BANK MARKUP BEHAVIOUR AND THE ELASTICITY OF THE SUPPLY OF FUNDS IN CANADA:
AN EMPIRICAL ANALYSIS

by

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Abstract

This dissertation studies the nature of the elasticity of the supply of funds through the analysis of concepts as presented by both post Keynesian horizontalists and post Keynesian non-horizontalists. These two competing views are outlined, and pertinent issues are isolated. Empirical analysis is performed using data for the Canadian economy in order to assess the validity of both positions.

According to the horizontalist view, the base interest rate is under the authority of the central bank. Despite changes in liquidity preference, increasing risk and uncertainty, and financial innovations and liability management, the money supply function is best depicted as horizontal in an interest-money space. This situation is possible because of the central bank's control over the base interest rate through its reaction function. The central bank is effectively able to change the base interest rate in order to accommodate changes in the demand for credit. Consequently, the money supply function remains completely elastic.

According to the non-horizontalist view, the presence of liquidity preference, increasing risk and uncertainty, financial innovations and liability management, and frown costs imply the presence of constraints on monetary creation. Due to these constraints, as the demand for funds increases, the central bank cannot remain accommodative with respect to supplying any necessary funds to commercial banks. As a result of the interdependence between money supply and money demand, the central bank cannot effectively control the interest rate. Instead, the interest rate is partly endogenously determined, and thus, the money supply function is best depicted as being upward sloping in an interest-money space.

The review of the literature highlights pertinent issues in distinguishing between horizontalism and non-horizontalism. The distinguishing feature between horizontalists and non-horizontalists is the nature of the variability of the commercial bank markup (i.e., the spread between the base interest rate and the commercial banks' lending rate). It is the horizontalist view that this spread is not dependent on changes in demand. Consistent with this reasoning, changes in the interest rate are purely a supply-side phenomenon resulting primarily from the actions of the central bank.

In order to distinguish empirically between horizontalists and non-horizontalists, the variability of the commercial bank markup is tested, as well as any evidence of the presence of financial fragility. A markup that varies with changes in gross domestic

product would indicate that the determination of the interest rate was not purely a supply-side phenomenon, and would violate the horizontalist position. Any evidence of the presence of financial fragility resulting from increased firm indebtedness would also indicate that constraints on monetary creation exist, as consistent with non-horizontalist views. The econometric tests attempted in this dissertation address both these issues using Canadian data for the 1980 to 1995 period. The results of the empirical tests conducted do not provide any evidence to support an upward sloping money supply function.

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1. Introduction

All post Keynesian economists support the concept of endogenously determined credit-money, as opposed to the neoclassical exogenously determined money supply. Thus, all post Keynesians accept the position that the money supply function can best be represented by a horizontal line, as opposed to a vertical line, in an interest-money space. However, within the post Keynesian theory of the endogeneity of money[1], there exists conflict concerning the nature of the slope of the money supply function. Horizontalist post Keynesians believe that the money supply curve is highly elastic at a given rate of interest because the monetary system is capable of accommodating increases in credit demand at a given rate of interest. In contrast, non-horizontalist post Keynesians believe that the money supply curve becomes upward sloping due to existing obstacles to satisfying increases in credit demand.

Controversy between the two positions is centered on the extent to which credit creation can continue without endogenous demand pressures undermining an exogenously determined interest rate. Non-horizontalists believe that endogenous money theory must be elaborated to include demand-side forces prevalent in the market which influence the interest rate. These forces include changes in the demand for liquidity, increasing risk and uncertainty, and demand conditions leading to the presence of financial innovations and liability management. Horizontalists do not deny that these factors, which result from demand-side forces, impact on central bank behaviour (Lavoie, 1996). However, they maintain that the slope of the money supply curve is unaffected by endogenous forces due to the central bank's control over the base interest rate. Also, to state that both the money supply and the interest rate are endogenously determined implies that the central bank has

[1] Where the term 'money' is used synonymously with credit-money. Money is created when agents obtain bank credit, and is destroyed when banks are reimbursed. Thus, money is a flow rather than a stock (Lavoie, 1992, 151).

limited control over monetary policy. This reasoning is inconsistent with Keynesian economics (Moore, 1995, 261) and incompatible with endogenous money theory. The supply of funds remains elastic. Thus, liquidity preference, risk and uncertainty, and financial innovations and liability management can all be incorporated into a model with a completely exogenously determined interest rate without violating the model.

All post Keynesians acknowledge the underlying principle of the endogeneity of money, i.e., that loans create deposits and deposits create reserves (Moore, 1988a, Chapters 3-5). However, controversy arises in their interpretation of the step at which commercial banks are maintaining their reserves (Pollin, 1991, 367). Those who do not advocate horizontalism claim that the banking system is not capable of accommodating all loan demand since total reserves are constrained. Therefore, there are presumed obstacles to the central bank's ability to accommodate commercial banks, and consequently, there exist obstacles to commercial bank lending. Any excess demand for credit places an upward pressure on the interest rate as agents compete for limited liquidity. Thus, non-horizontalists argue that, due to constraints, demand-side forces (i.e., forces not necessarily resulting from central bank interest rate determination) lead to an upward sloping credit-money supply curve. In contrast, horizontalists state that the credit-money supply function is best viewed as a horizontal line because the supply of liquidity is infinitely elastic, and thus, unconstrained at a given interest rate. Demand conditions in the market do not interfere with the slope of the credit-money supply curve since, ultimately, the central bank has complete control over the base interest rate. The determination of the base interest rate is purely a supply-side phenomenon, and it is not the product of endogenous forces. The base rate can effectively impact other interest rates. All other interest rates may vary above the base rate, but this variation is not due to demand-side factors.

Following the introduction, Section 2 of this dissertation reviews the literature dealing with this issue. This review presents the views associated with structuralists, the liquidity preference school, and the principle of increasing risk as expressed mainly in the

work of Pollin, Palley, Wray, and Rousseas. These views are compared with the views of horizontalists as defined by Moore and Lavoie. The purpose of the review of the literature is to emphasize that the mere presence of a variable commercial bank markup, frown costs, liquidity preference, risk and uncertainty, financial innovations, and liability management does not violate the horizontalist position. What is of concern is the determination of the base interest rate, and the *nature* of the variability of the commercial bank markup. After reviewing the literature, there are only two relevant issues to consider when concluding in favour of an upward sloping curve over horizontalism. These issues are (i) whether fluctuations in interest rates as a markup over the base rate are due to demand factors, and (ii) if it can be shown that the 'limits of lending' are reached, as consistent with Minsky's hypothesis of firm financing over the business cycle. If these cases can be empirically verified, then the upward sloping position is correct.

Section 3 reviews previous econometric work relevant to the issues discussed in Section 2, and Section 4 presents an econometric study involving Canadian data from 1980 to 1995. This econometric study tests whether the variation between the base interest rate and the commercial banks' prime lending rate is due to demand factors in the economy. In addition, this study also tests for any evidence of financial fragility. These tests will enable conclusions to be drawn either in favour of a horizontal money supply curve or an upward sloping money supply curve. These conclusions are presented in Section 5.

2. The Review of the Literature

This section will outline relevant issues in distinguishing between horizontalists and non-horizontalists. Moore admits that both horizontalists and those in favour of an upward sloping money supply curve have more in common than they have differences. Thus, all post Keynesians can be generalized as 'horizontalists' rather than 'verticalists' (Moore, 1991, 405). However, as Lavoie states, the distinction between an upward sloping money supply curve and a horizontal money supply curve is important because incorporating an upward sloping supply curve into post Keynesian monetary theory borders on orthodox neoclassical models. Such models involve the presence of scarcity which is incompatible with post Keynesian monetary theory (Lavoie, 1996, 277). The purpose of the review of the literature is to emphasize that the mere presence of a variable markup, frown costs, liquidity preference, risk and uncertainty, financial innovations, and liability management does not imply the presence of scarcity.

2.1 Endogenous Credit-Money

According to Post Keynesian theory, the supply of money is credit-driven and endogenously determined (see for example, Lavoie, 1984, 1992; Moore, 1988a; Wray, 1988). The quantity of investment is not dependent on savings. To state otherwise is consistent with the neoclassical loanable funds theory. Instead, investment is dependent on the expected profit of firms (see Wray, 1988). Investment is not constrained by previously existing revenue since savings do not have to precede investment. Rather, investment and, indeed, productive activity in general, is financed *ex ante* through credit which is extended by banks to entrepreneurs. The main determinant of bank lending is expectations of future profits, both for the firm and for the bank. The larger the firm's potential profits, the

greater its ability to meet debt commitments, and thus, the greater the bank's willingness to lend to it. If the bank is confident that its borrowers are credit-worthy, and the bank's expected return from its own investments is high, it can continue lending without fear of facing liquidity problems. However, the bank will curtail its lending if it anticipates either a low return or a loss in the future.

In order to undertake production, an entrepreneur must prove that he is credit-worthy and able to meet his debt commitments (Wray, 1988, 133). Thus, the magnitude of borrowing is dependent on both the credit-worthiness of a borrower and anticipated profit. Since loans precede firm profits, banks do not inactively await deposits. Instead, they extend loans to credit-worthy borrowers, and continually manage their own assets and liabilities in attempts to maximize returns on their own investments. Due to this behaviour of the banking system, loans create deposits and deposits create reserves. Credit enables the firm to operate prior to the generation of income (Wray, 1988, 136), and firm debts towards the bank are eased when profits materialize. Since investment is not constrained by savings (Wray, 1988, 131), all post Keynesians agree that the money supply function is best represented by a horizontal line as opposed to a vertical line. In contrast, the vertical neoclassical money supply function implies that the scarcity of savings sets constraints on the flow of investment, and this neoclassical representation of the capital market does not pertain to post-Keynesian credit-driven production.

> The banks hold the key position in the transition from a lower to a higher scale of activity... The investment market can become congested through shortage of cash. It can never become congested through shortage of saving (Keynes, 1973, 14, 222).

A horizontal money supply function implies that the short-term interest rate is exogenously determined. The interest rate is the central bank's principle instrument in administering monetary policy. Thus, the quantity of credit demand can be indirectly controlled through central bank regulation of this short-term interest rate, referred to as the

base rate. The base rate is an administered rate, which means that its level is determined at the discretion of the central bank. This base rate is the price at which the central bank is able to provide reserves to the banking system. The central bank is the price leader in the banking system because of both its ability to set the base rate and its role as the lender of last resort (i.e., as the ensurer of liquidity). The quantity of credit supplied at a particular base rate depends solely on the public's demand for credit (Moore, 1984, 107; Kaldor, 1982, 24). Since changes in the quantity of credit supplied are a function of changes in the demand for credit, the horizontal credit supply function can be mathematically expressed by the equation $S_{\Delta Credit} = f(D_{\Delta Credit})$ [Eichner, 1987, 858]. Diagrammatically, in an interest-money space, the money supply function will be horizontal at the level of interest at which the central bank chooses to provide liquidity.

In relation to the central bank, the commercial bank is the price-taker. The commercial bank sets its own lending rate as a markup over the base rate. The prime lending rate is the administered rate at which commercial banks lend to their most credit-worthy customers. The prime rate is a markup over the commercial bank's costs. The magnitude of the markup reflects both the bank's monopoly power and its overhead costs (e.g., wages, capital) [Deriet and Seccareccia, 1996, 141], and hence, the markup is positively related to the bank's profit. Thus, commercial banks are price-setters in the retail market and price-takers in the wholesale market (Rousseas, 1987, 643).

Although all post Keynesians can be generalized as 'horizontalists' rather than 'verticalists' (Moore, 1991, 405), there remains the dispute amongst them concerning whether horizontalism can be maintained regardless of the demand for credit. Conflict arises over the existence of interdependence between the supply of credit and the demand for credit. Non-horizontalists state that interdependence causes the money supply curve to become upward sloping, which implies that endogenous forces are involved in the determination of the interest rate.

When Pollin (1991) made the distinction between the two positions within post Keynesian monetary theory, he coined the term 'structuralists' to refer to those who believe that an excess demand for loans would lead to structural changes in the composition of the money supply. These structural changes, arising from the banks' response to increased demand, cause interest rates to rise, and thus, are represented by an upward sloping money supply curve. Those who believe in the independence of the central bank in setting the base interest rate, and subsequently accommodating reserve requirements, were referred to as 'accommodationists'. The term 'accommodative endogeneity' was chosen to describe the reliance of commercial banks on an accommodative central bank which would provide them with any necessary reserves. It is more restrictive to refer to this position as accommodative endogeneity instead of horizontalism because (as discussed in section 2.7) horizontalism can prevail regardless of whether the central bank is accommodative (Lavoie, 1996).

When Hewitson (1995) distinguished between the two different approaches, she described them as being the '(constant) markup school' and the 'liquidity preference school'. Constant markups imply that the cost of funds (i.e., the discrepancy between the bank rate and the prime rate) would remain constant due to the relationship between the central bank and the commercial bank. In contrast, the 'liquidity preference school' was used to describe those who advocated that changes in demand between less liquid assets and more liquid assets interfered with the central bank's control over the interest rate. It is more restrictive to consider horizontalism as being synonymous with the markup school (Hewitson, 1995, 294) because (as discussed in section 2.11) the horizontalist position remains intact whether the markup is constant or not. Similar to Hewitson, Wray (1995) has classified the two competing positions as horizontalism and 'endogenous money-liquidity preference'.

