supply function.

THEORETICAL CONTROVERSIES OVER THE MONEY SUPPLY FUNCTION AND INTEREST RATE STRUCTURE

There are numerous points of contention surrounding the issue of money and interest. At the most basic level, a widely accepted definition of "the" money supply and "the" rate of interest remains to be established. An examination of the determinants of the slope of the money supply function encompasses many important aspects of the monetary transmission mechanism, including the interplay between the monetary authorities and the banking system. As such, three conflicting theories of the money supply/interest rate process shall be examined below.

The orthodox Neo-Classical Synthesis is based upon the exogenous supply of money, represented by a vertical curve in interest-money space (Hence the designation Verticalist), with the quantity of money determined solely by the central bank and interest rates set endogenously within the IS/LM framework by the forces of productivity and thrift or portfolio adjustment.[1] Traditionally, the theoretical execution of monetary policy has hinged upon the central bank's direct control over the monetary base and the subsequent stable money multiplier effect on the total supply of money, as expressed by the following well known

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[1]For a detailed explanation of the mainstream theory see D. Laidler, The Golden Age of the Quantity Theory. (Toronto: Philip Allan Press, 1991).

money multiplier relation: $M = H(1+C/D)/(R/D+C/D)$.[2] Here, an increase (decrease) in "high-powered" money leads to an excess (shortfall) of reserves enabling chartered banks to expand (contract) their balance sheets.

However, the conventional implementation of monetary policy which alters the reserve position of the banks through an injection or retraction of high-powered money is quite simply not relevant in Canada. Firstly, in practice, the central bank's monetarist experiment implemented from November, 1975 through November, 1982, was an eventual failure.[3] Notably, this tight money policy did not even follow the "textbook" methodology of controlling the money supply directly via the monetary base, for it was discovered empirically that a stable money multiplier did not exist for Canada.[4] Instead, it entailed curbing the demand for money via interest rate targeting in an attempt to restrain the money supply indirectly:

> ...the key operating procedure for the Bank continued to be that of producing short-term interest rate consistent with desired trends

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[2]where, H = "high-powered" money, C = currency, D = bank deposits, and R = reserves.

[3]Notably, there are several explanations as to why the Bank failed to meet its target for M1. See P. Howitt, Monetary Policy in Transition. C.D. Howe Institute, (Scarborough: Prentice-Hall, 1986) for a thorough discussion of the issues.

[4]See G. Sparks, "The Theory and Practice of Monetary Policy in Canada: 1945-1983", in J. Sargent, Fiscal and Monetary Policy. (Toronto: University of Toronto Press, 1986). Notably, the "Fed" in the U.S. did attempt to restrain monetary expansion directly by targeting non-borrowed reserves. However, this policy too was eventually abandoned.

> in the rate of growth of the money supply (M1)...[5]

In order to determine the Monetary authorities' ability to exogenously control the money supply, one has only to observe the course of monetary aggregates during this monetarist experiment in which the Bank of Canada targeted M1. From Figure 1 (p.7) which depicts various monetary aggregates for the period 1968 to 1994, it is clear that in the late 1970s and early 1980s, there was an explosion of the more broad aggregates such as M2 and M3.[6] Thus, the definition of money became an intractable problem as the Canadian monetary authorities began to face a situation well known to the advocates of the Banking School in the nineteenth century, in which the "...restrictive control of one narrow group of monetary aggregates (ie. M1) leads to an endogenous expansion of other forms of less liquid and highly interest-bearing financial instruments."[7] Thus, "Goodhart's law" prevailed, which states that an observed empirical relationship will break down as soon as the government attempts to utilize it for control

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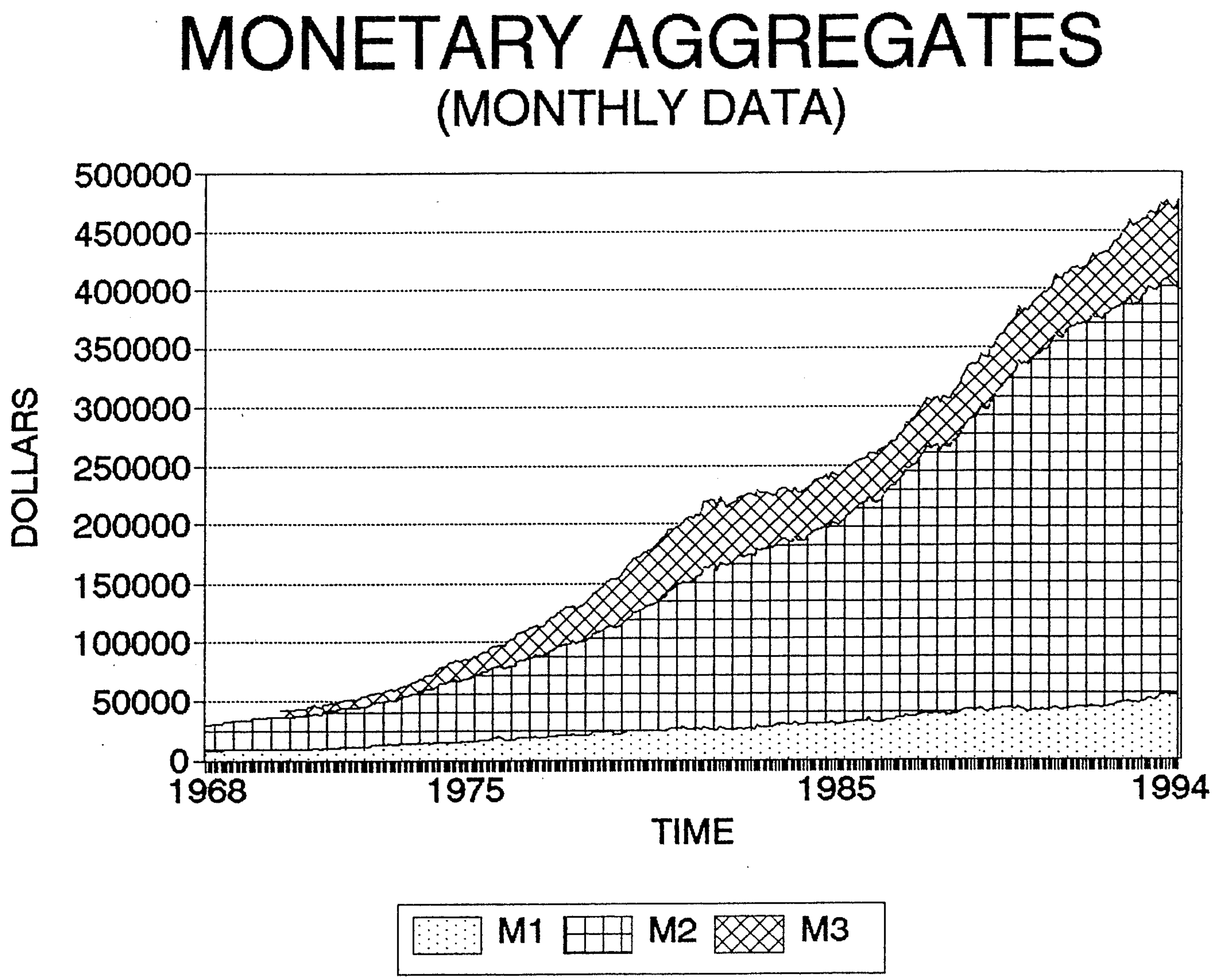
[5]G. Boreham and R. Bodkin, <u>Money, Banking and Finance: The Canadian Context</u>. Fourth Edition, (Toronto: Dryden Canada, 1993), p. 472.

[6]For a more detailed analysis of the endogeneity of broad monetary aggregates see, P. Aretis, "The credit segment of a UK post Keynesian model", <u>Journal of Post Keynesian Economics</u>. Vol. X, No. 2, Winter, 1987-88, pp. 250-269.

[7]Mario Seccareccia, "System Viability and Credit Crunches: An Examination of Recent Canadian Cyclical Fluctuations", <u>Journal of Economic Issues</u>. Vol. 22, No. 1, March, 1988, p. 62.

FIGURE 1[8]



[8]Source: CANSIM time series data:
M1-B2033
M2-B2031
M3-B2041

purposes.[9]

Moreover, successive financial innovations have led to an increasingly nebulous definition of money, furthering the banking system's independence from the Bank of Canada through the practice of "liability management".[10] The development of the wholesale market with such instruments as Certificates of Deposits (CDs) precludes the exogeneity of the money supply. Here, a financial institution can finance its lending, not from available excess reserves or an inflow of retail deposits, but rather by securing wholesale funds from the market by issuing CDs. This clearly impairs the monetary authorities control over the money supply and the expansion of banks' balance sheets through the use of the monetary base: "Banks' access to alternative sources of funds...causes monetary policy to have little direct impact on bank lending."[11] Accordingly, banks do not wait idly by for the central bank to create excess reserves in order to expand their loans as the conventional theory would have it. Instead, "[b]anks are essentially in the business of [actively] selling credit...[m]oney is created as a by-product of new loans granted by depository institutions. *Loans make*

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[9]B.J. Moore, Horizontalists and Verticalists, The Macroeconomics of Credit Money. (Cambridge: University of Cambridge Press, 1988), p. 86.

[10]See C. Freedman, "Financial Innovations in Canada: Causes and Consequences", American Economic Review, Papers and Proceedings. Vol. 73, No. 2, May, 1983.

[11]C. Romer and D. Romer, "New Evidence on the Monetary Transmission Mechanism", Brookings Papers on Economic Activity. Vol. 1, 1990, p. 198.

Deposits."[12] This fact is most evident, according to Moore and other Horizontalists, when one considers the substantial amount of unused lines of credit or "overdrafts" that have been negotiated by private agents at financial institutions. The exercising of these off-balance sheet items is completely demand-determined - the banks most certainly do not wait for a deposit or an injection of high-powered money.

Additionally, the recent elimination of the minimum reserve requirements for members of the Canadian Payments Association (CPA) renders the conventional implementation of the exogenous money supply impossible.[13] As such, the orthodox Verticalist theory of an exogenously determined supply of money is essentially a non-starter in light of today's complex financial system. Whereas textbooks of money and banking continue to relate the aggregate balance sheet of banks mechanically to the amount to cash via a fractional reserve ratio, "...bankers themselves lay stress on capital requirements. Ultimately, the link between equity and assets governs the size of the balance sheet, and bank management must earn for shareholders a return on equity employed commensurate with that in other industries."[14] Nevertheless, as shall be exemplified, the Bank of Canada

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[12]Moore (1988), p. 46.

[13]See The Bank of Canada, "The Implementation of Monetary Policy in a System of Zero Reserve Requirements", Discussion Paper No.3, May, 1991.

[14]M.K. Lewis, "Balance sheets of financial intermediaries", in The New Palgrave Dictionary of Money and Finance. p. 122.

maintains control over nominal magnitudes, mainly through the use of "cash management" via the drawdown/redeposit mechanism, with which it can influence the entire banking system.

An alternative Horizontalist approach to the monetary transmission mechanism, developed by Post-Keynesians such as Kaldor, Moore, and Lavoie, asserts that money is endogenous and therefore its supply curve is "...horizontal in interest-money space, and the quantity supplied is endogenously credit-driven and demand-determined."[15] This theory implies that,

> [i]n normal times commercial banks are ready to provide all loans, and central banks are ready to provide all reserves or advances which are demanded at the existing rate...[16]

Here, loans provided by the banking system represent a creation of credit money, which is analogous to the monetary authority's creation of high-powered money.

The base interest rate - the bank rate - is postulated to be exogenously set by the monetary authorities which determines the rate at which it lends funds to financial institutions. Although the central bank can influence interest rates generally, it is much less able to affect the formation of monetary assets selectively. Thus, as Horizontalists proclaim, "[i]n reality, the more exogenous, or policy-determined, variable is the change in interest rates, while both the monetary base and monetary

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[15]B.J. Moore (1988), p. 46.

[16]Marc Lavoie, Foundations of Post-Keynesian Economic Analysis. (Aldershot: Edward Elgar Press, 1992), p. 71.

aggregates are endogenous variables."[17] Hence, the power of the central bank is diminished to that of a price setter and a quantity taker:

> Central bank practitioners, almost always, view themselves as unable to deny the banks the reserve base that the banking system requires, and see themselves as setting the level of interest rates, at which reserves are met...[18]

This Horizontalist view of endogenous money suggests that the central bank must fully accommodate the reserve requirements of the banking system in order to fulfil its role as the lender of last resort, thereby ensuring the stability of the financial system.

Furthermore, banks are thought to be price takers and quantity setters in the wholesale market and price setters and quantity takers in the retail loan market.[19] According to the Horizontalists,

> ...the focus is on bank lending, or the asset side of the balance sheet. The liability side is seen as causally reacting to changes on the asset side. Portfolio theory is therefore downplayed and a Kaleckian approach to the banking industry becomes possible.[20]

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[17]C. Goodhart, "Monetarism", in J. Eatwell, M. Milgate, and P. Newman, The New Palgrave: a dictionary of economics. (New York: Stockton Press, 1990), p.729.

[18]Marc Lavoie (1992), p. 179.