In this dissertation, the two positions will be described as horizontalist and non-horizontalist, the latter pertaining to those supporting an upward sloping credit supply

curve. The primary area of conflict between the two positions involves interest rate determination. Non-horizontalists believe that a horizontal money supply curve implies that the supply of credit is unlimited. Such a situation can only be maintained with a central bank that is always accommodative with respect to supplying reserves. Moreover, they argue that such a situation cannot be possible in the presence of risk and uncertainty, changes in liquidity preference, and an increasing demand for credit. Thus, the issue concerns how much control the central bank can continue to maintain over interest rates as the financial system evolves (i.e., through financial innovations and liability management) to accommodate increases in the demand for loans in the market.

> The key difference between the two positions therefore, concerns the degree to which monetary authorities are free to determine the level of short-run interest rates exogenously in the market period as a policy instrument... The different policy implications of the two positions thus, pertain centrally to the freedom of the monetary authorities to administer the level of short-term interest rates exogenously and continuously (Moore, 1991, 406-407).

An upward sloping money supply curve implies that, although the interest rate may be exogenously determined over the short-run, this interest rate cannot *remain* completely exogenously determined. Consequently, in the long-run, the interest rate will not remain independent of demand conditions. [See Appendix A, Figure I]. Despite this reasoning, as described in the next section, the horizontalist position can be defended in the presence of demand pressures.

2.2 Horizontalism

The horizontalist position states that the base rate (i.e., the bank rate) is exogenously determined by the central bank (see for example, Moore, 1988a, 1988b;

Eichner, 1987, 858; Lavoie, 1996). The rate at which the commercial bank lends is determined by the commercial bank's markup over the base rate. The loan supply curve is constantly horizontal at the base rate. The base rate impacts all other short-term market determined interest rates (Moore, 1996, 89). All other market determined interest rates may vary as a markup over the base rate, as long as such variation is not due to cyclical factors (Lavoie, 1996, 277). Commercial banks must maintain a proportion of total deposits created by loans as reserves (where there exist reserve requirements). If they are unable to maintain their reserves, the central bank can intervene and supply these reserves. If it is unable to accommodate at the current base rate, the central bank will increase the base rate and accommodate at the new level. The base rate is continuously set in each short-run period by the central bank, and the long-term base rate is determined by expectations of the future short-term base rate. Thus, there is no long-term *ex ante* supply of credit, just a series of short-term rates (Moore, 1995, 265). Due to the central bank's authority over the base rate, horizontalists depict the money supply function as horizontal in an interest-money space.

The central bank can accommodate commercial banks either by increasing the availability of non-borrowed reserves[2] through expansionary open market operations, or by providing borrowed reserves at the discount window (U.S.). The supply of reserves is infinitely elastic at the interest rate at which the central bank chooses to provide liquidity. Thus, no quantity constraints exist on banks' reserve needs *at a particular interest rate* (Moore, 1988a, 263). To state otherwise would suggest the presence of scarcity in the monetary system.

According to horizontalists, the main inconsistency involving the upward sloping curve is in the concept that the interest rate may be both exogenously determined and

[2] Total reserves = borrowed reserves + nonborrowed reserves; where borrowed reserves include all reserves obtained from the central bank, and nonborrowed reserves include all reserves obtained through open-market operations.

endogenously determined. This implies that the interest rate can rise due to forces outside the control of the central bank, which is contrary to endogenous money theory (Moore, 1989, 486). According to Lavoie, the base rate is comparable to the price of a product as set by a monopolist (in this case the central bank) [Lavoie, 1996, 278-279]. The megacorp serves as the price leader, and its chosen price remains fixed until the period in which the megacorp decides to change it again. Similarly, the base rate is not controlled by market forces, and any changes in the base rate are made at the initiative of the central bank (Moore, 1988a, 266).

> For horizontalists the *base* interest rate is not a market phenomenon: it is a bureaucratically determined price, which may be more or less influenced by the political class and the financial lobby. The non-elected bureaucrats of the central bank have discretionary control over this interest rate. While the central bank only indirectly influences the monetary aggregates, it can fix the base interest rate with absolute precision, within the boundaries of existing financial wisdom (Lavoie, 1996, 278).

> ... short-term interest rates are an exogenous policy instrument, under the control of monetary authorities, rather than an endogenous market price equilibrating supply and demand for either loanable funds or liquidity or a "complex interaction" of authorities' and market forces (Moore, 1991, 406).

Due to the 'finance motive', funds are provided to the public upon demand. With endogenous money, there cannot be an upward pressure on interest rates. Keynes had stated that the presence of overdraft is, in itself, evidence that there is no scarcity of funds (Wray, 1992, 85). Moreover, firms have lines of credit which greatly exceed their needs (Moore, 1996, 90). To state that the money supply curve becomes upward sloping implies that interdependence between money supply and money demand results in an upward pressure on the interest rate during periods of increased loan demand due to a scarcity of funds.

Horizontalists argue that belief in a partly endogenously determined interest rate will result in rejection of post Keynesian principles and reversion back to neoclassical models (Lavoie, 1996, 277). This is evident in Dow's study (Dow, 1996). Dow states that as banks are unable to fund new loans during the downturn, pressures are placed on lending, and in extreme cases the supply curve will become vertical[3] (Dow 1996, 503). This reasoning is contrary to the post Keynesian theory of loans creating deposits. Likewise, Rousseas states that "to argue that the central bank fully accommodates any and all increases in the demand for money not only overstates the case but eliminates banks as a barrier to increased investment" (Rousseas, 1986, 45). However, according to horizontalists, in a world of endogenously financed investment, the only barrier to investment is a lack of credit-worthiness or low profit expectations. To state otherwise is to imply that investment is constrained by savings.

To summarize, the base interest rate is controlled by the central bank, and it is not the product of endogenous forces (Lavoie, 1992, 202). Horizontalists advocate that the relevant interest rate to the economy is the base interest rate because of the authority of the central bank. There are no demand-side factors which endogenously determine the discrepancy between the base interest rate and the commercial bank lending rate. A partly endogenously determined interest rate violates the post Keynesian concept of an exogenously determined interest rate. The implications of a partly endogenously determined interest rate will be studied in the following section.

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[3] In the same article, Dow states:

> Providers of funds to banks (through the interbank or equity markets) will likewise perceive a collapse in the value of the banks' assets and will endeavour to maintain their own liquidity by avoiding further commitment to the banks (Dow, 1996, 502-503).

This statement is incorrect since in the world of endogenous money, banks do not await to be provided with funds. Instead, loans make deposits.

2.3 Non-Horizontalism

The post Keynesian non-horizontalist position states that the aggregate loan supply schedule is positively sloped due to existing constraints within the financial system. Interdependence between loan demand and loan supply affects the degree of exogeneity of the interest rate. The money supply curve becomes upward sloping as the demand for credit increases because the central bank is not capable of enforcing fully accommodative policies. The presence of an upper limit on the quantity of loans extended causes commercial banks to economize on reserves through reliance on innovations and liability management (as opposed to the central bank). In economizing on reserves in order to increase their volume of loans, an upward pressure is placed on the interest rate. To state otherwise, i.e., that the money supply curve is completely horizontal, implies that the supply of reserves is infinitely elastic, and hence, any increases in loan demand would correspond to a constant proportional increase in reserves (Pollin, 1991, 370). The money supply curve is affected by endogenous demand-side factors in the market such as changes in liquidity preference, an increasing demand for loans, and increasing risk and uncertainty. These factors prevent the base interest rate from being fully exogenously controlled by the central bank (Wray 1990, 164-165), and prevent the central bank from impacting other short-term interest rates. Instead, these demand-side conditions cause structural changes in the composition of money as well as an upward pressure on the interest rate.

> Thus, the discount rate cannot be exogenously set, and cannot exogenously determine short-term interest rates. Indeed, it makes no more sense to argue that interest rates are exogenous than it does to argue that the money supply is exogenous... In other words, both the money supply and interest rates are endogenously determined (Wray, 1990, 187-188).

The horizontalist position is considered extreme and inaccurate (Davidson, 1989, 490). Davidson states that the structuralist position is not incompatible with endogenous money because post Keynesian monetary theory does not state that the central bank *must* be accommodative (Davidson, 1989, 489). Graphically presenting the money supply curve as horizontal is only a method of simplifying the basic post Keynesian theory of endogenous money. Instead, the money supply is only 'weakly endogenous' (Arestis and Driver, 1988, 122; Rousseas, 1989, 478). Rousseas states that only if overdraft facilities were unlimited would the interest rate remain unchanged, and the supply of money be perfectly elastic (Rousseas, 1986, 38). Limited overdraft implies the presence of constraints on finance. Thus, non-horizontalists maintain that interest rates rise due to constraints present in the financial system, namely the scarcity of reserves. These constraints will become more limiting as loan demand continues to increase.

> ... a reduction in the stock of reserves will necessarily reduce the quantity of such loans. Competition among banks for the scarce reserves needed to make these loans will then bid up interest rates paid by banks to depositors and this in turn will raise interest rates throughout the economy (Romer and Romer, 1990, 150).

To elaborate using Palley's example (Palley, 1991, 399), assuming that the demand for loans is increasing, the marginal cost of loans to firms increases as obtaining additional funds becomes more costly. As banks attempt to meet this increased demand, further pressure is placed on interest rates as firms continue to compete for limited funds. Banks must acquire the reserves to support deposits resulting from these increased loans by either (a) borrowing at the discount window, or (b) borrowing on the market from other banks, or (c) procuring additional funds from the public. Regardless of the choice of financing, banks' marginal costs will rise, in the first case due to frown costs associated with borrowing at the discount window, in the second case from the upward pressure on the interest rate as banks compete for funds, and in the third case from offering customers bank

liabilities with lower reserve requirements. In all three cases, additional funds become more costly for banks. This results in the supply curve becoming positively sloped. Palley (1991) criticizes Moore for not considering changes in demand by the public which would cause marginal costs to rise [i.e., due to increased loan demand and increased risk and uncertainty].

> The volume of bank assets and liabilities is determined by the intersection of schedules of marginal revenue from assets and marginal costs of liabilities. At lower volumes, these schedules may be flat and parallel, as Moore implies by his description of price setting and markups, but as volumes increase to include wholesale uses and sources of funds, marginal revenues will surely decline and marginal costs will surely rise (Dean, 1989, 204).

According to horizontalists, the explanation that Palley presents is incomplete. Continuing to extend credit during a time of increasing demand does place an upward pressure on the marginal cost of funds. However, Palley does not take into account the impact of the simultaneous stage of deposit creation which provides banks with the opportunity to make further profits. To state that the curve becomes upward sloping is to omit the impact of deposits increasing simultaneously as loans increase. In extending loans, deposits are created which are used to generate profits. Therefore, the revenues of banks do not decrease, but rather they increase. As debt increases, equity also increases, thereby maintaining (or decreasing) the bank's debt to equity ratio on an aggregate level (Lavoie, 1996, 286)[4]. Thus, rising volumes of loans do not necessarily imply that the interest rate is being bid up.

Some non-horizontalists (for example, Dean, 1989; Pollin, 1991, 1996) question the horizontalist assertion that the base rate is exogenously determined. According to Dean

[4] As emphasized by Lavoie (1996), it is important to make the distinction between an individual bank's situation and the situation on an aggregate level. The leverage position of a single bank does not necessarily reflect the leverage position of the entire banking system.

(1989), the base interest rate cannot be set independently of the demand for reserves. The interest rate is not completely determined by the central bank because the marginal cost of bank funds is market determined. Consistent with this reasoning, causality should run from the market rate to the bank rate. Dean questions the central bank's control over the base rate. Dean states that in the U.S., the federal funds rate "is hardly 'set by the central bank': it fluctuates minute by minute on the inter-bank market for funds" (Dean, 1989, 204). Pollin (1991, 1996) states that it is not the central bank which sets the base rate, but rather the long-term market rate which determines the base rate. Thus, the relevant interest rate to the economy is the long-term market rate. Dean also explains that in Canada, the bank rate is market determined since it is set as a markup over the Treasury bill rate which is determined on the auction market[5]. Although the Bank of Canada has an influence over the market for Treasury bills, these bills are close substitutes for other commercial bills whose rates are determined by the market (Dean, 1989, 204). This argument faces the obvious criticism that the Bank of Canada has a large role on the auction market.

Those who support a partly endogenously determined interest rate state that horizontalism is not applicable to the long-run. For this reason, Niggle criticizes Moore for not presenting a medium-term or a long-run money supply curve (Niggle, 1989, 1185). Niggle states that the money supply curve may be horizontal in the short-run, but it cannot remain perfectly elastic. As there exists a continuous increase in the demand for credit, the marginal cost of funds increases since reserves are constrained (Niggle, 1991, 142). As Hicks had stated as early as 1937, the money supply curve is horizontal in the short-run, but is upward sloping in the long-run, being "nearly horizontal on the left, and nearly vertical on the right" (Hicks, 1937, 154). This is because of the two limits placed on the money supply curve: there exists a minimum level for the interest rate which will not be

[5] Despite Dean's reasoning, although the Bank of Canada did not directly influence the bank rate from March 1980 to February 1996, it indirectly influenced it through the 91-day Treasury Bill rate. The central bank could control the bank rate by controlling the quantity of Treasury Bills auctioned on the market and/or by bidding high at the auctions in order to increase the rate (Boreham and Bodkin, 1988, 243).

undercut, and, due to constraints, there exists a price at which the maximum amount of financing is made available. Thus, according to this reasoning, in disregarding this upper limit to finance, horizontalists fail to distinguish between the short-run and the long-run (Harrington, 1983, 65).

> Only we can now generalize our LL curve a little. Instead of assuming, as before, that the supply of money is given, we can assume that there is a given monetary system-that up to a point, but only up to a point, monetary authorities will prefer to create new money rather than allow interest rates to rise. Such a generalized LL curve will then slope upward only gradually - the elasticity of the curve depending on the elasticity of the monetary system (Hicks, 1937, 157).

Although horizontalists specify that exogeneity refers to the base rate only (Lavoie, 1996), the majority of post Keynesians do not believe that the money supply curve should be depicted as horizontal. The upward sloping curve is presented in the case of the following situations: the base rate can rise due to endogenous forces either because the central bank is not accommodative, or because the central bank is accommodative, but banks, or the public, or both, either become more illiquid, or face increasing uncertainty (Lavoie, 1996, 277). Despite these factors, changes in demand do not endogenously affect the base interest rate. The horizontalist position can be defended in every situation: whether the central bank is accommodative or not, and in the presence of liquidity preference, risk and uncertainty, and despite financial innovations and liability management (Lavoie, 1996). These various cases will be discussed individually in sections 2.4 through 2.10.

2.4 Accommodation by the Central Bank

An accommodative central bank will provide reserves on demand if banks experience difficulty in obtaining reserves to back up their deposits. Commercial banks

lend to credit-worthy borrowers at a markup over the base rate. They must maintain reserves when deposits are created so that their own liquidity positions are not threatened. Banks accommodate reasonable loan requests only, and therefore, do not satisfy 'any and all' loan requests as still misinterpreted by some (such as Knodell, 1995, 267). An accommodative central bank will provide reserves at the base rate if the banks cannot maintain adequate reserves. Accommodative endogeneity is not synonymous with horizontalism because (as discussed in section 2.7) the central bank can be non-accommodative and still not violate the horizontalist model.

The central bank has incentive to follow accommodative policies because doing otherwise can result in loss of control over the financial system and a potential financial crisis [Lavoie (1984, 780); Arestis and Eichner (1988, 1007)]. The central bank will always serve as the 'lender of last resort' since failure to do so would threaten its role as price leader, and will result in rising interest rates. Such a situation can lead to a financial crisis or a cyclical downturn. If the central bank is not accommodative, interest rates will be bid up as banks compete for funds. This will result in the necessary sale of financial assets and consequent falling asset prices, rising interest rates, and a possible financial crisis (Eichner, 1987, 855). If commercial banks do not accommodate firms as they attempt to finance their outstanding debt through the process of rolling over, the result will be depressed assets prices as firms are pressured to sell their assets in attempts to reduce as much of their debt as possible (Minsky, 1980, 1982). Despite rising interest rates, the demand for loans will be high as firms require liquidity to ease their debts and to cover their interest payments. Consequently, the central bank will have to place pressure on the commercial banks to reduce their lending activity in order to prevent lending rates from rising further.

If the central bank was non-accommodating over a long period of time, commercial banks would be less willing to extend credit. This would eventually lead to a financial crisis as described by Minsky [see Section 2.12]. If firms are unable to receive loans even at higher interest rates, such credit crunches resulting from non-accommodation will

threaten both aggregate production and firm viability, and will lead to a cyclical downturn. It is such a situation that the central bank would rather avoid through accommodative policies (Hewitson, 1995, 288).

> (The central bank) can never quantity-constrain bank reserves or the money stock in the short-run, without by so doing abrogating its fundamental role as the financial system's provider of ultimate liquidity (Moore, 1984, 106).

According to Cardim de Carvalho, a perfectly accommodating central bank is not possible because the money supply is determined by banks' liquidity preference, as expressed through their portfolio choices (Cardim de Carvalho, 1992, 110-112). When liquidity preference is low, banks are able to meet the credit needs of their customers. However, when liquidity preference increases, banks are less willing to extend additional credit, and accommodation will be replaced by credit rationing (Wray, 1990, 165).

Palley admits that his view on this subject is 'eclectic'. He states that under normal conditions, the central bank will not be fully accommodating. However, during times of financial crisis, it will accommodate since the consequences of being non-accommodating would be too great (Palley, 1991, 400). Of course, as Palley admits, this raises the question of what conditions are characterized as 'normal', and what conditions constitute a 'crisis'. The presence of a price on reserves, as reflected through frown costs (described in the next section), also conflicts with the concept of a perfectly elastic supply of reserves. However, as will be explained in section 2.7, regardless of whether the central bank is accommodative or not, the horizontalist position remains intact.

2.5 Frown Costs

Frown costs are the implicit costs to commercial banks associated with borrowing from the central bank. The cost associated with borrowing at the discount window is possible future denial of borrowed reserves. Structuralists state that the main inconsistency regarding accommodative endogeneity is that it does not provide a sufficient explanation for the existence of frown costs in the United States (Pollin, 1991, 371; Dean, 1989, 203). Structuralists state that these costs imply that constraints on monetary creation exist in the system. Moreover, such constraints are proof that the central bank cannot always accommodate loan demand since borrowed reserves are unquestionably rationed at the discount window.

The greater the discrepancy between the bank rate and the commercial bank lending rate, the greater the potential profits from lending. Thus, the commercial bank's propensity to borrow from the discount window at the base rate will be greater when the markup is large because the bank will in turn be able to lend at the higher rate (Moore, 1988b, 375). In response to Moore's statement that "in all developed financial systems additional reserves are continuously available to banks on demand" (Dean, 1989, 203), Dean states that this is not the case because in the U.S., reserves are rationed through frown costs, and in Canada, banks rarely borrow from the Bank of Canada (Dean, 1989, 203). Despite such reasoning, the presence of frown costs does not imply the presence of scarcity in the monetary system. It may imply the presence of a scarcity of borrowed reserves, but it does not imply a scarcity of total reserves. If banks cannot borrow sufficient reserves from the discount window, they will obtain these reserves from the market. Frown costs do not affect the markup because they are considered as an implicit cost to the bank, and thus, are accounted for when the bank considers its marginal costs (Moore, 1988b, 376).

> Such a reaction function includes the case of the so-called frown costs, when commercial banks are forced to borrow reserves. Rising frown costs, and its consequent rising credit-money supply curve, are thus, just another aspect of the non-accommodating behaviour of the central bank. To a given monetary stand should correspond given frown costs (Lavoie, 1996, 280).

Frown costs are a tool used by the central bank to encourage commercial banks to retrieve reserves through the market mechanism. The presence of frown costs implies that the central bank may not always be accommodative. However, as discussed in Section 2.7, non-accommodation, in itself, is not evidence in favour of an upward sloping money supply curve. As discussed in the next section, similar to frown costs, the mere existence of unsatisfied borrowers is not sufficient evidence against horizontalism.

2.6 Credit-Worthiness

Another misinterpretation of the horizontalist stance, making such a stance seem extreme and unrealistic, is that an accommodative central bank supports an unconstrained banking system in which commercial banks grant any and all demands for credit, expecting the central bank to accommodate their reserve needs. Those supporting the upward sloping curve argue that there is always a 'fringe of unsatisfied borrowers' - those who are either denied credit or who receive less than requested. Their presence implies that there are constraints in the system which cause the money supply curve to become upward sloping as credit demand increases. Stating that full accommodation exists implies that there is no fringe of unsatisfied borrowers, no credit rationing, and thus, no barriers to investment (Rousseas, 1986, 45).

> Moore's argument for a horizontal money supply (rather than simply an endogenous money supply) seems to rest on the ability of the central bank to set an interest rate and on the willingness of banks to offer an infinite quantity of credit at any given interest rate (Wray, 1989, 1189).

The above statement that Wray makes is incorrect since banks are selective with respect to the credit-worthiness of borrowers. A credit-worthy borrower can continue to borrow within the borrower's designated credit limits. The unsatisfied borrowers consist of either those who would not be granted credit under any conditions, or those who would have received credit if the standards of credit-worthiness had not been so high. If a firm does not continue to meet the credit standards as established by the bank, it will be refused further credit. A bank will not adjust its lending rate to satisfy the demand of customers who are not credit-worthy.

> A firm can draw as much as it wants on its agreed line of credit, at a fixed cost. If it needs more, the bank will have to take a decision. If the response of the bank is positive, the line of credit will be extended and the same interest rate will prevail. If the bank has no confidence in the customer, no increase in the rate of interest will compensate for the likelihood of failure. The bank will provide no further loan. Offering to pay higher interest rates on advances will not do (Lavoie, 1996, 287).

Without credit controls, the money supply would not be quantity constrained. (Moore, 1988a, 263). There is nothing in the accommodationist argument to state that the financial system will accommodate infinite amounts of credit. Horizontalists do acknowledge that constraints exist in the system, however, constraints do not interfere with the demands of *credit-worthy* borrowers, where 'credit-worthiness' is a variable which is determined by the current level of demand since it is dependent on the number and nature of potential borrowers[6]. For example, Mott states that "a heavy demand for investment can exhaust the market" (Mott, 1985-86, 222) placing an upward pressure on interest rates. This 'exhaustion' of the market implies the neoclassical principal of scarcity. Any upward pressure on interest rates can be avoided by re-defining the standards of credit-worthiness

[6] According to Dow, it is merely a matter a semantics to refer to changes in the definition of 'credit-worthiness' as an act of credit rationing (Dow, 1996, 499).

to be compatible with the current demands faced by the financial system, thereby eliminating scarcity as a factor.

Although the existence of both frown costs and unsatisfied borrowers implies that the central bank (and therefore, the commercial bank) cannot remain accommodative, as discussed in the next section, horizontalism holds in the presence of non-accommodation.

2.7 Non-Accommodation

The difficulty in accepting accommodative endogeneity is in the fact that there are many other factors in the economy which affect long-term interest rates instead of only expectations of future short-term base rates. The central bank could restrict borrowed reserves to prevent high rates of inflation, or to avoid a devaluation of the domestic currency (Pollin, 1991, 374). Wray states that if the central bank was in complete control over the interest rate, then it should not be prevented from setting an interest rate which would result in full employment (Wray 1990, 185). However, Moore states that the central bank has a reaction function (see Lavoie, 1996, 280) which determines the limits within which the base rate can be set[7] (Moore, 1988a, 265). Demand forces are incorporated into this reaction function which specifies how the monetary authorities will react to deviations in these variables. This reaction function enables the interest rate to be exogenously determined by the central bank despite market forces.

[7] According to Wray, since the reaction function of the central bank incorporates all the endogenous forces in the economy, then it is contradictory to state that the interest rate is exogenously determined (Wray, 1995, 279). Similarly, Pollin states:

> In short, given within Moore's own framework, the 'exogenous' determination of interest rates is substantially influenced by a large number of endogenous factors. Why then insist, even if rhetorically, that interest rates are set by central banks alone? (Pollin, 1996, 502).

Despite this reasoning, to state that the base interest rate is not exogenously determined due to the presence of the central bank's reaction function, is not correct. If the central bank, using its reaction function, can set a base rate at which it can be accommodative, and which will impact other interest rates, then the interest rate *is* exogenously determined. If, however, using its discretion and its reaction function, it sets a base interest rate which causes it to lose control over the banking system leading to a financial crisis, then the base rate cannot be exogenously set.

> Market forces do have a substantial role in the determination of long-term rates, insofar as long-term rates depend on market participants' collective expectations of the level of future short-term rates. These in turn are jointly dependent on expectations of macroeconomic performance and of the Federal Reserve's "reaction function" (Moore, 1991, 412).

The reaction function of the central bank takes into account factors such as inflation and the exchange rate when setting the base rate. It is not difficult for the central bank to have exchange rate expectations because it can cause changes in the exchange rate by buying or selling the domestic currency. The future inflation rate can also be projected. For example, in Canada, the expected inflation rate is calculated from the discrepancy between the yields on government 30-year conventional and Real Return Bonds (Bank of Canada, 1995b, 19).

According to Pollin, "if reserve-short intermediaries consistently seek to obtain managed liabilities before going to the discount window, this suggests the presence of a constraint on total reserve supply" (Pollin, 1991, 371). As a result of this constraint, the central bank is limited in its ability to pursue accommodative open market operations, resulting in an upward sloping money supply curve. The less accommodative the central bank is, the greater the slope of the money supply curve.