[19]B.J. Moore (1988), p. 226.

[20]S. Rousseas, "A Markup Theory of Bank Loan Rates", Journal of Post Keynesian Economics. Vol. 8, No. 1, Fall, 1985, p. 135.

Consequently, the interest rates on loans are determined by a markup over the "cost of funds" determined by the degree of monopoly power or the profit margin of the bank. Thus, a markup theory of bank loan rates rejects the demand-supply analysis of competitive market behaviour.[21] More generally, Horizontalists suggest that the notion of a market-clearing equilibrium interest rate, whether in the productivity-thrift theory, the Keynesian IS-LM approach, or a market-determined short-run rate "...is a theoretical fiction used to provide determinate theoretical solutions within arcane models bearing no relation to the real world."[22] However, perhaps some Post Keynesian Horizontalists are subject to the same criticism.

A third alternative to the monetary transmission mechanism asserts that the money supply curve is neither vertical nor horizontal, but rather is upward sloping in interest-money space. In fact, there are two separate but related camps that prescribe to this notion, both of which support the endogeneity of the money supply. The Structuralists, such as Rousseas suggest that the central bank does not fully accommodate the banking system's required liquidity due to other priorities such as control over

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[21]For a comprehensive survey of mainstream models of the banking firm, see E. Baltensperger, "Alternative Approaches to the Theory of the Banking Firm", <u>Journal of Monetary Economics</u>. Vol. 6, 1980, pp. 1-37.

[22]S. Rousseas, <u>Post Keynesian Monetary Economics</u>. (Ann Arbor: Malloy Lithographing, 1986), p. 60.

inflationary and exchange rate pressures.[23] Wray, on the other hand, incorporates the importance of Keynesian liquidity preference theory directly into a theory of endogenous money.

Firstly, consistent with the Structuralists, it would appear that, in reality, the Bank of Canada does not fully accommodate the banking systems demand for liquidity. Advances from the Bank of Canada are subject to the constraints stipulated under the Rules Governing Advances to Financial Institutions:

> While the Bank of Canada is conscious of its responsibility as the lender of last resort, it expects potential borrowers to make every effort to adjust their cash positions through the money market and to use their lines of credit at the central bank sparingly.[24]

Moreover, it does not seem plausible that banks set their loan rates and, subsequently, supply an unlimited amount of credit to customers. Contrary to Moore's assertion, the existence of substantial off-balance sheet items such as unused lines of credit does not necessitate that the demand for credit be fully satiated, rendering the supply endogenously demand-determined. The more plausible scenario is that some borrowers' demands are not met as credit is rationed by the banks in order to minimize default risk:

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[23]S. Rousseas (1986), p. 98.

[24]Kevin Clinton, "Bank of Canada Cash Management: the main technique for implementing monetary policy", Bank of Canada Review., January, 1991, pp. 16-7.

> The usual explanation for credit rationing is that if interest rates were set to satisfy all demands for loans it would increase the probability of default, in the absence of very good information about the borrowers. This is perfectly consistent with under-utilised lines of credit...[5]

Furthermore, there is no theoretical basis for Moore's stipulation that banks must be either price or quantity setters. Instead, Arestis and Chick (1992) have recognized that, "[i]n financial markets, credit rationing is clearly observed to take place.[26] This suggests that banks are both price setters and quantity setters."[27]

Additionally, contrary to what some Post-Keynesian authors assert, the central bank may not exogenously determine the interest rate structure. Instead, some economists hold that market rates of interest are "...established through a complex set of interactions between market forces - especially the market for long run finances - [as well as] the monetary authorities policy interventions."[28] Excessive restrictions imposed by the monetary authorities may lead to liability management and

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[25]P. Arestis and V. Chick, Recent Developments in Post-Keynesian Economics. (Aldershot: Edward Elgar Publishing, 1992), p. 54.

[26]For empirical evidence of the existence of credit-rationing in the U.S., see J. McCallum, "Credit rationing and the monetary transmission mechanism", American Economic Review. Vol. 81, No. 4, September, 1991, pp. 946-51.

[27]Arestis and Chick (1992), p. 53.

[28]Robert Pollin, "Two Theories of Money Supply Endogeneity: Some Empirical Evidence", Journal of Post Keynesian Economics. Spring, 1991, Vol. 13, No. 3, p. 391.

circumventive financial innovations within the banking system in search for the required liquidity:[29]

> liquidity in modern economies does weaken the Quantity Theory...In the face of monetary stringency, transactors can sustain spending flows by reshuffling asset portfolios. Some part of this reshuffling will provide financial intermediaries with increased lending powers...In Quantity Theory language, money is in quite elastic supply, the velocity of circulation is volatile enough to offset monetary restriction...[30]

Structuralists proclaim that such liability management by financial institutions causes portfolio shifts which exert upward pressure on interest rates:

> This is because changes in M [the money supply] cannot be treated as a homogeneous mass. It must be recognized rather that it is the composite flow of various types of money in the financial system. The value of a change in M is but the sum of changes of numerous commercial and central bank liabilities, including the changes in the volume of high-powered money...[31]

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[29]For a thorough discussion on the topic of circumventive financial innovations within the banking system, see T.M. Podolski, "Control of a Monetary Quantity: Constraint or Contumacy", British Review of Economic Issues. Vol. 7, No. 17, Autumn, 1985.

[30]A.B. Cramp, "Liquidity", in J. Eatwell, M. Mulgate, and P. Newman, The New Palgrave: a Dictionary of Money and Finance., 1992, p. 594.

[31]Seccareccia (1988), p. 56.

Thus, it is through liability management on the part of commercial banks that changes occur in the composition of the money supply which exerts upward pressure on interest rates.

Consequently, "...a tightening of monetary policy may have strong effects on the real sector when credit is tight but weak effects when credit is initially plentiful."[32] The resulting money supply function is a segmented or stepwise upward sloping function.[33] This Structuralist theory suggests that commercial banks do not passively set interest rates as a markup over the bank rate, but rather, financial markets as well as the composition of banks' balance sheets exert a degree of influence upon the interest rate structure.

> We must recognize that much, perhaps the bulk, of private-sector debt will be owed to financial institutions, so that the picture is seriously incomplete unless we incorporate some notion, however simplified, of the conditions on which financial institutions will lend, and in particular of the elasticity of supply of credit - in response to changes in demand for credit, and in interest rates.[34]

Portfolio shifts in banks' balance sheets are clearly linked to liquidity preference, which leads to the second theory developed by Wray which supports an upward-sloping money supply function.

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[32]McCallum (1991), p. 946.

[33]Seccareccia (1988), p. 57.

[34]A.B. Cramp (1992), p. 593.

Wray founded a second adaptation of an upward sloping money supply curve which explicitly incorporates Keynesian liquidity preference into the theory of endogenous money.[35] Notably, the adoption of an endogenous credit theory by many Post Keynesians often precludes the significance of liquidity preference. This, according to some economists, is due to an unduly narrow interpretation of liquidity preference:

> The apparent rejection of liquidity preference theory is understandable if 'liquidity preference' refers to the demand for non-interest bearing money only...This narrow notion of liquidity preference is not of much interest, since money as a store of value falls outside its scope. In addition, if it is observed that the monetary authorities can, and normally do, set short-term rates in any case, the liquidity preference theory of interest becomes irrelevant.[36]

However, Dow and Dow assert that in practice, liquidity preference determines the difference between the interest rate on liquid deposits and on less liquid substitutes. The monetary authorities are thought to set the rate at the short-term end of the spectrum with liquidity preference determining the mark-up to

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[35]See L.R. Wray, "Alternative Theories of the Rate of Interest", Cambridge Journal of Economics. Vol. 16, No. 1, March, 1992. In fact, Wray's theory is based upon a much earlier article by K.E. Boulding, "A Liquidity Preference Theory of Market Prices", Economica. Vol. 11, May, 1944, pp. 55-63.

[36]A. Dow and S. Dow, "Endogenous Money Creation and Idle Balances", in J. Pheby, New Directions in Post-Keynesian Economics. (Aldershot: Edward Elgar Publishing, 1989), p. 148.

long-term rates.[37] Indeed the liquidity preference concept can be expressed in its broadest form as "...a desire to hold short-versus long-term assets"[38]

According to Wray and others, Moore's rejection of Keynes' liquidity preference theory seems to be due to a confusion regarding the distinctions between liquidity and money and between money demand and liquidity preference. Wray clearly distinguishes the concepts of money demand and liquidity preference, defining money demand as "a willingness to issue debt to finance spending,"[39] while liquidity preference is "a desire to exchange illiquid items on a balance sheet for more liquid items, or even decrease the size of the balance sheet by retiring debt."[40] Thus, rising money demand may normally be met by rising money supply, but rising liquidity preference will not induce an increase in the money supply if balance sheets matter to banks.[41] As Seccareccia points out, "[t]he usual Kaldorian [Horizontalist] Hypothesis of an infinite elasticity of money supply appears to mix the endogeneity of the money stock with passivity on the part

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[37]Dow and Dow (1989), p. 149.

[38]Tracey Mott, "Towards a Post-Keynesian Formulation of Liquidity Preference", Journal of Post Keynesian Economics. Vol. VIII, No. 2, 1985-86, p. 222.

[39]L.R. Wray, Money and Credit in Capitalist Economies: The Endogenous Money Approach. (Aldershot: Edward Elgar Publishing, 1990), p. 164.

[40]Ibid., p. 164.

[41]Ibid., p. 165.

of the commercial banking institutions."[42] So, Wray argues that, even if money supply always rises to meet money demand, this does not mean that liquidity preference cannot go into the determination of interest rates.[43] Keynes himself recognized the important role which banks' liquidity preference plays in the determination of interest rates:

> ...one could regard the rate of interest as being determined by the interplay of the terms on which the public desires to become more or less liquid and those on which the banking system is ready to become more or less liquid.[44]

Thus, in practice, Wray suggests that "...the supply of credit and liquidity preference are interdependent, in such a way that the supply of credit is by no means fully accommodating."[45] When liquidity preference is low, banks meet the demand for credit by expanding their balance sheets. As liquidity preference rises, banks become increasingly unwilling to meet the demand for credit, so that credit rationing replaces accommodative behaviour: "[t]he overall picture, then, is of credit creation accommodating demand when liquidity preference is

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[42]Seccareccia (1988), p. 58.

[43]L.R. Wray, "Endogenous Money and a Liquidity Preference Theory of Asset Prices", Review of Radical Political Economics. Vol. 23, No. 1, 1991, p. 82.

[44]J.M. Keynes, The Collected Writings of John Maynard Keynes. (London: MacMillan, St. Martin's Press, 1971), p. 219.

[45]Wray, (1990 b), p. 167.

low, but not when liquidity preference is high."[46] In short, Wray asserts that "...it is liquidity preference which determines interest rates, and not money demand."[47] Consequently, the money supply curve is upward-sloping relative to interest rates in the absence of financial innovations even though there is no strict quantity constraint on bank lending.

Expanding bank balance sheets may affect an individual bank's perceptions of risk. As a bank provides more and more credit it leverages equity and cash assets.

> Innovations and/or revisions of commonly accepted views regarding appropriate levels of leverage allow banks to expand financial portfolios without raising interest rates. Eventually, however, financial institutions will come up against the maximum 'prudent' leverage ratio which will lead to a rise in the liquidity premium.[48]

Hence, an expansion of bank balance sheets may affect interest rates precisely because banks are concerned with their balance sheet position. Thus, Wray argues that the Horizontalists such as Moore and Lavoie "...must make the further argument that all agents [including banks] are indifferent as to their liquidity and asset ratios [or that there is some] institution with the

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[46]Dow and Dow (1989), p. 154.

[47]Wray (1990 b), p. 165.

[48]Wray (1990 b), p. 166.

ability to create liquidity on demand and always stands ready to buy assets in sufficient quantities to peg all asset prices."[49]

However, Lavoie, a staunch Horizontalist, has recently clarified the distinction between proponents of the upward-sloping versus the horizontal supply curve:

> [i]n the special case where the central bank is leaning against the wind, there will be a set of temporally-ordered horizontal lines which, when money demand is taken into consideration, will seem to constitute a positively-sloped money supply curve. The upward-sloping curve is thus a special case, based on a particular feedback rule, of the more general horizontal depiction.[50]

In fact, as Lavoie has recently argued, the significance of banks' liquidity preference is consistent with the Horizontalist position:

> ...liquidity preference determines the differential between the base rate and all other rates. Looking more specifically at the liquidity preference of banks, it could be argued that is measured by the differential between the base rate and the prime lending rate.[51]

Thus, Lavoie argues that while the significance of banks' liquidity preference disproves Rousseas' theory of a stable markup, it does not refute the Horizontalist position. Instead,

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[49]Wray (1992), p. 82.

[50]Marc Lavoie, "Horizontalism, Liquidity Preference and the Principle of Increasing Risk", University of Ottawa, forthcoming paper, December, 1994, p. 8.

[51]Ibid., p. 22.

Lavoie, employing Kalecki's principle of increasing risk, suggests that while increasing loan to deposit ratios may force a single bank to increase rates, this may not be the case for the entire banking system. He feels that in order to prove that the money supply function is not infinitely elastic - horizontal - it must be shown that the aggregate loan/deposit ratio of banks moves pro-cyclically:

> [if] one assumes further that increases in economic activity always lead to more illiquid balance sheets, then the upward-sloping credit-money supply curve would be demonstrated on those grounds.[52]

Lavoie is quite correct in stating that the Horizontalist position has been oversimplified by the "less radical" Post Keynesians such as Chick and Wray.[53] An examination of the actual implementation of monetary policy within Canada shall provide further insight into the determination of the money supply and the structure of interest rates as well as which theory most closely characterizes the reality of Canada's financial system.

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[52]Lavoie (1994), p. 18.

[53]Interview, Marc Lavoie, the University of Ottawa, Dec. 10, 1994.

THE DRAWDOWN/REDEPOSIT MECHANISM: THE ACTUAL POLICY INSTRUMENT

In practice, while it is clear that the Bank of Canada does not use the monetary base as a policy instrument, it only occasionally employs open market operations to affect the Bank rate:

> The Bank therefore uses open market operation not to control the supply of cash [as the conventional theory suggests], but as a support instrument on occasions when a specific effect on the structure of rates is sought.[54]

The Bank might employ open-market operations to offset any undesired rate movement caused by an inappropriate settlement balance or to give a direct signal of the Bank of Canada's operating objectives. Specifically, "Special Purchase and resale Agreements (SPRAs) and the reverse, Sale and Repurchase Agreements (SRAs), are used to ease or constrain over-night funding respectively."[55] Additionally, to influence longer term rates, the Bank sells or purchases three-month t-bills.

The main policy instrument that the Bank of Canada uses on a continual basis is cash management via the drawdown/redeposit mechanism. Notably, the term "cash management" is somewhat deceiving in that it implies that the money supply itself is

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[54]Kevin Clinton (1991), p. 5.

[55]K. Clinton and D. Howard, "From Monetary Policy Instruments to Administered Interest Rates: The Transmission Mechanism in Canada", Bank of Canada Technical Report No. 69., June, 1994, p. 7.

under direct control.[56] However, under such a scheme, the supply of money is indeed endogenous, as is explicitly recognized by the Bank of Canada:

> *Advances to direct clearers* are extended to meet any shortages...or to maintain bank cash reserves at the minimum statutory level...and *withdrawals of bank notes* from the central bank are made as needed by the clearing institutions.[57]

In fact, it would seem that even narrow monetary aggregates such as M1 are endogenous and not merely the more broad aggregates such as M2 or M3 which include bank deposits. Thus, under the present system, not only is credit money endogenous, but fiat money or *Advances to direct clearers and withdrawals of bank notes* are also demand-determined.

This reality is, unfortunately, in sharp contrast with the theoretical basis both of many economists' models, and also of their teaching:

> The fact that it is commonplace to find economists treating the monetary base and/or the money stock as exogenously determined in their models does not mitigate the error, the

[56]For instance, D. Laidler's recent analysis of Canadian monetary policy incorrectly interprets the term "cash management" in this manner. See D. Laidler and W. Robinson, The Great Canadian Disinflation: The Economics and Politics of Monetary Policy in Canada, 1988-93. C.D. Howe Institute, Policy Study No. 19, December, 1993.

[57]Clinton (1991), p. 7.

> fact is that this approach is simply incorrect.[58]

Nevertheless, it is also explicitly recognized that the "availability of advances does not in any serious way loosen the influence of the cash setting over monetary conditions."[59]

This mechanism, according to the Bank of Canada, is "[T]he institutional arrangement that will ensure the Bank of Canada's continued ability to influence the course of short-term interest rates."[60] The fact that direct clearers in the banking system (members of the CPA) must settle on the books of the Bank of Canada ensures that the central bank maintains a certain extent of control over the system.[61] Specifically, via the drawdown/redeposit mechanism which employs Receiver-General demand deposits, the central bank can alter the amount of settlement balances of the direct clearers in aggregate relative to the amount that they wish to hold at existing interest rates. For instance, in order to move the overnight rate higher, the Bank will provide a lower level of settlement balances than the

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[58]Goodhart (1990), p. 729.

[59]Clinton and Howard (1994), p. 8.

[60]Clinton and Howard (1994), p. 1.

[61]In fact, the Bank of Canada would still maintain control even under the weaker "Free Banking" scenario in which both financial institutions used an autonomous clearing house, as long as the central bank was also a member of this mechanism, for it could still force the banking system as a whole into a negative settlement position. See Fischer Black, "Banking and Interest Rates in a World Without Money", Journal of Bank Research. Vol. 1, Autumn, 1970.

level demanded by the direct clearers. The direct clearers will attempt to cover the shortfall through such means as "...bidding higher rates for deposits, selling liquid assets such as treasury bills, or calling back loans against money market inventory from investment dealers,"[62] thereby putting upward pressure on the overnight rate.

This upward pressure on one-day interest rates in turn affects the whole maturity structure of interest rates.[63] Movements in overnight rates influence "the whole spectrum of market and administered interest rates and rates of return on a wide variety of assets and liabilities."[64] Treasury bill yields are heavily influenced by overnight borrowing costs as investment dealers and banks finance their trading inventories of bills largely with overnight money. In turn, market arbitrage ensures

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[62]Clinton and Howard (1994), p. 3.

[63]David Longworth and Patrice Muller, "Implementation of Monetary Policy in Canada with Same-Day Settlement: Issues and Alternatives". Bank of Canada Working Paper 91-3, August, 1991, pp. 6-7.

[64]John Crow, "The Work of Canadian Monetary Policy", Bank of Canada Review. Feb. 1988, p. 15. Notably, the transmission mechanism from monetary policy instruments to output stems from the Bank of Canada's influence over interest rates, not money, as the Quantity Theory suggests. Changes in interest rates and the cost of capital in turn lead, with a lag, to changes in expenditures on interest-sensitive goods and services, most notably new housing, fixed capital investment, and consumer durable goods. Movements in short-term interest rates can also influence the exchange value of the Canadian dollar. This affects, again with a lag, expenditures on exports, imports, and import-competing goods and services. However, the analysis in this paper focusses exclusively upon interest rate determination and the money supply process, and does not extend to the final influence upon aggregate demand.

a close link between bill rates and other short-term yields, including those on term deposits at financial intermediaries. Therefore, administered rates, such as the banks' prime loan rate, which are to a large extent determined by term deposit costs, also respond over time to significant changes in the level of overnight rates.[65] Thus, the central bank plays upon the relative price of banking services in order to expand or contract the total level of banking intermediation.[66]

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[65]Clinton and Howard (1994), p. 15.

[66]Clinton and Howard (1994), p. 15.

PREVIOUS STUDIES AND THEIR RELEVANCE TO THE CANADIAN ECONOMY

In order to examine the slope of the money supply function empirically, one must determine the relative influence of both the monetary authority and the chartered banks on the determination of interest rates. That is, if the central bank exogenously sets the interest rate structure, this lends support to the Horizontalists. However, if market forces - including banks' liquidity preference - are significant in determining interest rates, the money supply function may be upward-sloping, suggesting that the demand for money (credit) is not fully satiated, consistent with the Structuralists. However, in order to conclude that the money supply function is not infinitely elastic, one must make the further observation that banks' liquidity preference is pro-cyclical.

If the Bank of Canada has exogenous control over interest rates, then one would expect to find only one way causality running from the bank rate to various "market" rates of interest. In order to test this theory, Pollin conducted a series of Granger-Sims causality tests upon interest rates to discover if a degree of dual-causality exists in the U.S. The results of the tests for Canada which use monthly data from April, 1980 through May 1994 are provided in Table 1 (p. 29).

It is clear from the table that a high degree a dual causality exists between the bank rate and various market rates. These results, according to Pollin, are consistent with the notion that liability management practices exert upward pressure on interest rates while market innovations may counteract the upward interest rate pressure-in other words, that market behaviour will influence interest rates independent of Federal Reserve [or Bank of Canada] policy...[67]

TABLE 1: GRANGER-SIMS CAUSALITY TESTS

Dependent Variable	Explanatory Variables: Sum of lags[68]	Explanatory Variables: Sum of leads[69]	R^2	D-W
Bank rate	= 0.596 90-DAY PCP (16.64)[70]	+ 0.406 90-DAY PCP (11.31)	0.9771	2.2345
90-DAY PCP	= 0.426 BANKR (10.36)	+ 0.573 BANKR (13.92)	0.9723	3.0149
Bank rate	= 0.448 90-DAY CD (6.888)	+ 0.578 90-DAY CD (8.881)	0.9181	0.7985
90-DAY CD	= 0.567 BANKR (8.298)	+ 0.406 BANKR (5.937)	0.9315	0.9870
Bank rate	= 0.616 90-DAY BA (17.15)	+ 0.388 90-DAY BA (10.80)	0.9775	2.2552
90-DAY BA	= 0.409 BANKR (10.16)	+ 0.587 BANKR (14.55)	0.9739	2.9847
Bank rate	= 0.399 OVERNIGHT (8.950)	+ 0.609 OVERNIGHT (13.66)	0.9490	1.0818
OVERNIGHT	= 0.639 BANKR (10.55)	+ 0.355 BANKR (5.848)	0.9442	1.3320
Bank rate	= 0.364 PRIME (6.222)	+ 0.595 PRIME (10.17)	0.9579	1.1007
PRIME	= 0.631 BANKR (13.18)	+ 0.413 BANKR (8.631)	0.9571	1.4756

[67] Pollin (1991), p. 377.

[68] The SUM of the LAGS is simply an exponentially weighted summation of twelve lagged explanatory variables, (ie. $wX_{t-1} + w^2X_{t-2} + w^3X_{t-3} \ldots + w^{12}X_{t-12}$), where W=0.5 and X_{t-n} is the explanatory variable "n" periods in the past. Here, "n" is arbitrarily chosen as 12 because monthly data is employed. Also, an exponential weight is used in order to place progressively less influence on lagged rates.

[69] Similarly, the Sum of Leads is equal to the following: ($wX_{t+1} + w^2X_{t+2} + w^3X_{t+3} \ldots + w^{12}X_{t+12}$), where w=0.5 and X_{t+n} is the explanatory variable "n" periods ahead.

[70] Figures in parenthesis are the T-Statistics.

Table 1 (continued)

Bank rate	= 0.325 GOV.3-5 (3.186)	+ 0.676 GOV.3-5 (6.621)	0.8913	0.4345
GOV.3-5	= 0.621 BANKR (8.022)	+ 0.377 BANKR (4.872)	0.8477	0.4432
Bank rate	= 0.177 GOV.10+ (0.177)	+ 0.811 GOV.10+ (3.660)	0.6929	0.1606
GOV.10+	= 0.691 BANKR (5.207)	+ 0.317 BANKR (2.384)	0.3243	0.1613

In fact, contrary to the Post-Keynesian Horizontalist theory, market forces exert significant influence over the bank rate as exemplified by the generally high T-Statistics. All explanatory variables are significant at the 5% level with the exception of the Sum of Lags of the 10 Year and over Government Bonds (GOV.10+) on the Bank rate.[71] Notably, the regressions for both Government 3-5 year and 10+ year Bonds have a substantially poorer fit than do the regressions using rates of shorter terms.[72] This is an indication that the central bank has less influence over long versus short term securities. Consequently, it would appear that "...the Bank and the Government cannot dictate interest rates apart from national and international money-market trends."[73]

However, one must recognize that the formulation of expectations plays an integral role in determining interest rates. Thus, it is difficult to resolve in practice which rate is the causal factor, even if a particular rate of interest "led"

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[71]The critical value of the T-Statistic at the 5% significance level with 146 degrees of freedom is 1.645.

[72]This fact is based upon the much lower R^2 and D-W values.

[73]Boreham and Bodkin (1993), p. 227.

another in the Granger sense. Therefore, to the extent that the monetary authorities influence expectations, it may be that "[t]he financial markets set the Bank rate where the Bank of Canada wants it."[74] Nevertheless, these causality tests, although not definitive, certainly provide some evidence against the Horizontalist position that the monetary authorities exogenously determine the interest rate structure.

Additionally, the influence of the banking system upon interest rates must be examined in order to determine its impact upon the elasticity of the money supply function. Specifically, it must be determined whether banks set their rates as a markup over the cost of funds, as suggested by the Horizontalists, or if such factors as liquidity preference are significant. The banks' lending rate has been widely interpreted in the past:

> [t]o Mill the interest rate in the market is the rate that will equalize the demand for loans with the supply for them...To Wicksell, the market rate on actual loans is a price that depends on the momentary excess or scarcity of money. [Ohlin suggested that] the pricing process is not amenable to demand-and-supply-curve analysis. For those loans, the rates of interest are fixed by the lenders.[75]

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[74]Boreham and Bodkin (1993), p. 227.