Due to market pressures resulting from the actions of the private sector, the central bank may be unable to remain accommodative at a particular interest rate. However, the fact that the central bank cannot consistently follow accommodative polices should not affect the activities of commercial banks. This is because, with regards to maintaining reserve requirements, funds retrieved on the market are equivalent to funds directly borrowed from the central bank (Moore, 1991, 408).

It is important to note that, according to horizontalism, the central bank does not have to remain accommodative at a fixed interest rate. It can instead increase the interest rate, and be accommodative at this new interest rate. Although Wray confuses interest rate

targeting with interest rate pegging (Moore, 1995, 263), the central bank does not peg the interest rate leaving it unchanged over time. Thus, the central bank does not maintain the interest rate at a particular level regardless of changes in the demand for credit. The central bank can instead change the exogenous rate of interest (in reaction to changes in the market), thereby engaging in monetary policy. However, this does not imply that the central bank can vary the interest rate between 'plus and minus infinity', but rather, that the central bank can use its discretion in independently setting the base rate (Moore, 1991, 406).

> But by setting interest rates, the central bank does not have to maintain them unchanged at a constant level over time. Rather central banks are generally observed to change the level of their interest rate instrument, depending on the state of the economy and their ultimate policy objectives... But the central point is that the short-run money supply is always horizontal (Moore, 1988b, 384).

According to Kaldor, graphically, the horizontalist position is most accurately described by *a set* of horizontal lines, where the central bank is accommodative at each level of base interest rate. In any one short-run period, the money supply curve is horizontal at the level at which the central bank can provide liquidity (Moore, 1984, 106). If banks cannot meet increased loan demand, and if continued accommodation by the central bank at a particular interest rate is not possible, then the base rate is increased by the central bank. Thus, the horizontal curve shifts up without becoming upward sloping. This is the most realistic model depicting the horizontalist stance, and is not merely used to simplify the horizontalist position.

> So long as borrowers are within their credit allocation, a horizontal market period supply function may simply be viewed as a graphic representation that the supply price is given in the market period, *until sellers alter their administered price* (Moore, 1991, 406).

> Diagrammatically, the difference in the presentation of the supply and demand for money, is that in the original version (with M exogenous) the supply of money is represented by a vertical line, in the new version by a horizontal line, *or a set of horizontal lines, representing different stances of monetary policy* (Kaldor, 1983, 22).

Non-horizontalists believe that it is unrealistic to assume that the central bank could constantly follow accommodative policies, considering that one of the goals of the central bank is to control the inflation rate. Continuous accommodation at a particular interest rate could lead to inflation.

> For interest rates not to rise during an investment boom, the supply of finance must be infinitely elastic which implies either that a flood of financial innovation is taking place or that the central bank is supplying reserves in unlimited amounts. But this, in turn, implies that investment is an ever-increasing proportion of output and that accelerating inflation is tolerable (Kindleberger and Laffargue, 1982, 33).

Harrington states that the central bank may be able to set the interest rate in the short-run, and possibly accommodate demand pressures by increasing the interest rate, but this could lead to the problem of increasingly higher interest rates (Harrington, 1983, 65-66).

When taking the set of horizontal lines into account, the horizontalist position and the structuralist position appear to become identical (i.e., graphically, not intuitively) since the central bank is following a policy of 'leaning against the wind'. In this case, assuming that the central bank is responding to increases in demand, both the demand curve and the horizontal supply curve will shift up resulting in a dynamic upward sloping supply curve being generated. Graphically, an upward-sloping curve will be drawn through the intersection points between the horizontal money supply curves and the money demand curves (see Appendix A, Figure II). Consequently, the situation is one in which it *appears* that we are dealing with an upward sloping money supply curve. If the base rate had been pegged, the dynamic money supply curve would be flat (Palley, 1994, 79). Whereas the

static supply curve remains horizontal, the dynamic curve supply may be horizontal, upward sloping, or downward sloping, depending on central bank policy.

> It should also be clear that the upward slope of the dynamic supply curve rests on the non-accommodating behaviour of the central bank. Had the central bank pegged the federal funds rate, the dynamic supply curve of credit-money would be perfectly flat. If the central bank had decided to decrease the federal funds rate, the dynamic credit-money supply curve would be downward-sloping (Lavoie, 1996, 281).

Thus, structuralists confuse the dynamic supply curve with the static supply curve when they state that the long-run interest rate is not under the control of the central bank.

The next section discusses how the horizontalist position can be upheld in the presence of liquidity preference, again due to the 'set' of horizontal lines.

2.8 Liquidity Preference

Liquidity preference is the propensity to exchange less liquid assets for more liquid assets (see Wray, 1990, 163-164; Dow and Dow, 1989, 148). The liquidity preference school originates from Keynes' *General Theory* which stated that the rate of interest is determined by the public's choice between liquid assets and less liquid assets, where this demand is dependent on the 'speculative motive'. Liquidity preference determines asset pricing. If liquidity preference rises due to a loss of confidence in less liquid assets, then these asset prices will be depressed as the public attempts to obtain liquidity either by decreasing new purchases of less liquid assets, or by selling assets. Likewise, if liquidity preference falls or the money supply rises, then prices of less liquid assets will increase (Wray, 1992, 73). When the demand for liquidity is high, agents will not react by substituting from liquid assets into less liquid assets. Since liquidity is limited, inevitably, interest rates must rise (Wray, 1992, 79). This rise in interest rates would further constrain

investment (Wray, 1991, 11), whereas a fall in liquidity preference would lower interest rates and encourage investment.

According to non-horizontalists, liquidity preference is dependent on the actions of all agents, and is outside the control of the central bank. Therefore, changes in liquidity preference result in a less than fully elastic money supply function.

> As the debt to equity ratios of borrowers increase, the riskiness of loans increases and commercial banks have to be rewarded with higher interest rates to encourage them to forego liquidity and enter into illiquid industrial loans... This conflicts with Moore's claim that the money supply schedule is horizontal (Hewitson, 1995, 296).

According to Wray, liquidity preference theory is incompatible with horizontalism. Consequently, Wray integrates liquidity preference theory into endogenous money theory, but without specifying an exogenously determined interest rate (Wray, 1992).

Davidson states that money supply endogeneity does not necessarily imply that the money supply curve is *fully* endogenous. Instead, the money supply curve is ideally represented by an upward sloping curve which may even become downward sloping due to changes in liquidity within the system (Davidson, 1988, 158; 1989, 489). According to Dow and Dow, the central bank sets the interest rate in the short-run during the boom period, while the long-run rate is determined by liquidity preference (Dow and Dow, 1989). Thus, liquidity preference determines the spread between the short-term interest rate and the long-term interest rate (Wells, 1983, 533; Dow and Dow, 1989, 148). This implies that the long-term interest rate is market determined instead of being chosen at the discretion of the central bank. The money supply curve becomes upward sloping because, even though commercial banks enter risk into their reaction function, risk is difficult to assess since it is difficult to measure liquidity preference (Dow and Dow, 1989, 154). Dow and Dow state 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" (Dow and Dow, 1989, 149). Consequently, the money supply curve faced by borrowers is upward sloping.

Wray criticizes Moore for not including liquidity preference in his model (Wray, 1991, 17; 1992, 80-82), and for consequently failing to consider the impact of risk and uncertainty. According to Wray, Moore's omission implies that when a borrower wants a liquid asset, the borrower will be issued the asset at a *fixed* price (Wray, 1992, 82). This unrealistic assumption implies that the desired level of liquidity is always met by the commercial bank which will make pegging asset prices its priority, and therefore, will not be concerned about its own liquidity position. In order to peg the prices of a wide range of assets, the Federal Reserve would have to be responsible for buying these assets. Wray also states that Kaldor's and Moore's view of endogenous money should have incorporated Minsky's impact of changes in leverage ratios because Wray assumes that liquidity preference, like leverage ratios, fluctuates over the course of the business cycle (Wray, 1991, 5).

Due to liquidity preference, accommodation by the central bank follows cyclical behaviour (Dow and Dow, 1989; Dow, 1996). During the upswing, there will be an increased demand for credit as firms and entrepreneurs have high profit expectations and plans for investment. At this point, there is low liquidity preference and a high demand for investment in non-liquid assets. This results in increasing prices of less liquid assets and a highly indebted system. As interest rates are bid up, investment drops. Moreover, those who are heavily indebted find it increasingly difficult to make their interest payments. During the downswing, there is an increase in liquidity preference as agents attempt to ease their debts. It is difficult for the central bank to remain accommodative in the downswing since interest rates remain high. This scenario is a combination of the instability hypothesis and liquidity preference theory (Hewitson, 1995, 299-304).

> The overall picture, then, is of credit creation accommodating demand when liquidity preference is low, but not when liquidity preference is high (Dow and Dow, 1989, 161).

> ... we can abstract from the problems of differential liquidity preference and consider the broad sweep of the cycle as being characterized by falling liquidity preference in upswings and rising liquidity preference in downswings (Dow and Dow, 1989, 158).

Smithin describes the position which opposes horizontalism as the 'liquidity preference position' (Smithin, 1994, 108-109). He states that even if the central bank was trying to set the interest rate in one direction, it could move in the opposite direction during times of crisis due to changes in liquidity preference (Smithin, 1994, 111-112). Thus, the central bank would have little control over the base rate and little impact on all other interest rates.

> The remaining debating point is then, whether the setting of short rates by the central bank uniquely determines the entire structure of interest rates including long rates, or whether there is still room for an alternative, but still monetary, principle by which interest rates other than those directly controlled by the central bank can be determined (Smithin, 1994, 110).

If liquidity preference did not exist, then the rate of interest as set by the central bank would be permanently fixed. In the presence of a lack of accommodation, interest rates may rise if banks become less liquid. In the presence of accommodation, interest rates may still rise if either banks or customers have become illiquid, or interest rates rise because of the forces of uncertainty (Lavoie, 1996, 277). According to Wray, both situations would result in an upward sloping money supply curve because the central bank cannot fully accommodate the increasing demand for liquidity (Wray, 1988, 143).

Contrary to Wray's interpretation, horizontalism (Moore, 1995, 263) does not imply that the central bank can set all interest rates despite changes in liquidity preference.

Instead, the central bank's reaction function (Moore, 1989, 487) takes into account changes in liquidity preference when setting the base interest rate. Due to this reaction function, changes in liquidity preference can be graphically represented by shifts in the horizontal money supply curve, as opposed to a change in slope. Therefore, the impact of liquidity preference can be captured through the set of horizontal lines, where each line corresponds to a different level of liquidity preference.

There is no inconsistency with horizontalism and liquidity preference theory. The central bank considers changes in liquidity preference when setting the base interest rate, and commercial banks take into account changes in liquidity preference when setting their loan rates. Liquidity preference does not determine the long-term base interest rate. Instead, it determines the spread between the base interest rate and all other interest rates (Lavoie, 1996, 293-294).

Changes in liquidity preference arise from changes in risk assessment. As agents perceive more risk, they switch from less liquid assets into more liquid assets. Risk and uncertainty, and its role in the upward sloping money supply curve will be addressed in the next section.

2.9 Risk and Uncertainty

The two types of risk facing a bank are liquidity risk and default risk (Baltensperger, 1980, 2). Liquidity risk is dependent on the risk/return tradeoff. While it is less risky to keep a large quantity of cash or marketable securities as assets, these liquid assets earn little interest, and therefore, contribute little to bank profit. The opportunity cost for the bank of holding liquid assets may exceed the interest earned on liquid assets. Thus, there exists a tradeoff between reducing risk and making further profit (Gardner, 1988, 290). According to the Kaleckian principle of increasing risk, the money supply curve

becomes upward sloping as banks continue to satisfy increasing levels of credit demand because banks are placing themselves in risky, more illiquid positions (Kalecki, 1937, 442). As lending increases, lender's risk rises due to the increased possibility of default.

Arestis and Driver describe the money supply function as being 'weakly endogenous' as a result of the forces of risk and uncertainty which are apparent in liquidity preference. In their view, belief in the endogeneity of money is synonymous with the acknowledgment of an upward sloping money supply curve (Arestis and Driver, 1988, 122). The slope of the money supply function is dependent of the level of risk, where banks are willing to take on riskier positions if compensated with higher interest rates.

> ... the supply function of money would be upward-sloping rather than horizontal, reflecting the view that, as banks increase the supply of money in response to increases in the demand for credit, they will require higher interest rates as compensation for taking what are perceived to be more illiquid, and hence riskier, positions (Smithin, 1994, 108).

Le Héron draws the money supply curve as being initially horizontal at the base rate, but then becoming upward sloping due to the marginal risk of the lender. The height of the upward sloping section of the curve represents the magnitude of lender's risk (Le Héron, 1986, 83), where this height varies with the degree of anticipated risk:

> En intégrant le risque du prêteur, nous devons abandonner la droite horizontale souvent introduite dans le schéma de la détermination de l'investissement par la comparison de l'emc et de r. Le risque marginal du prêteur se traduit par une courbe croissante à partir d'un certain niveau de crédit; les banquiers modulent le taux d'intérêt du marché monétaire en fonction de leur coût (taux de base bancaire) et de ce risque (Le Héron, 1986, 81).