[75]W.M. Brown, Bank Lending to Business Borrowers: Interest Rates and U.S. Monetary Policy. (Boulder: Westview Press, 1992), p. 144. For a mainstream application of bank markup theory based on such factors as the degree of bank management risk aversion, the market structure in which the bank operates, the average size of bank transactions, and the variance of interest rates, see T. Ho, and A. Saunders, "The Determinants of Bank Interest Margins: Theory and Empirical Evidence", Journal of Financial and Quantitative Analysis. Vol. XVI, No. 4, November, 1981, pp. 581-

Some Horizontalists state that the banks' lending rate is set passively as a markup over the cost of funds. For instance, Rousseas proxies the markup as the difference between the Prime lending rate and the Federal Funds rate and proports that this markup "can be taken to be relatively stable."[76] Specifically,

> The markup equation...for commercial banks is i = k(u), where i is the interest rate on loans, k the degree of monopoly or market power...and u the unit prime or variable costs incurred by banks.[77]

However, there are many simplifications in Rousseas' markup model, rendering it unrealistic.

Firstly, Laudadio examines the markup on small versus large loans in the U.S. and concludes that,

> [t]he apparent stability of the margin between the prime rate and the federal rate cannot be used to support the view that oligopolistic behaviour characterizes the market for large loans. It is likely, on the contrary, that this market...is a very competitive one.[78]

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[76]Rousseas (1985), p. 142.

[77]Ibid., p. 136.

[78]L. Laudadio, "Commercial banks: market structure and short-term interest rates", Journal of Post Keynesian Economics. Vol. IX, No. 4, Summer, 1987, p. 640.

The flexibility of interest rate in the market for large loans stands in sharp contrast to the sluggishness of rate adjustment in the market for small loans.[79]

Moreover, Rousseas states that the markup on bank loans is fairly stable in the U.S. An analogous markup for Canada is the Prime over the Bank rate. From the plot of this markup displayed in figure 2 (p. 34), one can see that after March, 1980, when the Bank of Canada fixed the Bank rate at 25 basis points above the 91-day Treasury Bill rate, the markup has been quite volatile. Furthermore, TABLE 2 (p. 35) presents the means and standard deviation of the spread or markup between the Prime and various market rates. Notably, the means of all spreads have declined during recent years, probably due to the more rapid adjustment of the Prime rate. However, the standard deviations, while declining slightly, have remained quite high for the most part, ranging from a low of 39 basis points to a high of 56 from January, 1990 through May, 1994.

Notably, a recent study at the Bank of Canada found that the spread of the Prime over the Bank rate is non-stationary, containing a unit root. As such, unit root tests shall be performed on the various markups studied here in order to

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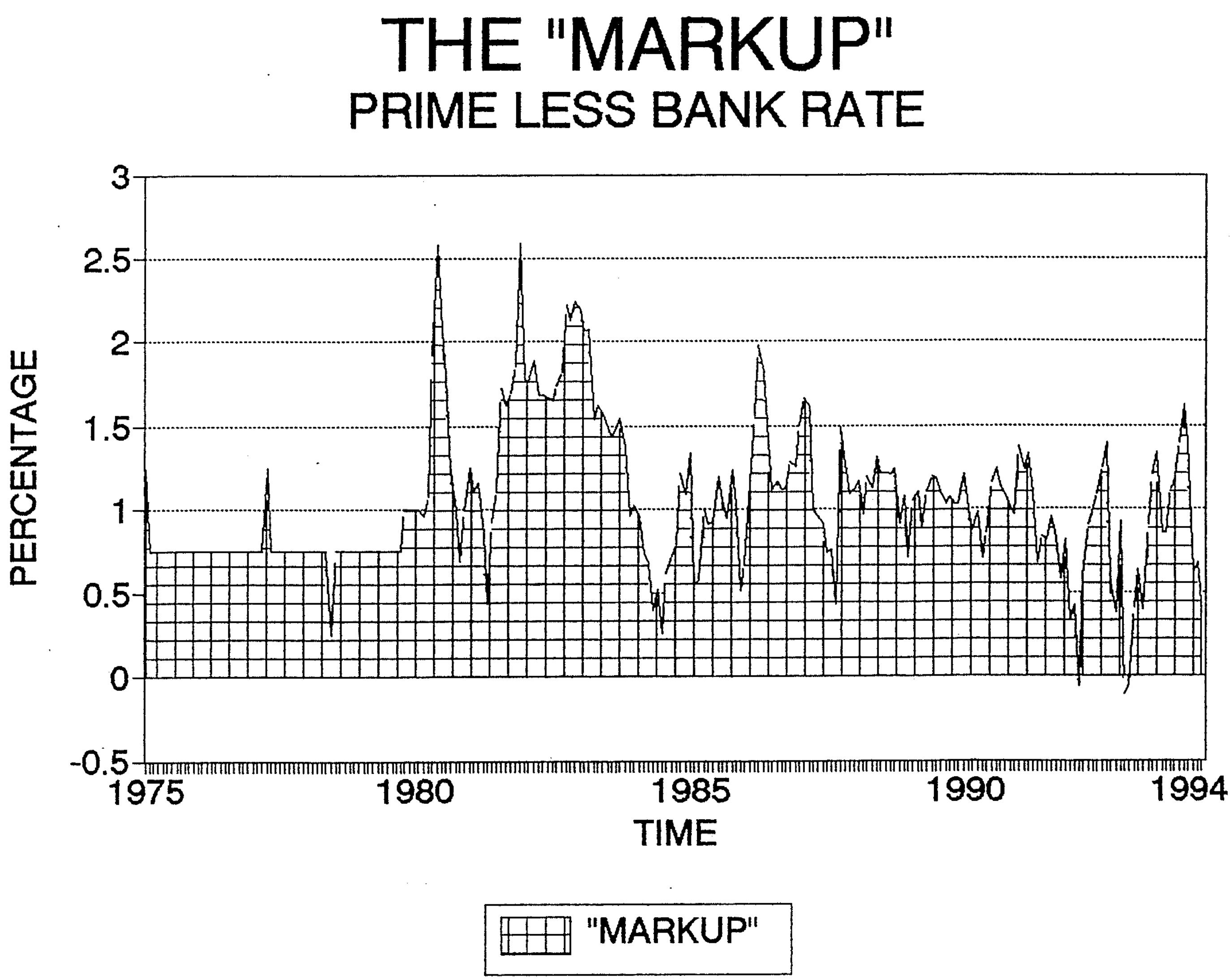
[79] Ibid., p. 640.

FIGURE 2[77]



[77]Source: CANSIM time series data:
Matrix 2560-Canadian Bond Yield Ave. and Interest Rates:
B14006-Bank rate
B14020-Chtd. Bank Prime Business Lending Rate.

determine if there is a stable relationship between the Prime less various market rates of interest, or if the markups do not converge to a given mean (contain a unit root). These tests give an indication of which rates of interest fundamentally influence

TABLE 2: PRIME RATE DIFFERENTIALS (MARKUPS)

MEAN (STANDARD DEVIATION) IN BASIS POINTS

Prime rate less:	1980-04 to 1989-12	1990-01 to 1994-05	1980-04 to 1994-05
Bank rate	126 (44)	87 (39)	114 (42)
91-day T-Bill	146 (40)	111 (46)	135 (42)
90-day PCP	122 (47)	95 (56)	137 (50)
90-day CD	191 (70)	111 (44)	165 (64)
90-day BA	128 (50)	103 (53)	120 (50)
Overnight	123 (113)	111 (52)	120 (99)

the Prime rate in a statistical sense. That is, if a unit root is found, this suggests that the relationship is non-stationary over time. Accordingly, both Augmented Dickey-Fuller (ADF) and Phillips-Perron Tests were conducted, the results of which are presented in TABLE 3 (p. 36). From this table, it is clear that both tests reject the presence of a unit root for the markup of the Prime over 90-day Prime Corporate Paper (PCP), and the Overnight Rate, and do not reject a unit root for the Term-Deposit rate at the 5% level of significance.

TABLE 3: UNIT ROOT TESTS FOR THE MARKUPS

H_0 = Unit Root
H_1 = No Unit Root

AUGMENTED DICKY-FULLER TESTS

Prime less:	**Measured Test Stat.**		**Critical Values (at 5% signif.)**[81]	**Reject/Do Not Reject H_0**
Bank	T=-2.6229	>	T^*=-2.885	DNR
Rate	F= 3.6482	<	F^*= 4.66	DNR
90-day	T=-2.9796	<	T^*=-2.885	Reject
PCP	F= 4.6675	<	F^*= 4.66	Reject
90-day	T=-2.6136	>	T^*=-2.885	DNR
CD	F= 3.4463	<	F^*= 4.66	DNR
90-day	T=-2.8117	>	T^*=-2.885	DNR
BA	F= 4.0969	<	F^*= 4.66	DNR
Over-	T=-5.6027	<	T^*=-2.885	Reject
Night	F= 15.827	>	F^*= 4.66	Reject
Term-	T=-2.7702	>	T^*=-2.885	DNR
Deposit	F= 3.8674	<	F^*= 4.66	DNR
PHILLIPS-PERRON TESTS				
Bank	Z=-35.225	<	Z^*=-13.85	Reject
Rate	T=-4.4768	<	T^*=-2.885	Reject
	F= 10.003	>	F^*= 4.66	Reject
90-day	Z=-98.720	<	Z^*=-13.85	Reject
PCP	T=-7.7742	<	T^*=-2.885	Reject
	F= 30.275	>	F^*= 4.66	Reject
90-day	Z=-32.444	<	Z^*=-13.85	Reject
CD	T=-4.2034	<	T^*=-2.885	Reject
	F= 8.8395	>	F^*= 4.66	Reject
90-day	Z=-89.215	<	Z^*=-13.85	Reject
BA	T=-7.3268	<	T^*=-2.885	Reject
	F= 26.888	>	F^*= 4.66	Reject
Over-	Z=-77.580	<	Z^*=-13.85	Reject
Night	T=-7.5022	<	T^*=-2.885	Reject
Rate	F= 28.146	>	F^*= 4.66	Reject
Term-	Z=-12.906	>	Z^*=-13.85	DNR
Deposit	T=-2.7537	>	T^*=-2.885	DNR
Rate	F= 3.821	<	F^*= 4.66	DNR

[81]Note: the critical values employed here were taken from tables based on Monte Carlo experiments found in J.D. Hamilton, Time Series Analysis. (New York: Princeton University Press, 1994).

However, the results between the ADF and PP tests conflict with respect to the markup of the Prime over the Bank Rate, the 90-day Certificate of Deposit (CD) rate and the 90-day Banker's Acceptance (BA) rate. In order to resolve this conflict, one may examine the plots of the Sample Auto-correlation Functions (ACFs). If the plot of the ACFs does not converge to zero quickly, this is indicative of the presence of a unit root. Upon examining such plots, the following conclusions have been made: reject the presence of a unit root in the spread of the Prime over the 90-day BA rate, but, do not reject a unit root for the 90-day CD rate, nor the Bank rate. To summarize, we reject the presence of a unit root in the markups of the Prime over 90-day PCP, 90-day BA, and the Overnight rate, suggesting that these rates share a fundamental statistical relationship with the Prime, while we do not reject a unit root in the markups of the Prime over the 90-day CD rate, the Term-Deposit rate, nor the Bank rate. In short, the results of these unit root tests certainly put into question Rousseas' claim that the markup exhibits a stable relationship. However, Lavoie states that "...empirical data showing the variability or the flexibility of the mark-up over base rates only disproves Rousseas' version of interest rate determination. It has no bearing on Moore's theory or the validity of horizontalism."[82] Specifically, even if banks do not passively set rates as a markup over the bank rate, this in and of itself does not render the bank rate endogenous.

[82]Lavoie (1994), p. 9.

Significantly, Niggle suggests that Rousseas' "...particular specification of a markup model.. is too simplified and inaccurate in certain important institutional respects."[83] He states that,

> in practice, procedures for estimating a bank's cost of funds are necessarily quite complex, depending on how one chooses to treat such variables as the historic, present, and future mixes of sources of funds...[84]

Also, according to Niggle, most empirical studies indicate that bankers pay attention to loan demand elasticities, "...especially those of their customers with access to alternative sources of funds such as the bond and commercial paper markets [as well as BAs]"[85] Thus, Rousseas' markup model is certainly too simplistic to capture the complex setting of bank lending rates.[86]

Goldberg provides an alternative empirical test for the pricing of the prime in the Horizontalist spirit. He suggests that the prime is "...an administered price based on a bank's average cost of its currently-and previously-issued, but still

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[83]C.J. Niggle, "A comment on the markup theory of bank loan rates", Journal of Post Keynesian Economics. Vol, IX, No. 4, Summer, 1987, p. 629.

[84]Ibid., p. 630.

[85]Ibid., p. 630.

[86]Notably, Rousseas admits that the proxy for the markup of the prime over the Federal funds rate is indeed oversimplified. See, S. Rousseas, "Rejoinder", Journal of Post Keynesian Economics. Vol IX, No. 4, Summer, 1987, p. 642.

outstanding, managed liabilities."[87] To proxy such costs, Goldberg employs a weighted average of the interest expense on a bank's "present and past deposit liabilities incurred to finance the business loan portfolio."[88] He finds that "...banks price their prime rate on the basis of some average"[89] of the costs of their currently outstanding managed liabilities. Thus, Goldberg concludes that banks employ average as opposed to marginal cost pricing which is suggestive of a mark-up type of pricing system. However, Goldberg also can be charged with being too simplistic for he restricts the explanatory variables of the Prime to large denominations of CDs. Consequently, Goldberg's model, like that of Rousseas, is under-specified.