As demonstrated by Kalecki, the money supply curve is composed of two parts: the base rate of interest, and the magnitude of marginal risk. The height of the left-most section

of the curve is determined by the level of the base rate, and the height of the upward sloping section constitutes the marginal risk component. The curve can shift up if the borrower becomes more risky, but it will always remain upward sloping (Kalecki, 1937, 443). Thus, even if borrower's risk stays constant, lender's risk will eventually rise (Lavoie, 1996, 288). As balance sheets expand, so will lender's risk (Wray, 1991, 15). The cost of funds is directly related to the degree of anticipated risk.

> A firm can draw as much as it wants on its agreed line of credit, at a fixed cost. The cost of borrowing is set in advance, according to the risk grade assigned to the firm, which may depend more on the absolute size of the firm's earning assets than on any measure of its debt to equity ratio (Lavoie, 1996, 287).

The rising supply curve incorporates lender's risk as firms' debt to equity ratios increase upon refinancing. The greater the overall level of firms' indebtedness, the greater the risk for banks, and therefore, firms may be forced to borrow at a higher interest rate (Kalecki, 1937, 442). Thus, according to non-horizontalists, to state that the curve is infinitely elastic is to ignore the forces of risk and uncertainty as determined by 'animal spirits'.

Uncertainty exists because the central bank can only make projections in assessing expectations of inflation. Expectations regarding inflation can feed into expectations about future inflation. This can in turn lead to a higher, or lower, trend inflation rate than the policy objective. Uncertainty arises for commercial banks due to the difficulty in assessing the true credit-worthiness of customers. The lack of information concerning the credit-worthiness of a borrower makes default a possibility (Wray, 1990, 179). In approving a loan, the bank foregoes liquidity, and increases its ratio of risky assets to equity and liquid assets. If the loan was extended to a credit-worthy customer, future equity will increase, but if the loan was not extended to a credit-worthy customer, then the bank will experience a loss. Although banks maintain relationships with their customers, they cannot be

completely certain whether a customer will continue to remain credit-worthy after a loan has been extended (Wray, 1990, 146). Thus, in order to avoid the second scenario, interest rates must increase to compensate for the risk involved in dealing with potentially risky customers (Wray, 1990, 188). A previously less risky customer can become more risky as leverage ratios rise (Wray, 1990, 179). There is also uncertainty in setting the long-term rate since the bank cannot foresee the outcome of its own investments. In addition, the liquidity preference of the public can be undervalued, thus underestimating the interest rate required on the long-term bond (Wray, 1990, 167). Due to the presence of risk and uncertainty, credit rationing is required, and hence, not all loan demand is met (Wray, 1991, 15).

Moore states that as long as reserves and capital expand at a constant rate, banks do not experience rises in lender's risk, and therefore, the curve does not become upward sloping (Moore, 1995, 264-65). Moreover, there is no evidence to support the concept that as economic activity increases, risk necessarily increases. However, even if one were to omit risk and uncertainty as being a factor in causing an upward sloping money supply curve, according to non-horizontalists, there still remains the impact of the banks' response to increases in credit demand. Their response may result in an upward slope. The presence of financial innovations and liability management is evidence that demand factors do impact on the banking system. It will be further assessed in the next section whether the presence of financial innovations and liability management results in the money supply curve being most accurately described by an upward sloping curve.

2.10 Financial Innovations and Liability Management

Since reserves are non-interest bearing, they are an implicit cost to commercial banks. Thus, banks, in order to maximize profits, will attempt to decrease reserve

requirements. Such actions have led to increased liability management [and similar techniques such as 'upstreaming' and 'securitization' (Niggle, 1991, 146)], and numerous financial innovations (see Podolski, 1985; Freedman, 1983) such as certificates of deposits, EuroCDs, purchase and resale agreements, and the sale of bank holding company commercial paper (Arestis and Eichner, 1988, 1008). Such financial innovations are permanent (Podolski, 1985, 29), and result in a loss of control over credit by the central bank. This does not mean that banks or the public expect the central bank to abandon its 'lender of last resort' function. Such an expectation would lead to an increased demand for liquidity which would hinder innovations. Instead, innovations and liability management reduce dependence on the discount window, and enable banks to increase their equity relative to a lower volume of reserves. When banks are confronted with an increased demand for loans, but do not have sufficient reserves to accommodate the excess demand, they may sell liabilities with lower reserve requirements in order to meet this demand while maximizing their own profit (Wray, 1988, 133; Niggle, 1991, 142).

Liability management entails banks increasing their lending activity by borrowing funds which appear on the liability side of their balance sheet. This involves switching from demand deposit accounts to accounts which have lower reserve requirements. Banks attract time deposits by offering higher deposit rates. These higher deposit rates are compensated for by higher interest rates associated with the asset side of commercial bank balance sheets. Liability management, as emphasized by structuralists, results in structural changes in the composition of money. Thus, a given quantity of reserves will support more loans if liability management is practiced. Tests showing the increase in the ratio of total loans to total reserves (Pollin, 1991, 381) acknowledge the significance of liability management. Total reserves are limited, whether they be borrowed reserves or non-borrowed reserves, and therefore, liability management is necessary in order for banks to practice profit maximization (Moore, 1988a, 26-30). Liability management causes 'all

other interest rates' to rise due to more aggressive banking practices (see Podolski, 1985; Pollin, 1991, 375).

> Under liability management, a rise in the demand for credit would tend to raise the general level of interest rates, but the banks would then raise rates on wholesale deposits even further in order to provide funds to meet that rise in credit demand: so, under these circumstances, the total interest-bearing deposits would rise, and often the total of broad money would increase, while M1 would unambiguously fall (Goodhart, 1984, 155).

> Financial innovation, combined with the interactions by which increased investment leads to increased profits, implies that current output prices rise. Either because the central bank attempts to restrict financing available through banks or because the pace of the demand for financing outraces the availability of finance, the rise in investment in the "pipeline" will lead to a rise in interest rates (Minsky, 1980, 517).

An upward sloping 'step-wise' money supply curve resulting from liability management has been dealt with by Seccareccia (1988). In a non-accommodating situation, banks attract deposits with lower reserve requirements through manipulation of the liability side of the bank's balance sheet, rather than the asset side. This results in more time deposits being created relative to demand deposits. Seccareccia empirically verified that in 1975, when the Bank of Canada tried to restrict M1, M3 widened greatly over the next seven years. This indicates an increase in liability management, or structural changes in the portfolio choices of the public. This increase, due to restrictive monetary policy, resulted in overall higher interest rates. The step-wise curve reflects the impact on interest rates of changes in the composition of the money supply. Thus, according to Seccareccia, the interest rate is composed of two parts: the 'supply-side' exogenous part as set by the central bank, and the 'demand-side' endogenous part due to changes in demand (Seccareccia, 1988, 58). Should the central bank alter its bank rate, the step-wise curve will shift up. It is important to note that the increase in interest rates resulting from liability

management is due to the lending behaviour of the commercial banks, and is not an endogenous phenomenon.

Palley (1991) distinguishes between structuralists and accommodationists on the basis of how loan demand is met. He states that accommodationist models involve banks turning to the monetary authorities for funds, whereas structuralist models incorporate innovations and liability management (Palley, 1991, 74). Similarly, Pollin questions why liability management has grown in importance if banks have the option of borrowing at the discount window (Pollin, 1996, 502). Thus, both Palley and Pollin imply that the presence of liability management is evidence in favour of structuralism and against accommodative endogeneity. However, what Palley and Pollin are really distinguishing between is accommodation and non-accommodation. The latter is the one that encourages liability management and innovations. The alternative to accommodation is non-accommodation, and not necessarily structuralism.

The structuralist reasoning is that financial innovations, which result from a non-accommodating central bank, can cause the central bank to lose further control of the money supply. The rapid introduction of innovations causes the monetary authorities to be unable to account for such innovations in their reaction function as they are determining the interest rate. For this reason, the President of the Federal Reserve Bank of New York was complaining that innovations were interfering with the central bank's control (Rousseas, 1986, 91, Freedman, 1983). According to horizontalists, innovations do not threaten the central bank's control over the interest rate because they do not affect control over the base rate. Instead, innovations are a positive response to a central bank which is unable to be fully accommodative. This response is preferable to credit rationing (Eichner, 1987, 857). An increase in financial innovation does not imply that the money supply curve becomes upward sloping. This is because as the demand for these new instruments increases, the central bank is able to intervene by changing the base rate (Lavoie, 1992, 211). Lavoie also states that the possibility of the central bank losing control due to

innovations provides incentive for it to follow accommodative policies (Lavoie, 1984, 780).

The remaining point in distinguishing between the horizontalist and the non-horizontalist positions concerns the nature of the markup. The behaviour of the markup reflects the relationship between the central bank and the commercial banks. The nature of the variability of the markup reflects whether the interest rate is determined purely by supply-side factors (i.e., central bank actions), or if it is partly endogenously determined.

2.11 The Markup

The money supply curve faced by commercial banks is horizontal at the bank rate as chosen by the central bank. The money supply curve faced by firms may or may not be upward sloping. Although 'all other interest rates' vary due to liability management and innovations, this variation in itself does not violate the horizontalist position. It must be further determined if the discrepancy between the base rate and 'all other rates' is determined by cyclical factors. The markup (see Rousseas, 1985, 1986), i.e., the discrepancy between the supply curve faced by banks and the supply curve faced by firms, may not be constant, and still the horizontalist position would not be violated if this discrepancy does not result from demand-side factors.

The constant markup approach implies that, if horizontalism exists, then the discrepancy between the base rate and the prime lending rate must remain constant. Any variability of the markup would imply an upward sloping supply curve. In order for a constant markup to be possible, the level of liquidity preference, and risk and uncertainty must remain constant. Thus, a constant markup is not a realistic assumption, and is not a necessary condition for horizontalism (Hewitson, 1995, 294). It is obvious that the markup is variable (see Appendix D, Graph I). Deriet and Seccareccia (1996) demonstrate this

using Canadian data from 1980 to 1986. The markup was concluded to be variable when they failed to find the presence of a unit root in the markup, i.e., the markup over this period did not converge to a constant mean. Despite their results, in tests presented in Section 4 using the same data series, the markup was not demonstrated to be due to cyclical factors, and therefore, horizontalism was not violated.

> Can liquidity preference or leverage ratios affect the size of the markup? That is, as bank balance sheets expand, do banks require rising interest rates to induce them to leverage equity and liquid assets? If so, then the money supply curve is upward sloping rather than horizontal (Wray, 1989, 1188).

This statement that Wray makes, concerning the variability of the markup resulting from constraints on reserves being an argument against horizontalism, is not a relevant issue. When Horizontalists state that the money supply curve is horizontal, they are referring to the base rate only. Although the money supply curve shifts up to correspond to the chosen base rate, the curve will remain both horizontal and under the control of the central bank (Lavoie, 1996). The commercial bank lending rate is chosen as a markup over the base rate. To draw a parallel, Eichner compares the base interest rate to a base wage rate (Eichner, 1987, 859). There are many types of wages, and each wage rate can be mathematically expressed as some degree of markup over the base wage rate. For interest rates, the magnitude of the differential will depend on the nature of the borrower, the magnitude of collateral, and the duration of the loan, where all three of these factors can be referred to as the risk premium (Eichner, 1987, 859). When structuralists state that increased demand for credit results in an increase in the overall cost of funds, this refers to all other interest rates, and does not include the base rate. This is presented graphically (see Appendix A, Figure III) by Deriet and Seccareccia (1996, 142), where the base rate is a horizontal line, and all other rates are represented by an upward sloping step-wise curve above the base rate.

The markup is dependent on a premium ε, where ε incorporates liquidity preference and risk. This implies that commercial banks take into account their costs before administering their loan rates. Since constant markups are not an issue, what distinguishes the structuralists and accommodationists with respect to the markup is the variation of ε. As long as ε does not fluctuate with demand, and does not exhibit cyclical behaviour, the horizontalist position remains intact, otherwise the non-horizontalist position is supported (see Appendix A, Figure III). Lavoie does not deny that ε affects the markup, but he states that ε is not a function of changes in demand over the business cycle. The markup does not increase with the level or the growth rate of economic activity (Lavoie, 1996, 277) because of the central bank's control over the base rate. He states that when demand increases, markups do not necessarily increase, and may even decrease (Lavoie, 1996, 279). Thus, what is of concern is not the existence of a variable markup, but the nature of the variability.

> If, for instance, the structure of bank assets as reflected in their liquid asset ratios were to fluctuate cyclically, undoubtedly this would suggest that ε would be highly sensitive to demand conditions as emphasized by the supporters of structuralism (Deriet and Seccareccia, 1996, 143).

In attempts to distinguish between horizontalism and non-horizontalism, the econometric tests conducted in this dissertation involve the variability of the markup. In addition, the presence of financial fragility, as described by Minsky, is tested for in order to determine if increased demand for credit places endogenous pressure on the interest rate. The implications of Minsky's Financial Instability Hypothesis are presented in the next section.

2.12 Minsky's Financial Instability Hypothesis

Minsky's hypothesis (Minsky, 1980, 1982; Lavoie, 1983) involves the process of firm financing throughout the business cycle, assuming that there is a tendency for any stable system to move towards instability (see Skott, 1994). During a boom, households, firms, and banks, have incentive to take advantage of potential profit-generating investments. Since internal funds (i.e., profits) are limited, additional funds are procured through the banking system. Firms take on increasingly riskier leverage positions as increased financing is required. As the boom develops, participants become more speculative, causing their profit expectations, and consequently, their amount of borrowing to increase. Thus, as the boom progresses, aggregate firm debt to equity ratios increase.

The greater the debt to equity ratio, the greater the probability of default and bankruptcy. Due to this growing indebtedness, interest rates increase either because of the excess demand for loans, or because of the increasing risk to the lender who may also be experiencing trouble with his own leverage position (Wray, 1990, 149), or both. In any case, lending becomes more costly. As all agents attempt to refinance loans in the downswing, on a macroeconomic level, the accumulation of debt exceeds the flow of profits (Minsky, 1982, 83). As a result of their debt to equity ratios increasing, and banks reaching the limits of lending, more firms move into increasingly riskier leverage positions. More firms find themselves in a position of 'Ponzi' finance, meaning that they have to borrow just to cover their interest payments. Due to the unavailability of credit, firms have no choice but either to sell assets, or to slow down asset acquisition in attempts to reimburse their debts.

In order to both accommodate increased credit needs and maximize their own profits, banks will economize on reserves by substituting more demand deposits with time deposits. In short, interest rates rise (both short-term and long-term) because the supply of

finance is not perfectly elastic. Financial fragility increases as all agents find it increasingly difficult to pay back their debts in an environment where there is a rising cost of finance (or an unavailability of finance). A crisis can occur when finance costs rise, when liquidity preference rises, or when profits cannot keep up with debt commitments (Wray, 1990, 136). Consequently, although the money supply curve is horizontal in the short-run, as the boom develops, the curve becomes upward sloping due to demand pressures. According to Davis, in theory, three curves are becoming upward sloping: the cost of debt, the cost of equity, and the weighted cost of capital (Davis, 1992, 42).

> Because investment decisions lead to a sequence of investment demands, a run of tranquil behaviour leads to a rising inelastic demand for financing for the production of investment goods. Given this inelasticity, any emerging inelasticity in the supply of finance will lead to a sharp rise in interest rates (Minsky, 1982, 84).

During the trough that follows the boom, the banking system will rely more on the central bank's lender of last resort function. The central bank will attempt to control inflation through restriction of the money supply. This will adversely result in an increase in other sources of financing, which will lead to a rapid increase in short-term interest rates (Seccareccia, 1988). The result is a chain reaction of firm failures. This is a situation which worsens due to the overall lack of financing coupled with the actions of the central bank.

> However, the internal workings of the banking mechanism or Central Bank action to constrain inflation will result in the supply of finance becoming less than infinitely elastic - perhaps even approach zero elasticity. A rising inelastic demand curve for finance due to the investment in process combined with an inelastic supply curve of finance leads to a rapid increase in short-term interest rates (Minsky, 1982, 107).

Hewitson (1995, Section 7) integrates Minsky's hypothesis with the markup school and the liquidity preference school. The liquidity preference school states that, during a boom, liquidity preference is low, and the interest rate is bid up and continues to remain high as agents compete for funds. The upswing of the business cycle is characterized by falling liquidity preference since agents are optimistic, and the downswing is characterized by rising liquidity preference. As borrowers become more indebted and face a greater risk of default, lender's risk increases, and thus, commercial banks have to be compensated with higher interest rates. If banks cannot meet the demand for liquidity, a crisis could result (Sinai, 1976). Regardless of the role of liquidity preference in the process of financial instability, pro-cyclical debt to equity ratios have not yet been demonstrated.

Minsky's Financial Instability Hypothesis borders on the lack of savings thesis, which is contrary to post Keynesian theory (Lavoie, 1985, 77). Moreover, the weakness in Minsky's hypothesis is that it has not been empirically verified using actual data when studying the macro-economy (Lavoie, 1996, 286). In order to observe financial instability as described by Minsky, aggregate banking statistics and aggregate firm debt to equity ratios must be studied, instead of the balance sheet of a single bank or of a single firm (Wray, 1991, 8). It must further be proved that any moments of crisis were due to the inelasticity of the money supply curve, and not to an independent decline in profit rates.

Isenberg (1988) tested Minsky's hypothesis using U.S. sectorial data spanning two business cycles (1924-1927 and 1927-1929). The results were that although debt to equity ratios did rise during expansions, these ratios only declined slightly during recessions. In addition, the rate of increase was less than the rate of decrease. Moreover, financing remained conservative over the period, and firms continued production without resorting to speculative or Ponzi positions of finance. On the contrary, most sectors were in more stable financial situations at the end of the decade than they were in 1919. Thus, no evidence has been presented to support an upward sloping money supply function arising from financial fragility.

3. Previous Econometric Testing

Before turning to the econometric tests attempted in this dissertation, previous econometric tests, which attempt to distinguish between a horizontal money supply curve and an upward sloping money supply curve, will be reviewed. The only two relevant tests pertaining to this dissertation are those of Pollin (1991) and Palley (1994). It will be shown that their tests are inadequate because their methods do not address pertinent differences between structuralism and horizontalism. They tested, instead, for factors that are common to both sides, and therefore, their tests cannot be considered conclusive.

3.1 Pollin's Econometric Tests, 1991

Pollin's paper "Two Theories of Money Supply Endogeneity (1991)"[8], presents three empirical tests which attempt to distinguish between structural and accommodative endogeneity using U.S. data from 1953 to 1988. These tests restrict the horizontalist position to the case of accommodation only. The purpose of the first test was to detect for proportionality between loans and reserves; the purpose of the second test was to find the degree of substitutability between non-borrowed and borrowed reserves; and the purpose of the third set of tests was to find the direction of causality between interest rates.

The first test was undertaken because, according to Pollin, a perfectly accommodating system should imply the existence of a constant proportionality between loans and reserves over time. His reasoning is that an accommodative central bank would respond to credit demand by supplying a sufficient amount of reserves, either through open market operations, or through the discount window. However, the results indicated that reserves support increasing volumes of loans instead of a constant volume, which implies

[8] See also Pollin, 1996.

that the Federal Reserve does not passively supply reserves. This indicates the existence of supply constraints, which Pollin concludes as being in favour of the structuralist position. However, according to Moore, even in the presence of accommodation, banks will want to economize on reserves since they are non-interest bearing (Moore, 1991, 407). Such behaviour results in an increasing proportionality between loans and reserves which is independent of central bank behaviour. Thus, the tests prove nothing against accommodationism. Instead, they prove that all commercial banks practice profit maximization through liability management. This is a fact that neither accommodationists nor horizontalists deny.

The second test measures the degree of substitutability between borrowed reserves and non-borrowed reserves [i.e., borrowed = $\beta_0 + \beta_1$(non-borrowed)]. A significant inverse relationship (i.e., $\beta_1<0$) between changes in borrowed reserves and changes in non-borrowed reserves would imply substitutability. Due to the restrictions placed by frown costs, structuralists do not accept the view that discount window borrowing is a close substitute for non-borrowed reserves (i.e., funds obtained through open-market operations). Instead, the discount window is seldom used, and only in the case of emergencies. Thus, borrowed reserves account for only 3 percent of total reserves, whereas non-borrowed reserves constitute the remaining 97 percent (Moore, 1988b, 374). These statistics seem contradictory to the reasoning that the central bank will make up for any inadequacy in reserves. In addition, Pollin found the relationship between borrowed reserves and non-borrowed reserves, although negative, to be very weak. Borrowed reserves failing to be an adequate substitute for non-borrowed reserves, also implies the practice of liability management which structuralists state is favourable evidence.

In response to Pollin's second set of test results, Moore states that the reserve tests are 'misspecified' because both borrowed reserves and non-borrowed reserves are capable of meeting total reserve requirements, and therefore, they are *perfect* substitutes (Moore, 1991, 409). However, the equation that was tested is not relevant since borrowed reserves

are constrained by frown costs, and thus, all banks have a different propensity to borrow at the discount window (Moore, 1991, 408). One must also take into account the markup between the bank rate and the prime rate or the federal funds rate (Moore, 1988b, 377). The larger this discrepancy, the greater the inducement to borrow at the discount window since it is more profitable. Moreover, a negative β_1 coefficient would imply perfect substitutability only if total reserves remained constant throughout the period tested. If total reserve requirements were instead increased (depending on central bank policy), both borrowed reserves and non-borrowed reserves would also increase, causing the sign of the coefficient to be positive. Thus, the β_1 coefficient is not relevant in testing for the degree of substitutability, and the low adjusted R^2 value itself (one percent) implies only that the test is weak (Moore, 1991, 409). Moore states that, due to the actions of the Federal Reserve, pressure will not be placed on the interest rate as banks search for reserves:

> So long as the Federal Reserve increases the quantity of non-borrowed reserves it supplies *pari passu* with increases in required reserves, borrowed reserves will not increase. There is thus, no necessity for interest rates to rise as the volume of bank credit increases (Moore, 1988a, 130).

According to Palley, Pollin's tests are weak. He states that the low coefficient β_1 could be justified by accommodationists as being the result of the central bank increasing the bank rate during certain periods so as to discourage discount window borrowing. Palley (1991, 403) doubts whether it is possible to perform empirical tests in favour of either position because it is difficult to distinguish between the upward sloping reasoning and the dynamic credit-supply curve, where the latter neither violates structuralism nor horizontalism.

Pollin's third set of tests were performed to resolve the issue of interest rate determination. The results of his Sims-Granger causality tests were that causality runs from (a) the bank rate to the short-term rate (with evidence of two-way causality), (b) from the

long-term rate to the bank rate, and (c) from the long-term rate to the short-term rate. According to Pollin, result (a) favours the accommodationist argument that the central bank can fix the bank rate. However, the second two results, (b) and (c), favour structuralism: the long-term market rate determines the bank rate, and the long-term market rate determines the short-term market rate. These results are consistent with the structuralist argument that the central bank has little power in independently setting the base rate.

According to Moore, the results of the interest rate tests support the accommodationist position instead of the structuralist position. The results imply that long-term market rates cause the bank rate. However, long-term rates are based on expectations of future short-term rates[9], where the short-term rate is exogenously determined by the central bank (Moore, 1988a, 258; Moore, 1991, 412). Thus, market rates only *appear* to cause central bank controlled rates[10]. After performing the interest rate causality tests himself, Moore concluded:

> These Granger-Sims results should be read not as "causality" but rather as "informativeness" tests... What they really demonstrate is that future values of the federal funds rate, and of short-term rates generally, are informative in predicting current values of long-term rates. This is precisely consistent with the view that long-term rates are based on market participants' estimates of future short-term rates (Moore, 1988a, 286).

[9] The Expectations Hypothesis (see Meiselman, 1962, 9-13) states that long-term interest rates are determined by the expectations of future short-term interest rates, where the expected short-term rates cover the time period spanned by the long-term rate. This view has been criticized by many: Robinson (1979, 145-48; Mott, 1986, 226) had stated that this reasoning implies that the reverse could also hold, i.e., that expectations of long-term rates determine short-term rates. Keynes, Hicks, and Kaldor have argued that the long-term interest rate is determined by expectations of the long-term rate itself, as opposed to expectations of future of short-term rates (Wray, 1990, 177). Moreover, Pollin states that the preferred habitat theory is more realistic than the Expectations Hypothesis because the former includes a positive risk premium when mathematically representing the relationship between short-term rates and long-term rates (Pollin, 1996, 504-505).

[10] See Palley, 1991, 402, for a mathematical proof of the Expectations Hypothesis.

Although Pollin states that his results are in favour of structuralism, this seems to be subjective rather than conclusive. From his results, it is possible to rule either in favour of accommodationism or structuralism. Moreover, these tests are inadequate because horizontalism can hold in the presence of non-accommodation.

3.2 Palley's Econometric Tests, 1994

Palley's paper "Competing Views of the Money Supply Process: Theory and Evidence (1994)"[11] presents causality tests in order to distinguish between accommodative endogeneity and structural endogeneity. Palley presents three models, two of which are relevant to this dissertation. His accommodationist model, described as the 'pure loan demand model', includes a fixed markup, i.e., a constant proportion between the loan rate and the federal funds rate. This model excludes both shifts in the demand for funds, and the 'private initiatives' of commercial banks which lead to liability management and financial innovations. Instead, it only considers the actions of the central bank. In contrast, his structuralist model, the 'mixed portfolio-loan demand model', includes both the actions of the central bank and the private initiatives of commercial banks.