Brown examines the pricing of the prime in the U.S. by developing a weighted average of deposit rates as a proxy for the cost of bank funds.[90] However, his empirical results are inconclusive, suggesting that, "...while the banks' cost of borrowed funds is probably the strongest influence on them in setting their lending rates, this influence was reduced and sometimes overwhelmed by contrary influences during the period measured."[91]

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[87]M.A. Goldberg, "The Sensitivity of the Prime Rate to Money Market Conditions", The Journal of Financial Research. Vol. VII, No. 4, Winter, 1984, p. 271.

[88]Goldberg (1984), p. 272.

[89]Ibid., p. 271.

[90]Brown (1984), p. 165.

[91]Ibid., p. 168.

Additionally, Epstein analyses the determination of the Prime lending rate in the U.S. in order to determine if it is characterized by a markup. Notably, Epstein correctly employs a friction model due to the observed stickiness of the Prime.[92] In fact, he does not actually attempt to test the statistical significance of bank liquidity per se. Instead, Epstein suggests that, in the past, banks formed a cartel in which the central bank acted as a price leader, setting the Federal Funds rate which the banks prime would follow. However, he concludes that this cartel broke down in the 1970s due to such factors as increased competition:[93]

> Increasing competition from the Euro-currency markets as well from the domestic commercial paper market may have contributed to the breakdown of prime rate setting conventions.[94]

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[92]Notably, S. Forbes and L. Mayne were the first to recognize the importance of the friction model for the prime which provided asymptotically consistent and unbiased estimates. See "A Friction Model of the Prime", Journal of Banking and Finance. Vol. 13, 1989, p. 127-35.

[93]Notably, some economists suggest that the advent of such alternative sources of funds contributes to the cyclically asymmetric setting of the prime. See M. Arak, A. Englander, and E. Tang, "Credit Cycles and the Pricing of the Prime Rate", Federal Reserve Board of New York, Quarterly Review. Summer, 1983, pp. 12-18. For a detailed empirical examination of asymmetries in the prime, see P. Levine and P. Loeb, "Asymmetric Behaviour of the Prime Rate of Interest", American Economist. Vol. 32, No. 2, Fall, 1989, pp. 34-38.

[94]Gerald Epstein, "Prime rates, Federal Reserve signalling, and financial instability", The Journal of Post Keynesian Economics. Vol XII, 1990, p. 631.

Notably, several studies have examined the competitive structure of the Canadian banking industry, the majority of which conclude that it does not exhibit the characteristics of "...monopolistic or oligopolistic behaviour..."[95] Instead,

> Canada's banks face strong international competition for large corporate business... compete with each other as well as with mortgage companies and credit unions for retail business...[and] with Canadian Savings Bonds for retail savings business.[96]

Thus, it would seem that despite the relatively high concentration level of a few large banks, the overall structure of the banking industry in Canada is a competitive one, suggesting that banks do not possess significant market power in determining the "price" of credit.[97]

King provides evidence for banks' liquidity demand for securities in the United States. He proxies the liquidity of a bank by the "ratio of total loans less capital to demand deposits

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[95]S. Perrakis, "Assessing Competition in Canada's Financial System: a note", Canadian Journal of Economics. Vol. XXIV, No. 3, 1991, p. 727. See also, A. Nathan and E. Neave, "Competition and Contestability in Canada's Financial System: Empirical Results", Canadian Journal of Economics. Vol. XXII, No. 3, 1989.

[96]E. Neave and A. Nathan, "Reply to Perrakis", Canadian Journal of Economics. Vol. XXIV, No. 3, 1991, pp. 734-5.

[97]Notably, Rousseas' theory may have some relevance for other countries. Evidence for Australian banks of "...a stable relationship between...loan/deposit interest margins and measures of market power..." is provided in R. McShane and I. Sharpe, "A Time Series/Cross Section Analysis of The Determinants of Australian Trading Bank Loan/Deposit Interest Margins: 1962-1981", Journal of Banking and Finance. Vol. 9, 1985, pp. 115-36.

net of reserve requirements, less 1."[98] This measure of liquidity is found to be statistically significant in determining the prime lending rate. Notably, King finds that bank liquidity affects the loan rate only in periods of tight money or in "credit crunch periods."[99] This is consistent with Wray's theory, suggesting that, as banks reach the maximum prudent leverage ratio, the liquidity premium will rise.[100]

Similarly, Slovin and Sushka develop a model of the commercial loan rate for the U.S. in which the liquidity preference of banks is tested. They acknowledge the possibility that "...as banks become more 'loaned up', they become averse to issuing new loans and increase loan rates."[101] An alternative possibility is that a "...high loan/deposit rate indicates that commercial banks have reached a minimum liquidity constraint which results in an increase in the loan rate to a level above that appropriate for the level of open market interest rates."[102] However, this study found the loan/deposit ratio to be statistically insignificant in determining the loan rate.

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[98] S. King, "Monetary Transmission: Through Bank Loans or Bank Liabilities?", Journal of Money, Credit, and Banking. Vol. 18, No. 3, August, 1986, p. 295.

[99] King (1986), p. 296.

[100] Wray (1990 b), p. 167.

[101] M. Slovin and M. Sushka, "A Model of the Commercial Loan Rate", The Journal of Finance. Vol. XXXVIII, No. 5, December, 1983, p. 1593.

[102] Ibid., p. 1593.

In a similar study by Jaffee, bank liquidity is proxied by (L/A-L), where A is total loans and investment, and L is the commercial loan portfolio of banks.[103] This specification implies that the illiquidity cost of loans approaches zero as the loan portfolio approaches zero and approaches infinity as loans approach total assets. Also, changes in the liquidity ratio, Δ(L/A-L), are considered, "...since a dynamic short run increase in loans that is beyond the control of the bank would have additional (although only transitional) liquidity costs."[104]

Finally, several authors have attempted to create an efficient frontier for a bank's portfolio by employing Markowitz' theory of Portfolio Selection.[105] Notably, McCallum provides a very pertinent comparison of efficient portfolios versus actual holdings of chartered bank assets. However, he also recognizes the numerous difficulties associated with such an approach:

> [t]here may be bias in the data, the crude approach to unanticipated interest rate movement may not be satisfactory, the holding period assumption [of three months] may not

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[103]D.M Jaffee, Credit Rationing and the Commercial Loan Market: An Econometric Study of the Structure of the Commercial Loan Market. (Toronto: John Wiley and Sons, 1971), p. 92.

[104]Ibid., p. 93.

[105]For relevant applications of Markowitz' theory to bank portfolios at the micro-level, see T. Gollinger and J. Morgan, "Calculation of an Efficient Frontier for a Commercial Loan Portfolio", The Journal of Portfolio Management. Vol. 5, Winter, 1993, pp. 39-46. Also, see J. Francis, "Portfolio Analysis of Asset and Liability Management In Small, Medium, And Large-Sized Banks", Journal of Monetary Economics. Vol. 4, 1978, pp. 459-480.

> be valid, the bank bond portfolio manager's utility function may not be represented by the Markowitz approach...[106]

Furthermore, Pulliam suggests that the application of Portfolio Selection to the analysis of bank management should perhaps be ignored altogether:

> A strategy of ignoring portfolio structure, buying efficient bonds and selling inefficient bonds appears to provide the possibility of long-run performance superior to conventional [portfolio] management methods.[107]

Thus, there are numerous difficulties associated with the portfolio selection theory and, as such, it shall not be incorporated into the model of the prime rate developed in this paper.

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[106] J. McCallum, "The Canadian Chartered Banks and the Government of Canada Bond Market: Ex Post Efficient Portfolios and Actual Holdings", Journal of Bank Research. Spring, 1976, p. 85.

[107] K.P. Pulliam, "A Liquidity Portfolio Management Strategy Approach", Journal of Bank Research. Vol. 2, Spring, 1976, p. 112.

AN EMPIRICAL MODEL OF THE PRIME RATE IN CANADA

Upon examining the actual movements of the Prime lending rate in Canada, there does appear to be a significant change in the manner in which it is set. Specifically, before the late 1970s, the chartered bank prime loan rate was relatively slow to adjust to money-market conditions. In contrast, since the introduction of the floating Bank rate in March, 1980,[108] the prime rate has changed much more frequently, (an average of about 6 times a year).[109] Thus, "[b]ank lending rates have become more sensitive to the current cost of raising funds in the money market."[110]

Bank-rate policy is thought to be most effective when there is a close relationship between the cost of central bank accommodation and the cost of bank credit and other market rates.[111] Since the adoption of the floating Bank Rate in 1980, "...there is no significant news in Bank rate changes per se,[112] banks nevertheless often wait until the Bank Rate goes up before raising their prime lending rate, to take advantage of an

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[108]The Bank Rate is now set at 25 basis points above the three-month T-bill rate and thus is a floating rate, largely market determined as exemplified by the Granger-Sims causality tests in TABLE 1.

[109]Boreham and Bodkin (1993), p. 307.

[110]Ibid., p. 307.

[111]Ibid., p. 225.

[112]The statistical insignificance of the relationship between the Bank rate and the Prime has been suggested in TABLE 3 in which a unit root was discovered in the markup of the Prime over the Bank rate.

opportune time for the announcement."[113] Hence, banks make announcements of prime rate increases at the most politically opportune time. From Appendix #1 (p. 62) depicting the plot of the Prime rate versus the Bank rate, it is clear that there is a strong correlation between the two rates.

According to some economists, "...monetary policy operates mainly through its effect on the portfolio and lending decisions of lenders, chiefly banks."[114] When the monetary authorities restrict overall liquidity, banks are forced to sell off securities which eventually leads to an increase in lending rates:

> ...the sale of securities reinforces the fall in security prices and the rise in yields, and higher yields, combined with a continuing reduction in the liquidity of bank portfolios, cause banks to demand a corresponding increase in the quality of new loans and the rate of interest charged on these loans...[115]

Consequently, the banks' Liquid Asset ratio may be an appropriate indicator of the chartered banks' willingness to meet the demand for loans.[116] Courchene recognized the importance of the banks' liquid asset holdings in the transmission mechanism: "the Bank of Canada must recognize that the liquid asset ratio is a chartered

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[113]Clinton and Howard (1994), p. 15.

[114]Boreham and Bodkin (1993), p. 456.

[115]Ibid., p. 461.

[116]Ibid., p. 462.

bank decision variable and, as such, is responsive to the economic development in which the banks find themselves..."[117] Indeed, from Appendix #2 (p. 63), there appears to be a strong negative correlation between the Liquid Asset Ratio and the Prime rate. Moreover, from Appendix #3 (p. 64), the Loan/Deposit Ratio, an alternative proxy of liquidity preference, appears to be somewhat correlated with the Prime rate as well.

Hence, if banks pay attention to their liquid asset ratios (if balance sheets matter) the effective marginal cost of funds used for business lending is not mechanically related to other short-term interest rates. Instead, in a period of strong loan demand, the rate on wholesale short-term deposits, the volume of which can be quickly adjusted, is key. However, when loan demand has been low or the banks have had large holdings of liquid assets, "the effective marginal cost of lending is more likely to be the yield foregone on assets such as treasury bills and commercial paper."[118] It follows that banks consider their own cost of funds, represented by interest rates on wholesale deposits and by rates on liquid assets, as well as the competing interest rates available to businesses in the commercial paper market. "In Canada, yields on short-term money market paper are

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[117]T. Courchene, Money, Inflation, and the Bank of Canada: An Analysis of Canadian Monetary Policy from 1970 to Early 1975. C.D. Howe Research Institute, 1976, p. 87.

[118]Clinton and Howard (1994), p. 16.

the best available measures of both the cost of funds and competing rates for business loans."[119]

As such, an attempt shall be made to incorporate many of the aspects mentioned above into a model of the markup of the prime lending rate over the bank rate. The data employed for this model includes monthly data from December, 1985 through October, 1993 of the following time series: The Chartered Bank Prime Business Lending Rate (PRIME), The Bank Rate-Last Wednesday of Month (BANK) , 90-day Prime Corporate Paper (PCP), 90-day Bankers' Acceptances (BA), Chartered Bank 5-year Fixed Term Deposit (TERM), Total Liquid Assets as a percentage of Total Canadian Dollar Assets (LIQUID), Total Loans/Total Canadian Dollar Deposits (LOAN/DEP), Inventories-Non-Farm (INVENT).[120] The Bank rate is included in order to test the markup theory developed by Rousseas (1985). Both the 90-day PCP and BA rates were suggested by Clinton and Howard (1994) for proxies of the alternative sources available to businesses as well as the cost

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[119]Ibid., p. 18.