Palley relies on the distinction that the presence of liability management implies structural endogeneity, whereas a system that did not rely on liability management would imply accommodative endogeneity. The difference between his structuralist model and his accommodationist model is that the structuralist model includes both the demands for bank liabilities and bank choices regarding bank assets and liabilities.

> The modeling of bank asset and liability choice provides banks with an incentive to seek the cheapest sources of financing, which affects their

[11] See also Palley, 1996a; 1996b, Chapter 7.

> response to higher federal funds rates induced by increased bank lending. Such incentives are absent in the accommodationist model (Palley, 1994, 79).

Palley's methodology implies that banks actively managing their portfolios in order to maximize profit is evidence against accommodative endogeneity. Through Granger causality testing using data for the U.S. economy, Palley found the presence of liability management as consistent with his structuralist model. He subsequently concluded that the structuralist model best represented the U.S. monetary system.

Palley states that "Unlike the accommodationist model, the money supply implications are not straightforward, and the money supply does not increase one-for-one with bank lending" (Palley, 1994, 80). However, accommodationists do not claim that the money supply must increase proportionately with bank lending. It is also incorrect to state that accommodationists feel that the banking system has no incentive to economize on reserves, because this would imply that accommodationists do not believe that banks are profit maximizers. Despite Palley's conclusions, as with any model, the models presented in his paper are restricted by the assumptions made for each model concerning the nature of the financial system. The underlying assumption of Palley's tests, that the mere presence of liability management resulting from changes in the public's demand for funds is contrary to accommodative endogeneity, is incorrect. As is the case with Pollin's econometric tests, Palley's results do not provide any evidence against horizontalism.

4. Empirical Analysis

Econometric testing using Canadian data was performed to determine whether there exists sufficient evidence in favour of an upward sloping money supply curve. There are only two relevant concepts to test: (i) the nature of the variability of the commercial bank markup, and (ii) any existence of limits on lending, leading to a financial crisis. The purpose of the econometric work presented in this dissertation is to test whether the variability of the markup is dependent on demand factors in the economy. The validity of Minsky's hypothesis is also tested, by observing if firms reach any limits of lending as their indebtedness increases. If the liquidity position of the banking system can be approximated by a variable, then the presence of financial fragility, as described by Minsky, can be viewed through the impact of increases in this variable on the markup. In addition, the impact of aggregate firm debt to equity ratios on the magnitude of the banks' markup is tested.

4.1 Modeling Criteria

This study utilizes both monthly and quarterly data from January 1980 to July 1995. Prior to March 1980, the bank rate was fixed by the Bank of Canada. From March 1980 to February 1996[12], the bank rate was set at one-quarter of one percent above the latest 91-day Treasury Bill rate which was determined on the weekly auction market. Using data prior to the first quarter of 1980 would result in a structural break due to the differences in the determination of the bank rate. Thus, only data spanning 1980 to 1995 is utilized. Sufficient data is available for this period: 187 observations are available monthly,

[12] As of February 22, 1996, the bank rate has been under the direct control of the Bank of Canada. It is set at the upper level of the Bank's operating band for the overnight rate, and is no longer set relative to the 91-day Treasury Bill rate (Bank of Canada, 1995a, 23).

and 62 observations are available quarterly. This data is sufficient to produce reliable results since Box and Jenkins suggest a minimum of 50 observations in order to proceed with reliable analysis (Pankratz, 1983, 10). This period also contains three recessions which are sufficient to test for the pro-cyclical variation of the debt to equity ratios, and for the nature of the variation of the markup. The recessions[13], according to GDP based criteria, occurred in the second quarter of 1980, from the third quarter of 1981 to the fourth quarter of 1982, and from the second quarter of 1990 to the first quarter of 1991. The downswing in 1986 may also be considered a possible recession (Statistics Canada, 1996, 3.35).

The main variables[14] used in this econometric study include the markup of the commercial banks, the ratio of total loans to total deposits, the ratio of total liquid assets to total assets, the ratio of total firm debt to total firm equity, the gross domestic product, and the three-month bankers' acceptances rate.

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[13] Recession Dates:
GDP criteria: 1980:2, 1981:3 - 1982:4, 1990:2 - 1991:1
GDP per capita criteria: 1980:1 - 1980:3, 1981:3 - 1982:4, 1986:2 - 1986:4, 1989:2 - 1992:4
GDP per capita and Employment criteria: 1980:2, 1981:3 - 1982:4, 1990:2 - 1992:3
[*Source*: Statistics Canada, 1996, 3.35]

[14] All data for all variables used in this empirical study were retrieved from Statistics Canada, *Cansim Data*, 1995:

Total Bankruptcies, Canada - Matrix 136, D93467

Total Loans [L] - Matrix 913, B428
Total Canadian Dollar Deposits [D] - Matrix 913, B450
Total Major Assets [T] - Matrix 913, B400
Total Liquid Canadian Assets (excluding chartered banks' instruments) [LIQ] - Matrix 913, B466

Bank Rate (last Wednesday of the month) [BR] - Matrix 2560, B14006
Chartered Bank Prime Business Loan Rate [PR] - Matrix 2560, B14020
Overnight Money Market Financing Rate (7 day average) [OVER] - Matrix 2560, B14044
Chartered Bank Five Year Personal Fixed-Term Deposit Rate [TERM] - Matrix 2560, B14045
Chartered Bank Typical Mortgage Rate, 5 Year [5YEAR] - Matrix 2560, B14051
Three Month Bankers' Acceptances Rate [BA] - Matrix 2560, B14057

Debt to Equity, Total Non-Financial Industries [DEBT/E] - Matrix 3917, D86311

Gross Domestic Product (Canadian dollars, seasonally adjusted) [GDP] - Matrix 6724, D10057

The markup represents the discrepancy between the bank rate and the prime lending rate[15]. The bank rate is the base rate, and is under the direct control of the Bank of Canada. The prime rate is set by commercial banks as a markup over the bank rate (see Equation 1 below, Deriet and Seccareccia, 1996, 33). The prime rate is chosen to represent the behaviour of commercial banks because it has been used in previous econometric studies (Deriet and Seccareccia, 1996), and because Lavoie states that the discrepancy between the prime rate and the bank rate is a measure of the banks' liquidity preference (Lavoie, 1996, 293-294). The prime rate is the administered loan rate of commercial banks. It is the rate which commercial banks offer their most credit-worthy customers, and it is the rate that is associated with the majority of firm loans (Clinton and Howard, 1994, 15). Thus, the prime rate is a good interest rate to be associated with changes in the demand for credit since it reflects changes in business activity (Goldberg, 1984, 269). The bank rate is the minimum cost to the commercial bank, and the prime rate is the price offered to the firm. Thus, the markup is directly related to the profit of commercial banks since it is their markup over costs. Changes in the markup reflect changes in liquidity preference and changes in the profits of commercial banks. Since the markup incorporates lender's risk, movements in the markup reflect whether or not the banking sector is moving into increasingly riskier positions.

Equation 1: prime rate = (markup) bank rate

where markup = $[1 + m(\varepsilon)]$; $\varepsilon = f$(risk, liquidity preference)

The loans to deposits ratio is equal to total loans divided by total Canadian dollar deposits. This variable is used as a proxy for commercial bank liquidity since total loans represent a large proportion of less liquid bank assets, and total deposits represent the

[15] For the purposes of testing, the bank rate will be interchanged with other interest rates in regressions involving the markup.

majority of bank liabilities (Gardner, 1988, 252-254). Total Canadian dollar deposits include personal savings deposits (chequable, non-chequable, fixed-term), non-personal term and notice deposits (notice and fixed-term), gross demand deposits (personal chequing and other), and government of Canada deposits [see *Bank of Canada Review*, Table C4]. Total liquid assets include Bank of Canada notes and coins, Bank of Canada deposits, Treasury Bills (amortized value), Government of Canada direct and guaranteed bonds, call and short loans, and holdings of selected short-term assets (i.e., short-term paper and chartered bank instruments). Total less liquid assets include non-mortgage loans (personal and federal government, provincial and municipal), business loans, leasing receivables, loans to non-residents for business purposes, mortgages (residential and non-residential), and Canadian securities (provincial and municipal, and corporate) [*Bank of Canada Review*, Table C1]. Total assets are equal to liquid assets plus less liquid assets.

The total loans to total deposits variable is dependent on the interest rates associated with it. Deposits cost the bank the deposit rate r_D. They are the result of previously extended loans, and a fraction of deposits is kept as reserves. Loans are made at a price of r_L to the borrower. As banks make loans, they are transferring liquidity to the borrowers and taking on more illiquid positions. There exists no secondary market for loans (King, 1986, 291). The expected return to the bank as a result of such loans is $q(r_L)$, where $q(r_L)$ is a monotonic increasing function. The loan rate r_L is sufficient to cover a certain amount of default, as well as the administrative costs of loans (King, 1986, 292). In order to maximize profits, the bank will set the prime lending rate at the level at which the marginal return (net of cost) from further increasing the prime rate is zero. Since, according to theory, loans create deposits, total loans must be deflated by total deposits. Since this variable reflects the banks' liquidity position, it thus affects how commercial banks set the prime rate.

If the total loans to total deposits ratio increases, there are four possible explanations: both variables increased, but loans increased more than deposits, or loans

increased while deposits remained constant, or loans increased while deposits decreased, or loans remained constant while deposits decreased. When testing for increasing firm indebtedness and financial fragility, the first three cases are possibilities.

Both the total loans to total deposits variable and the total liquid assets to total assets variable will be used interchangeably, in separate tests, as a proxy for aggregate bank liquidity. The first variable will be used to test if the ratio of loans to deposits rises during expansions causing banks to become 'loaned up' and consequently to experience difficulty in issuing additional loans. The loans to deposits ratio rises if commercial banks cannot meet increased loan demand, and therefore, must sell bonds to the public causing deposits to contract (Lavoie, 1996, 290). Similarly, the ratio of total liquid Canadian assets to total major assets will be used to test whether the markup rises as commercial banks become less liquid and less able to supply loans.

The firm debt to equity ratio is used as a proxy for firm risk. It will be tested whether rising debt to equity ratios during booms cause the markup to rise as the prime rate is being bid up due to an excess demand for funds. It will be further observed whether a rising prime rate causes firms to fail as their interest payments become more difficult to meet, and as it becomes more difficult to re-finance. The debt to equity ratio is the total debt of all private non-financial enterprises divided by the total equity of all private non-financial enterprises. Total debt includes total short-term and long-term loans from banks, financial institutions, and any other lenders. It also includes debt securities such as paper rates, bonds and debentures, and mortgages. Total equity includes share capital, contributed surplus, etc., and retained earnings. (See Statistics Canada, Catalogue 61-207, xxv-xxvii). Total debt is divided by total equity in order to represent the leverage position of total firms.

Changes in gross domestic product (GDP) is used as a variable to represent changes in demand. The change in GDP is regressed against the change in markup to test whether the markup responds to changes in demand. This will serve as the most crucial test in

distinguishing between horizontalism and non-horizontalism. If there is a significant relationship between the change in the GDP and the change in the markup, then Granger causality testing will be undertaken to test whether the markup is caused by cyclical factors.

The purpose of testing is to observe whether (a) the markup is affected by the banks' liquidity position, (b) increased firm indebtedness places pressure on the bank markup due to the scarcity of funds, and (c) the markup varies due to cyclical factors. The results of parts (b) and (c) will be used to distinguish between horizontalism and non-horizontalism. It is likely that the results will be in favour of (a). The quantity of loans that the bank extends is dependent on the demand for credit. The demand for credit (as represented by the total loans to total deposits ratio) will raise the price (as represented by the markup) charged by commercial banks. Thus, there should be a positive significant relationship between the markup and the banks' loans to deposits ratio (or a negative significant relationship when using the total liquid assets to total assets ratio to represent bank liquidity). If the results are in favour of (b), then there is evidence in support of Minsky's financial fragility hypothesis. If there exists a significant positive relationship between the bank markup and firm debt to equity ratios, then it can be concluded that increasing firm indebtedness places pressure on the markup due to the scarcity of funds. If there is no relationship, it can be concluded that, despite firm indebtedness, the limits of lending have not been reached, and therefore, there could not exist a crisis situation. If the results are in favour of (c), then it is obvious that the situation of an upward sloping money supply curve prevails for the 1980 to 1995 period in Canada.

The initial model attempted in this study consists of the following two equations which will be solved simultaneously:

(1) $MU = \alpha_0 + \alpha_1 (L/D) + \alpha_2 (DEBT/E) + \alpha_3 (GDP)$

(2) $D = \beta_0 + \beta_1 (L)$

Unless otherwise specified, all variables are in terms of first differences of the natural log value. Thus, changes in the endogenous variable are a function of changes in the exogenous variables. Equation (1) represents the relationship to be studied. MU represents the markup of commercial banks, L/D represents the loans to deposits ratio of commercial banks, DEBT/E represents the debt to equity ratio of firms, and GDP is the seasonally adjusted gross domestic product in Canadian dollars. Any effects from variables other than the three exogenous variables specified will be captured by the intercept term α_0. The problem with using equation (1) is that the three explanatory variables are not completely independent. Obviously L/D would share a relationship with DEBT/E since firms becoming more indebted relative to their equity would impact on the demand for loans. This indicates the presence of multicolinearity which would tamper with the true impact of these variables on MU. Despite this problem[16], the above model will be used. The problem of multicolinearity prevented the inclusion of more than one interest rate as explanatory variables when equation (1) was modified for further testing.