[120]All series were retrieved from CANSIM. Specifically:
Matrix 2560-Canadian Bond Yield Averages and Interest Rates
B14020-PRIME
B14006-BANK
B14017-PCP
B14057-BA
B14o45-TERM
Matrix 2524-Chartered Banks-Assets and Liabilities-unadjusted
B1456 -LIQUID
Matrix 913 -Chartered Banks-Statement-Wednesday unadjusted
LOAN/DEP consists of;
B428 -Total Loans
B450 -Total Canadian Deposits
Statistics Canada, Monthly Survey of Manufacturing. Catalogue 31-001 Monthly/ISSN 0840-8238: INVENT.

of wholesale funds. The TERM rate was also alluded to by Clinton and Howard (1994) but was not formally tested for the cost of funds to banks. The importance of the LIQUID variable was suggested by Courchene (1976) and Jaffee (1971) to proxy the banks' liquidity preference. Similarly, King (1986) and Slovin and Sushka (1983) tested the significance of the LOAN/DEP ratio as a proxy for liquidity preference. Finally, several authors, including Niggle (1987) have stressed the significance of the demand for loans upon the prime rate as proxied by inventories (INVENT). Notably, fixed capital investment was also tested on its own as well as added to the INVENT variable. However, inventories alone was found to be the most appropriate in a statistical sense. Also, the natural logarithms have been used in order to smooth the data, as is the standard procedure.[121]

Notably, any model which employs time series data must always commence with tests for non-stationarity, or unit roots. Appendix #4 (p. 65) contains both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests for all series under consideration. Both the ADF and PP tests do not reject the null hypothesis of a unit root at the 5% significance level for all time series.[122] Hence, we are faced with the common problem of non-stationarity of time series data. Notably, the majority of the previous studies cited in this paper have entirely ignored

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[121]Hence, data for all empirical tests is in LOG form.

[122]Notably, tests for integration of order two, or a second root were all rejected at the 5% level of significance.

this econometric problem in their analysis, with the exception of those presented by Clinton and Howard (1994) and Hendry (1992) sighted above.[123]

In order to address the problem, one may attempt to transform the data by differencing to obtain stationary series. However, in doing so, all long run information is sacrificed in the conventional Ordinary Least Squares (OLS) regression.[124] An alternative measure is to construct an Error Correction Model (ECM) which requires that the series be cointegrated. As such a series of cointegration tests were conducted, the results of which are given in Appendix #5 (p. 66). Again both ADF and PP tests for the cointegration of all the series were performed, interchanging the regressand for each test.[125] Here, all tests, with the exception of the tests with INVENT and LIQUID as the regressands, reject the null hypothesis of no cointegration at the 10% level. Thus, one may side in the direction of cointegration among all of the series and continue with the construction of an ECM.[126]

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[123]If the problem of non-stationary time series data is ignored and one proceeds with an OLS model, this will result in a spurious regression characterized by a very high R^2 and a low D-W statistic.

[124]See Hamilton (1993), for a detailed discussion of the solutions to non-stationarity.

[125]Each variable must be used as the regressand because economic theory does not suggest which variable to use.

[126]Notably, an ECM was chosen over a Probit or "friction" model with threshold values because monthly data of the PRIME rate is quite volatile relative to the more "sticky" weekly data, and the inclusion of such variables as LIQUID, LOAN/DEP, and

There are two alternative methods of constructing ECMs, when the cointegrating vector is known and when it is not known. Specifically, when the cointegrating vector is known, or is suggested by economic theory, we have the following relation:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \beta_3 Y_{t-1} + \epsilon_t \quad (1)$$

Here, economic theory suggests that Y_t and X_t grow at the same rate, i.e. $(Y_t - X_t)$ = constant. In the long run equilibrium, we have $Y^* = Y_t = Y_{t-1}$ and $X^* = X_t = X_{t-1}$. Thus, we have the following long run relationship:

$$Y^* = \beta_0 + \beta_1 X^* + \beta_2 X^* + \beta_3 Y^* \quad (2)$$

Where, $\beta_1 + \beta_2 + \beta_3 = 1$.

Transforming equation 1, we have;

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + (\beta_3 - 1)(Y_{t-1} - X_{t-1}) + \epsilon_t \quad (3)$$

Where $(Y_{t-1} - X_{t-1})$ is the error correction term.

Rousseas' simplistic model interprets ΔY_t as the first difference in the PRIME rate, ΔX_t as the first difference of the BANK rate and $(Y_{t-1} - X_{t-1})$ as the markup of the PRIME over the BANK rate. The results for such model are provided in TABLE 4 (p. 52). Thus, applying this standard ECM to a model of the Prime lending rate is very appropriate for our purposes.

INVENT necessitated the use of monthly data.

However, the more realistic version of the model is when the cointegrating vector is unknown. In fact, for the purposes of

TABLE 4: SIMPLE MARKUP MODEL OF THE PRIME

Dependent Variable = ΔPRIME

Independent Variable	Coefficient	Test Statistic	Significant?[127]
CONSTANT	-0.02690		
$\Delta BANK_t$	0.78849	T=14.84	YES
$(PRIME\text{-}BANK)_t$	0.25015	T=3.441	YES

R^2 = 0.7018
D-W = 2.0948

this paper, it is more appropriate to develop a model for the markup of PRIME over the BANK rate. The formulation of this type of model is somewhat different from that of the above model. Specifically, both leads and lags of the explanatory variables are added to the model in the following fashion:

$$Y_t = \beta_0 + X^*\eta^* + \sum_{j=-p}^{p} \Delta X^*_{-j}\,\gamma_j + \epsilon_t \qquad (4)$$

Where, η^* is the cointegrating vector, X^* is the vector of explanatory variables, and $\sum_{j=-p}^{p} \Delta X^*_{-j}\,\gamma_j$ is the lead/lag structure of the explanatory variables.

Notably, one of the problems that arises with such a model is the selection of "P", the number of leads and lags. Here, P has been chosen as six because, with monthly data, it is necessary to have

[127] The critical value at the 5% significance level with 91 degrees of freedom is T^* = 1.67.

ample leads and lags while, on the other hand, there must be sufficient degrees of freedom.

The results of tests employing the above ECM are provided in Table 5 (p. 54). Here, the Bank rate was found to be the dominant interest rate and, as such, separate regressions were fitted using the Bank rate, 90-day PCP and BA rates.[128] Also, different models were estimated with the LIQUID variable and the LOAN/DEP variable. Firstly, the Bank rate is certainly influential in determining the markup with a coefficient of 0.011441 or 0.47251. However, other factors are indeed statistically significant. The TERM rate, a proxy for the cost of attracting deposits, is significant in all tests with a coefficient ranging from -0.21779 to -0.59439. Notable, the INVENT variable is found to be significant in only one of the six regressions, which is contrary to the theoretical holdings.

Additionally, the proxies for banks' liquidity preference (LIQUID and LOAN/DEP) are significant although the LOAN/DEP ratio has a much higher coefficient ranging from 1.13461 to 1.4338 as compared to a mere 0.08076 to 0.11994 for the LIQUID asset ratio. This result provides substantial evidence that banks' liquidity preference does influence the setting of the Prime rate - balance sheets do indeed matter. Thus, it is clear that banks do not passively set rates as a stable markup over the cost of funds.

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[128] This is done because, when coupled with the BANK rate, only the TERM rate is statistically significant at the 5% level.

Table 5: Error Correction Model

Dependent Variable = PRIME - BANK

Independent Variable	Coefficient	Test Statistic	Significant?[129]
Regression #1: R^2 = 0.8766 D-W = 2.1021			
$BANK_t$	0.47251	T=7.73916[130]	YES
$TERM_t$	-0.59439	T=7.67741	YES
$LIQUID_t$	0.11994	T=10.3793	YES
$INVENT_t$	-0.01134	T=0.80708	NO
Regression #2: R^2 = 0.8815 D-W = 1.7480			
$BANK_t$	0.11441	T=2.03694[131]	YES
$TERM_t$	-0.26568	T=3.00615	YES
$LOAN/DEP_t$	1.13461	T=5.40389	YES
$INVENT_t$	0.01263	T=0.94621	NO
Regression #3: R^2 = 0.8897 D-W = 1.7413			
BA_t	0.42704	T=5.11454[132]	YES
Regression #3 (continued):			
$TERM_t$	-0.54117	T=5.12314	YES
$LIQUID_t$	0.11846	T=7.35860	YES
$INVENT_t$	0.02203	T=1.67214	YES

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[129]The critical value at the 5% significance level with 88 degrees of freedom is $T^* = 1.667$.

[130]T-Statistics are adjusted in the following manner to account for the lack of a normal distribution:

$T(S_T/\lambda_1)=1.99258$; where S_T=unbiased estimate of sigma (δ_T), the standard deviation of the regression (equation 4) and, $\lambda_1=\delta_1 / (1-\Phi_1-\Phi_2-...-\Phi_q)$; where Φ_q is computed from the OLS estimation of the lagged residuals (e_t) derived from the regression (equation 4) as follows:

$$e_t=\Phi_1 e_{t-1}+\Phi_2 e_{t-2}+...\Phi_q e_{t-q}+w_t \text{ and,}$$

$$\delta_1=\sum_{t=q+1}^{T} e_t^2 / (T-P).$$

Notably, each ECM has a different value of q (the number of significant lagged residuals) which is determined by testing down. Consequently, each ECM will also have a different value for the T-Stat. adjustment, $T(S_T/\lambda_1)$.

[131]Where, $T(S_T/\lambda_1)=1.331334$.

[132]Where, $T(S_T/\lambda_1)=1.228275$.

Regression #4: R^2 = 0.8938 D-W = 1.5203			
BA_t	0.14960	T=2.06297[133]	YES
$TERM_t$	-0.35285	T=2.97535	YES
$LOAN/DEP_t$	1.43380	T=4.78907	YES
$INVENT_t$	0.01156	T=0.91584	NO
Regression #5: R^2 = 0.7942 D-W = 1.4166			
PCP_t	0.16370	T=2.47327[134]	YES
$TERM_t$	-0.21779	T=2.60703	YES
$LIQUID_t$	0.08076	T=6.38449	YES
$INVENT_t$	0.00410	T=0.21229	NO
Regression #6: R^2 = 0.8428 D-W = 1.4119			
PCP_t	0.06847	T=1.63046[135]	NO
$TERM_t$	-0.23313	T=3.41451	YES
$LOAN/DEP_t$	1.23653	T=7.21112	YES
$INVENT_t$	0.013774	T=0.67170	NO

Notably, many of the "less radical" Post Keynesians such as Wray, Arestis, Chick, and others, upon recognizing the significance of banks' liquidity preference, conclude that the money supply function is upward-sloping. However, the debate over the slope of the money supply function is still unresolved for, as Lavoie argues, it must be further shown that the LOAN/DEP ratio moves pro-cyclically - in line with money demand.[136] In order to informally examine this issue, the plots of the LOAN/DEP ratio versus GDP and the Capacity Utilization Ratio are shown in Figure

[133]Where, $T(S_T/\lambda_1)=0.919737$.

[134]Where, $T(S_T/\lambda_1)=1.887786$.

[135]Where, $T(S_T/\lambda_1)=1.882307$.

[136]Horizontalists such as Lavoie have been widely misinterpreted in the literature and, in fact, Lavoie recognizes that the influence of banks' liquidity preference could, under certain conditions, produce a stepwise, upward-sloping money supply curve. (From interview, Marc Lavoie, the University of Ottawa, December 10, 1994). Also, see Lavoie (1994).

#3 and Figure #4 respectively.[137] From the plots, it does appear that, during the period under consideration from 1986 through 1993, the LOAN/DEP ratio has moved broadly with both GDP and Capacity Utilization. This evidence is also supported by the simple correlation coefficients between LOAN/DEP and GDP which equals 0.52 and between LOAN/DEP and Capacity Utilization which equals 0.31.

The above analysis, although far from conclusive, certainly provides some evidence in favour of an upward-sloping money supply curve. This would suggest that, although the supply of credit money does appear to be endogenous, there are indirect limits imposed by banks as they adjust their lending rates in accordance with "prudent" liquidity and leverage ratios. This scenario also seems to be the most intuitively appealing. However, further empirical work is definitely required before a strong conclusion can be reached.

[137]Figures 3 and 4 display the plot of the three-month moving average annualized growth rate of the natural logarithm of Loan/Dep and GDP and Capacity Utilization. Logs and three-month moving averages were used in order to smooth the data and annualized growth rates were used for easier comparisons. Sources of Data are from the following publications:
GDP - Statistics Canada, "System of National Accounts: GDP by Industry". Catalogue 15-001 Monthly.

Capacity Utilization - Statistics Canada, "Canadian Economic Observer", Catalogue 11-010 Monthly.

FIGURE 3

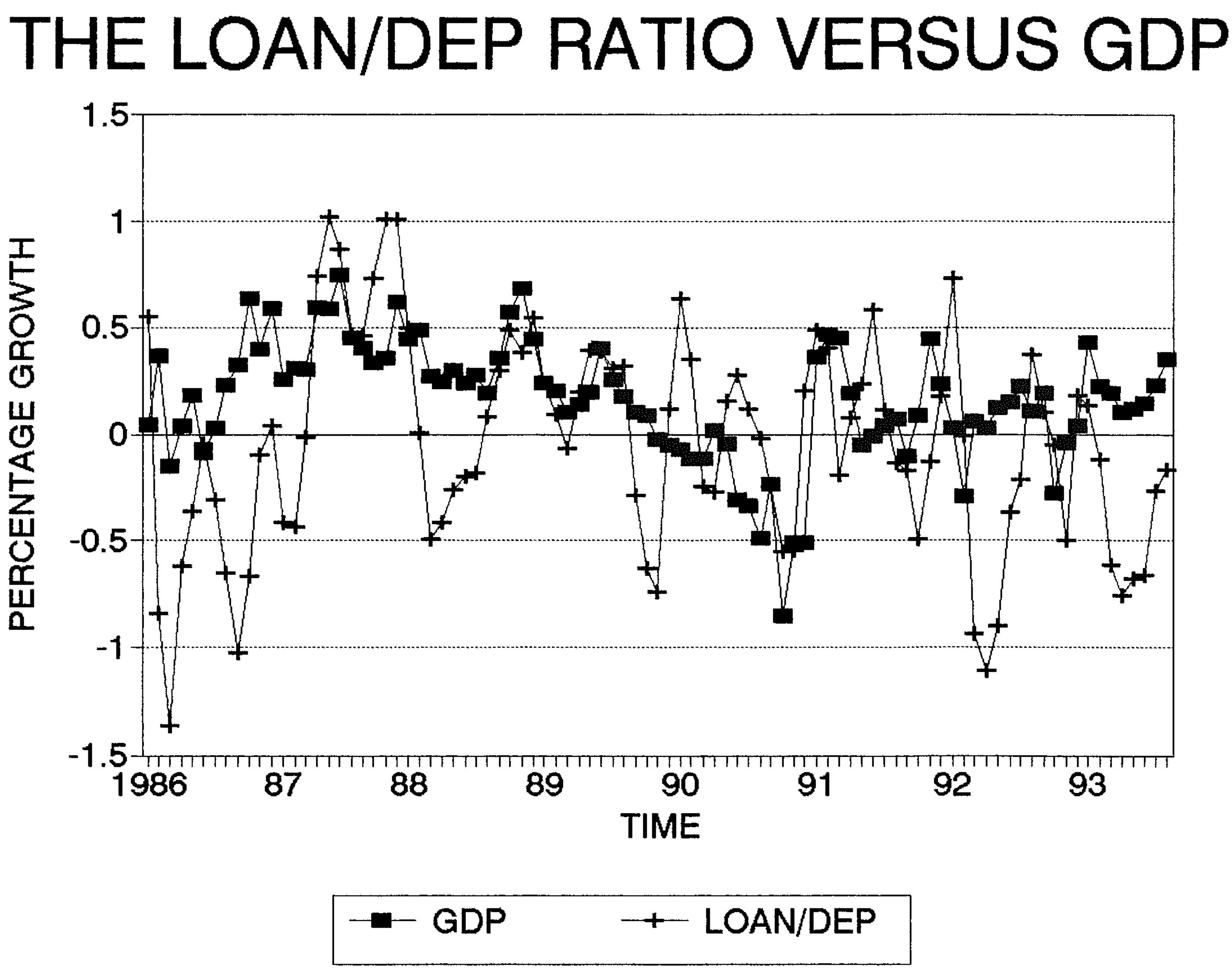
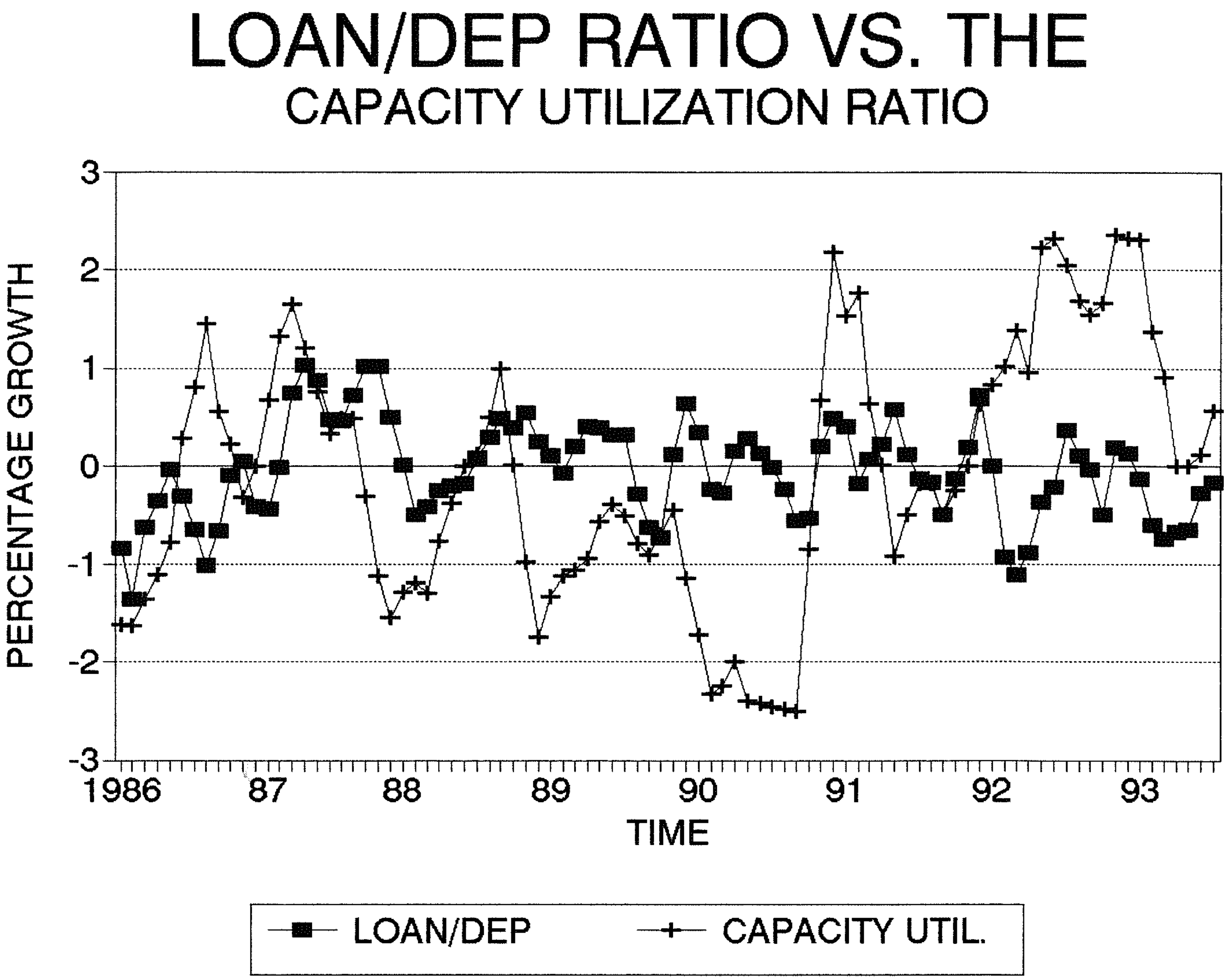

THE LOAN/DEP RATIO VERSUS GDP
1.5
1
0.5
0
-0.5
-1
-1.5
PERCENTAGE GROWTH
1986
87
88
89
90
91
92
93
TIME
GDP
LOAN/DEP

FIGURE 4


LOAN/DEP RATIO VS. THE
CAPACITY UTILIZATION RATIO
PERCENTAGE GROWTH
3
2
1
0
-1
-2
-3
1986
87
88
89
90
91
92
93
TIME
LOAN/DEP
CAPACITY UTIL.

CONCLUSIONS

The examination of three conflicting theories of the elasticity of the money supply function has indeed provided some insight into the monetary transmission mechanism in Canada. An analysis of the actual policy instruments employed by the monetary authorities accompanied by empirical evidence on the banks' pricing of the Prime lending rate leads to the tentative conclusion that the money supply function is neither vertical, nor horizontal, but rather upward-sloping in interest-money space. Banks' liquidity preference is not only significant in the determination of the Prime rate, but also moves pro-cyclically. This would suggest that the central bank and the banking system jointly determine the "price" and quantity of credit money.

The complex modern financial system has severely inhibited the Bank of Canada's ability to control any single monetary aggregate. Instead, through its main policy of cash management through the drawdown/redeposit mechanism, the central bank influences the entire banking system via short term interest rates. Similarly, banks do not set their lending rates as a mere markup over the cost of funds, satiating the demand for credit, as some Horizontalists state. Instead, banks must adhere to a host of considerations - including their liquidity preference - but also profit maximization, loan default risks, client relations, and competition with other financial institutions as well as the money market. Thus, it is the interplay between the

Bank of Canada and the banking system which has a direct impact upon the supply of money and credit as well as influencing the interest rate structure. Under such a scheme, the money supply is indeed endogenous. However, there are indirect limits imposed by both the banks - which adjust their lending rates in accordance with, among other things, "prudent" liquidity and leverage ratios - and the central bank which alters the banking systems overall liquidity. Consequently, neither institution is a strict quantity or price setter in the wholesale or retail markets as Horizontalists such as Moore suggest.

In short, the transmission of monetary policy is an extremely complex mechanism. The slope of the money supply function and the determination of bank lending rates is but a piece of an enormously complex puzzle, the workings of which are not entirely straight forward. As one economist states,

> [w]hat is quite clear is that defining endogeneity in terms of the elasticities of money supply functions in interest rate-money stock space is adequate neither to the general phenomenon of credit money as a pervasive feature of transactions in some economies nor to the historical specificities of banking sector responses to monetary policy.[138]

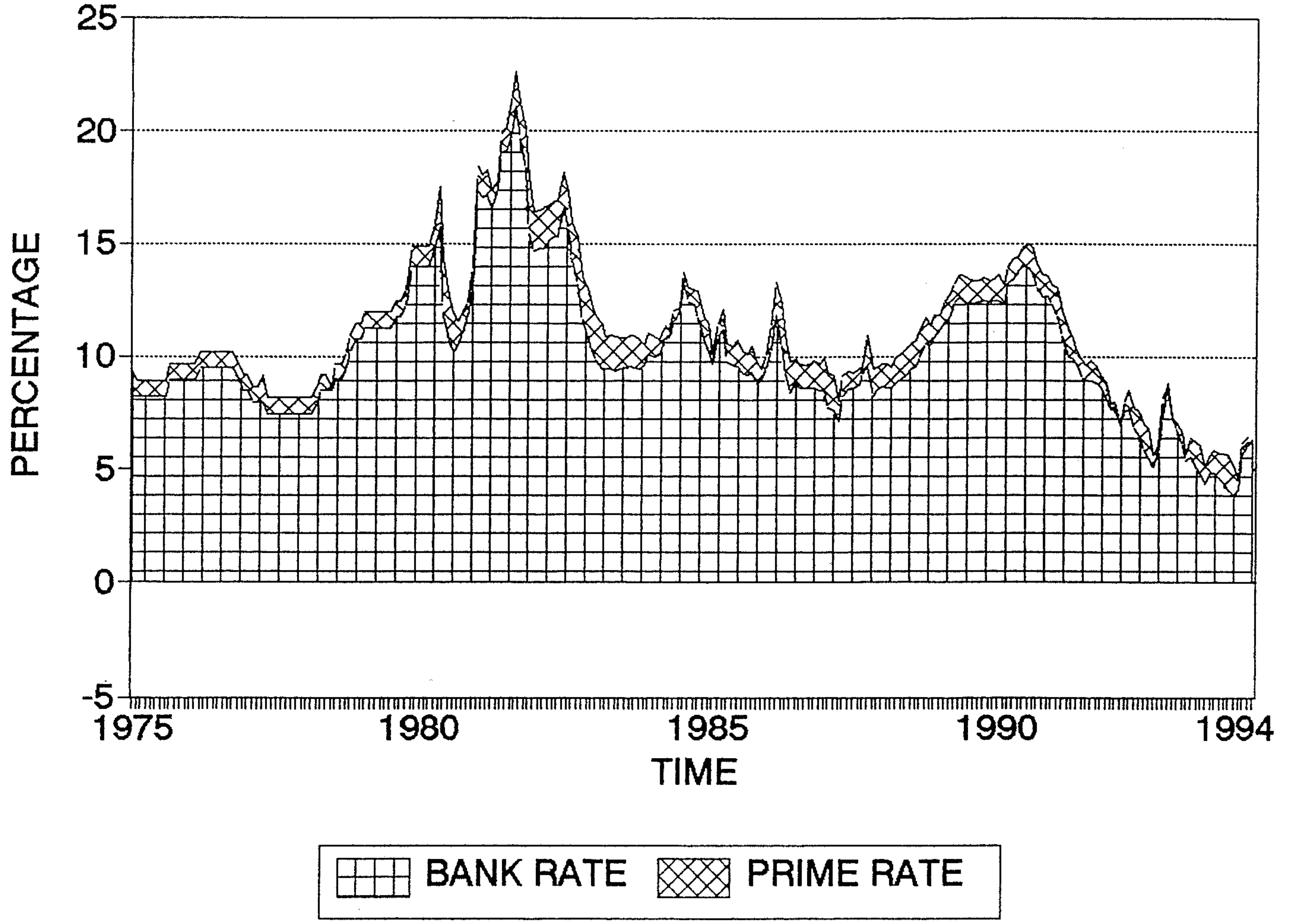
The controversies surrounding monetary policy in general, and the transmission mechanism in particular, are simply to complex to capture within simplistic economic models. To this extent, all of the theories presented herein are flawed. Nevertheless,

[138]Arestis and Chick (1992), p. 55.

although one single model or theory certainly fails to paint the entire picture of the financial system, economic analysis of this kind most definitely serves to further the understanding of many important and controversial issues. The evidence provided within this paper suggests that the Post-Keynesian Structuralist theory most closely follows reality, rendering the money supply function upward-sloping. However, without a doubt, further analysis into these issues is required, for the evidence provided here is neither comprehensive nor absolute.

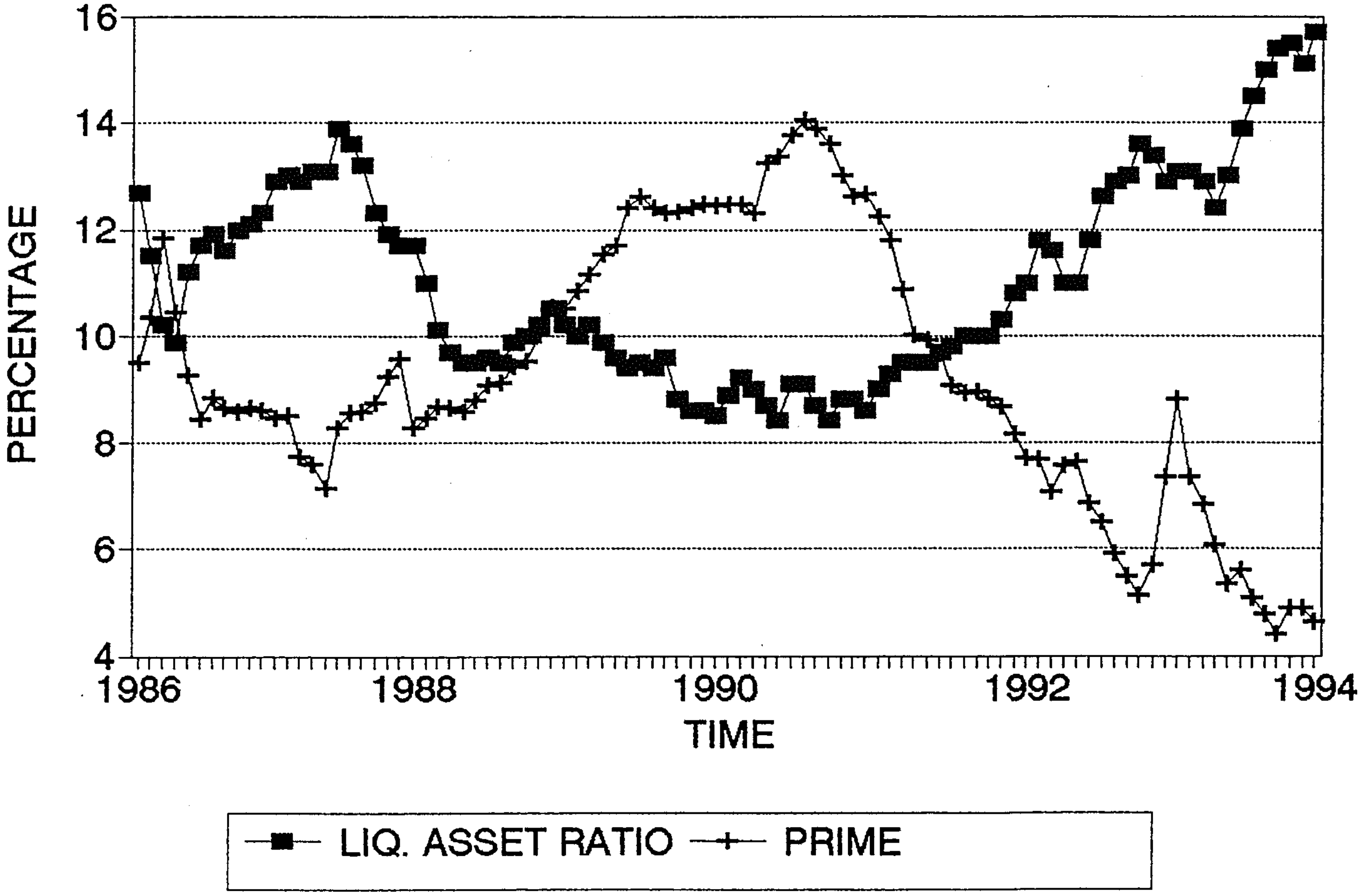
APPENDIX #1

PRIME RATE VERSUS THE BANK RATE

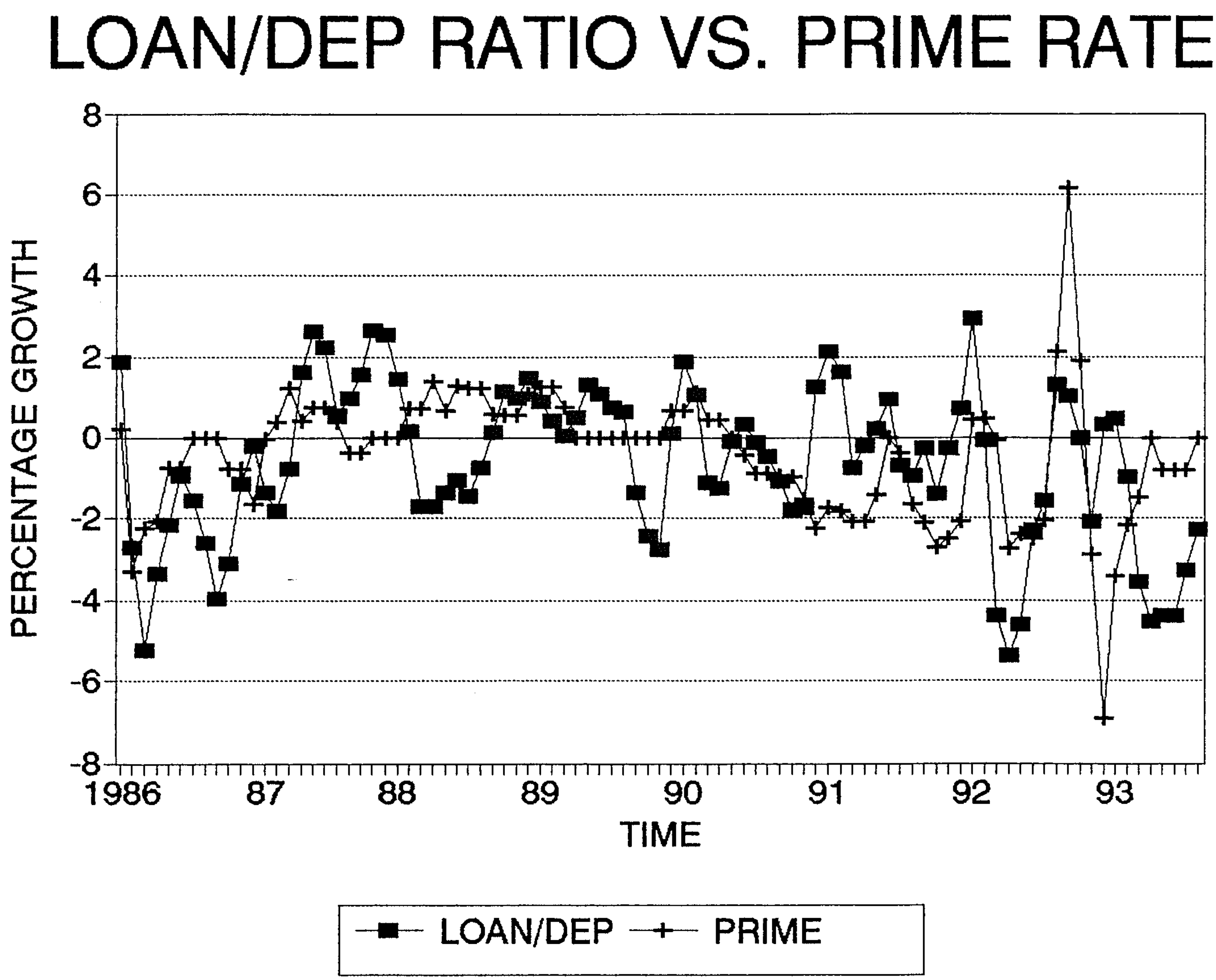


APPENDIX #2

THE LIQUID ASSET RATIO
VERSUS THE PRIME RATE



APPENDIX #3


LOAN/DEP RATIO VS. PRIME RATE
8
6
4
2
0
-2
-4
-6
-8
PERCENTAGE GROWTH
1986
87
88
89
90
91
92
93
TIME
LOAN/DEP
PRIME

APPENDIX#4: UNIT ROOT TESTS

H_0=unit root
H_1=no unit root

Variable less:	Measured Test Stat. ADF	PP	Critical Values (at 5% signif.)	Reject/DNR H_0
Prime		Z=-0.3156	Z^*=-13.7[138]	DNR
Rate	T=-0.8629	T=-0.1381	T^*=-2.89	DNR
	F= 0.5450	F= 0.4404	F^*= 4.71	DNR
Bank		Z=-0.7492	Z^*=-13.7	DNR
Rate	T=-0.6374	T=-0.2829	T^*=-2.89	DNR
	F= 0.6795	F= 0.4960	F^*= 4.71	DNR
90-day		Z=-0.8601	Z^*=-13.7	DNR
PCP	T=-0.5098	T=-0.3135	T^*=-2.89	DNR
	F= 0.8940	F= 0.4884	F^*= 4.71	DNR
90-day		Z=-0.7319	Z^*=-13.7	DNR
BA	T=-0.5155	T=-0.2732	T^*=-2.89	DNR
	F= 0.8890	F= 0.4948	F^*= 4.71	DNR
90-day		Z=-6.4996	Z^*=-13.7	DNR
CD	T=-1.8676	T=-7.8592	T^*=-2.89	DNR
	F= 1.8005	F= 2.0067	F^*= 4.71	DNR
Term-	Z= 0.5899	Z=-0.2130	Z^*=-13.7	DNR
Deposit	T= 0.2656	T=-0.0875	T^*=-2.89	DNR
	F= 1.2209	F= 1.0288	F^*= 4.71	DNR
Loan/		Z=-3.2091	Z^*=-13.7	DNR
Deposit	T=-1.3339	T=-0.9390	T^*=-2.89	DNR
Ratio	F= 1.0701	F= 0.5924	F^*= 4.71	DNR
Liquid		Z=-1.7553	Z^*=-13.7	DNR
Asset	T=-0.0097	T=-0.6353	T^*=-2.89	DNR
Ratio	F= 0.6362	F= 0.3097	F^*= 4.71	DNR
Inven-		Z=-16.870	Z^*=-20.7[139]	DNR
tories	T=-2.1728	T=-2.9354	T^*=-3.45	DNR
	F= 3.7733	F= 4.8389	F^*= 6.49	DNR

[138] Critical values based on CASE 2 (constant, no time trend) after rejecting the significance of a time trend at the 5% level.

[139] Critical values based on CASE 4 (constant, time trend).

APPENDIX #5: COINTEGRATION TESTS

H_0=no cointegration
H_1=cointegration

Regressand	Measured Test Stat. ADF	PP	Critical Values (at %10 signif.)	R/DNR H_0
Prime Rate	T=-3.9586		T^*=-4.42[140]	DNR
		Z=-39.121	Z^*=-38.4	R
		T=-5.2183	T^*=-4.42	R
Bank Rate	T=-4.4873		T^*=-4.42	R
		Z=-52.557	Z^*=-38.4	R
		T=-7.8293	T^*=-4.42	R
90-day PCP	T=-4.3112		T^*=-4.42	DNR
		Z=-65.379	Z^*=-38.4	R
		T=-6.8292	T^*=-4.42	R
90-day BA	T=-4.6121		T^*=-4.42	R
		Z=-64.944	Z^*=-38.4	R
		T=-6.8391	T^*=-4.42	R
Term-Deposit Rate	T=-3.8779		T^*=-4.42	DNR
		Z=-22.106	Z^*=-38.4	DNR
		T=-3.9425	T^*=-4.42	DNR
Liquid Asset Ratio	T=-4.9625		T^*=-4.42	R
		Z=-39.974	Z^*=-38.4	R
		T=-4.7521	T^*=-4.42	R
Loan/ Dep. Ratio	T=-4.4692		T^*=-4.42	R
		Z=-38.732	Z^*=-38.4	R
		T=-4.5245	T^*=-4.42	R
Invent-ories Ratio	T=-3.8674		T^*=-4.42	DNR
		Z=-27.8124	Z^*=-38.4	DNR
		T=-4.07340	T^*=-4.42	DNR

[140] Critical values based on the asymptotic values at the 10% level of significance using CASE 2 (constant, no time trend) after rejecting the significance of a time trend at the 5% level. Notably, according to Hamilton, The asymptotic values at the 10% level are superior to critical values created by Monte Carlo Experiments. See J.D. Hamilton, Time Series Analysis.

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