Equation (2) is necessary since, according to post Keynesian monetary theory, loans cause deposits[17]. Since L/D is being used in the first equation, and because there is a relationship between L and D themselves, although previous studies have assumed L/D to be exogenous, this relationship will be modeled. The system of equations is exactly identified, and thus, will result in unique coefficients. Solving equations (1) and (2) for MU yields the following reduced form equation:

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[16] There are four options available for dealing with the problem of multicollinearity in this case. Two separate tests can be performed: in the first case, dropping L/D out of equation (1) and only solving for equation (1); and in the second case, using L/D and dropping DEBT/E out of the equation, and then solving for equations (1) and (2) simultaneously. The second option is not to drop any variables, as many equations that are estimated do contain some multicolinearity caused by combinations of variables which cannot be dropped because they are crucial to the equation. The third option is to form a principal component. The fourth option is to construct an error correction model (ECM). However, since GDP and DEBT/E statistics are only available quarterly resulting in only 62 data points, degrees of freedom will be sacrificed since the ECM requires x number of lags.

[17] The same argument can be made for the firm debt to equity ratio.

(3) $MU = \alpha_0 + \alpha_1 \{(L) / [\beta_0 + \beta_1 (L)]\} + \alpha_2 (DEBT/E) + \alpha_3 (GDP)$

Logarithmic transformation of the variables was undertaken in order to reduce the trend in variance. For example, ln(markup) = ln(prime/bank) = ln(prime) - ln(bank). All econometric tests were conducted using both the actual data and its logarithmic transformation. However, for the majority of tests, only the results involving logs are presented because their autocorrelation functions (ACFs) decay to statistical insignificance quickly (see Appendix C).

Since these tests deal with time series data, it is necessary to render the data stationary so that all series have a mean, variance, and an autocorrelation function that is not dependent on time (Pankratz, 1982, 11)[18]. The first step[19] was to conduct tests to verify if the variables followed a time stationary process (TSP) or a difference stationary process (DSP). It was concluded that all variables followed a DSP (see Appendix B, Tables I and II). Thus, first differencing was undertaken to reduce the trend in mean. Next, Augmented Dickey-Fuller (ADF)[20] tests were conducted on all variables, the results of these stationarity tests are provided in Appendix B. According to these tests, all variables were stationary when first differenced, both when they were in log form and when they were not[21]. All econometric tests were conducted both before and after first differencing. However, only the regression results involving first differences are presented because their ACFs decay to statistical insignificance quickly (see Appendix C).

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[18] For a summary of nonstationary processes, see Granger, C.W.L. and Newbold, P., 1986.

[19] For a description of the procedures used, see:
1) Griffiths, W.E. et al, 1993, 696-700.
2) Holden, D. and Perman, R., 1994, 47-94.

[20] For a description of Dickey-Fuller testing procedures and for critical value tables, see Banerjee, A. et al., 1993, Chapter 4.

[21] Although, after the appropriate transformations, ADF tests implied stationarity, stationarity cannot be guaranteed because ADF tests have been criticized for being weak tests. However, this paper does not question the validity of ADF testing, and therefore, it is assumed that use of the ADF testing has ensured that the results obtained in this study are not the product of spurious regressions.

After stationarity of the data was verified, tests were conducted on MU and L/D to ensure that the loans to deposits ratio is a valid proxy for the commercial banks' liquidity position. Monthly data was available for MU and for L/D. The sample autocorrelation function did not imply the presence of seasonality [(i.e., none of the variables exhibited significant spikes at every twelfth interval (see Appendix C)], and therefore, first differencing was used instead of twelfth differencing. The autocorrelation functions of both MU and L/D decay to statistical insignificance quickly when data is expressed in natural logs (see Appendix C), and thus, only the results involving the log values of variables are presented in Tables 1(a) through 1(i).

TABLE 1(a) [22]

ITEM	VALUE
DEPENDENT VARIABLE	LMU1
INDEPENDENT VARIABLE	LLD1
COEFFICIENT	-0.0918
STANDARD ERROR	0.3137
T-STATISTIC	-0.2926
R^2 ADJ	-0.0050
DW	1.8886

[22] In Tables 1(a) through 4, **L** denotes the logarithmic transformation of the variable, **1**, indicates that the first difference of the variable has been taken, and x indicates that the variable has been lagged by x number of periods. The symbol * is used to indicate t-statistics corresponding to significant coefficients at α=0.05. The symbol ^ is used to indicate evidence of positive autocorrelation at α=0.05, and the symbol ^^ is used to indicate evidence of negative autocorrelation at α=0.05.

TABLE 1(b)

ITEM	VALUE
DEPENDENT VARIABLE	LMU1
INDEPENDENT VARIABLE	LLD1, 3
COEFFICIENT	-0.0108
STANDARD ERROR	0.3172
T-STATISTIC	-0.0340
R^2 ADJ	-0.0055
DW	1.8609

TABLE 1(c)

ITEM	VALUE
DEPENDENT VARIABLE	LMU1
INDEPENDENT VARIABLE	LLD1, 6
COEFFICIENT	-0.6933
STANDARD ERROR	0.3104
T-STATISTIC	-2.2340 *
R^2 ADJ	0.0218
DW	1.8691

TABLE 1(d)

ITEM	VALUE
DEPENDENT VARIABLE	LMU1
INDEPENDENT VARIABLE	LLD1, 9
COEFFICIENT	0.4274
STANDARD ERROR	0.3134
T-STATISTIC	1.3640
R^2 ADJ	-0.0049
DW	1.9254

TABLE 1(e)

ITEM	VALUE
DEPENDENT VARIABLE	LMU1
INDEPENDENT VARIABLE	LLD1, 12
COEFFICIENT	0.4482
STANDARD ERROR	0.3162
T-STATISTIC	1.4170
R^2 ADJ	0.0058
DW	1.9418

TABLE 1(f)

ITEM	VALUE
DEPENDENT VARIABLE	LLD1
INDEPENDENT VARIABLE	LMU1, 3
COEFFICIENT	-0.0028
STANDARD ERROR	0.0175
T-STATISTIC	-0.1617
R^2 ADJ	-0.0054
DW	1.5822 ^

TABLE 1(g)

ITEM	VALUE
DEPENDENT VARIABLE	LLD1
INDEPENDENT VARIABLE	LMU1, 6
COEFFICIENT	0.0038
STANDARD ERROR	0.0177
T-STATISTIC	0.2179
R^2 ADJ	-0.0053
DW	1.5760 ^

TABLE 1(h)

ITEM	VALUE
DEPENDENT VARIABLE	LLDI
INDEPENDENT VARIABLE	LMUI, 9
COEFFICIENT	-0.0121
STANDARD ERROR	0.0181
T-STATISTIC	-0.6646
R^2 ADJ	-0.0032
DW	1.5633 ^

TABLE 1(i)

ITEM	VALUE
DEPENDENT VARIABLE	LLDI
INDEPENDENT VARIABLE	LMUI, 12
COEFFICIENT	-0.0164
STANDARD ERROR	0.0181
T-STATISTIC	-0.9044
R^2 ADJ	-0.0011
DW	1.6038 ^

From the above results, it is evident, through both the t-statistics and the magnitude of the adjusted R^2 values, that there is no significant relationship between MU and L/D. The tests also involved lagged values of 3 months, 6 months, 9 months, and 12 months in

attempts to assess if there exists a relationship which involves a time lag. These tests also yielded negative results. Using a time lag of more than 12 months would be contrary to the theory that commercial banks constantly respond to changes in liquidity through changes in the prime rate. A high adjusted R^2 cannot be expected to be found in a simple regression involving only one explanatory variable. However, if loans to deposits was significant in determining the markup, its simple regression would have yielded a positive R^2 adjusted value of more than 0.0218, which is the best result obtained. Slovin and Sushka account for such results through their explanation concerning their own tests which used U.S. data:

> In our rate-setting model, the loan/deposit ratio is a measure of the consequences of bank actions, not a variable which influences the loan rate... More precisely, the loan/deposit ratio can be viewed as primarily a reflection of the relative elasticities of the demand for loans and the demand for deposits (Slovin and Sushka, 1983, 1588).

Lavoie also questions:

> How is bank liquidity to be measured in those financial systems where liability management is a structural feature? (Lavoie, 1996, 288)

In order to verify that the negative results obtained are not due to an inadequate number of explanatory variables, the basic regressions were re-run with the inclusion of the chartered bank five year personal fixed term deposit rate (TERM) and the rate on the three-month bankers acceptances[23] (BA). Both rates were used in the study by Deriet and Seccareccia (1996), and were found by them to be significant in determining the markup. Both the TERM and the BA variables were found to be DSP, and both were stationary after first differencing (see Appendix B). Since the autocorrelation functions of TERM and BA

[23] Banker's acceptances are drafts drawn, by either an individual or a firm, on a bank. The bank is ordered to pay a specified sum of money to a third party, either at a specified time (ranging from a few days to a year) or upon demand (Boreham and Bodkin, 1988, 313).

showed better results when logs of the variables were not taken, and since the autocorrelation function of L/D was the same whether logs were taken or not (see Appendix C), only the logs of MU were taken. The results are presented below in Tables 2(a) and 2(b):

TABLE 2(a)

REGRESSION: LMU1 = f(LD1, TERM1, BA1)

DEPENDENT VARIABLE	LMU1	LMU1	LMU1
INDEPENDENT VARIABLE	LD1	TERM1	BA1
COEFFICIENT	-0.0991	-0.0041	-0.0178
STANDARD ERROR	0.3052	0.0061	0.0041
T-STATISTIC	-0.3246	-0.6702	-4.3810 *

R^2 ADJ 0.1590 DW 2.1008

TABLE 2(b)

REGRESSION: LMU1 = f(LD1, BA1)

DEPENDENT VARIABLE	LMU1	LMU1
INDEPENDENT VARIABLE	LD1	BA1
COEFFICIENT	-0.0793	-0.0195
STANDARD ERROR	0.3033	0.0032
T-STATISTIC	-0.2613	-6.1230 *

R^2 ADJ 0.1615 DW 2.0937

It is evident from Tables 2(a) and 2(b) that BA is significant in determining the markup, causing the R^2 adjusted in the second regression to be 0.1615 with a significant t-statistic associated with the BA variable. A significant relationship could not be found between TERM and MU, and, as expected, L/D is not significant in determining MU.

There are three possible explanations for the lack of a relationship between L/D and MU. The most obvious possibility is that there exists no relationship between the two variables. The second possibility is that L/D does not adequately reflect the banks' liquidity position. The third possibility is that the markup (i.e., the difference between the banks' costs and their price) is not adequately represented by the discrepancy between the bank rate and the prime rate.

To explore the possibility that L/D does not effectively represent the banks' liquidity position, tests were run on the relationship between the markup and the ratio of total liquid Canadian assets to total major assets (LIQ/T). These tests should yield a significant negative relationship since as the banking system is low on liquidity, its price, as reflected in the markup, will be bid up. The results are presented in Tables 3(a) through 3(d) below. As in the previous case (when using L/D), these tests did not yield any relationship between MU and the banks' liquidity position.

TABLE 3(a)

DEPENDENT VARIABLE	LMU1	LMU1	LMU1	LMU1	LMU1
INDEPENDENT VARIABLE	LLIQT1	LLIQT1, 3	LLIQT1, 6	LLIQT1, 9	LLIQT1, 12
COEFFICIENT	0.0456	-0.0478	0.1703	-0.0254	-0.2307
STANDARD ERROR	0.0702	0.0702	0.0690	0.0704	0.0688
T-STATISTIC	0.6499	-0.6739	2.4680 *	-0.3607	-3.3530 *
R^2 ADJ	-0.0031	-0.0030	0.0277	-0.0050	0.0559
DW	1.8966	1.8819	1.8751	1.9391	1.9044

TABLE 3(b)

DEPENDENT VARIABLE	LLIQT1	LLIQT1	LLIQT1	LLIQT1
INDEPENDENT VARIABLE	LMU1, 3	LMU1, 6	LMU1, 9	LMU1, 12
COEFFICIENT	0.0125	-0.0216	0.0087	0.0637
STANDARD ERROR	0.0782	0.0788	0.0810	0.0813
T-STATISTIC	0.1603	-0.2740	0.1070	0.7840
R^2 ADJ	-0.0054	-0.0052	-0.0056	-0.0022
DW	1.4817 ^	1.4771 ^	1.4735 ^	1.4901 ^

TABLE 3(c)

REGRESSION: LMU1 = f(LIQT1, TERM1, BA1)

DEPENDENT VARIABLE	LMU1	LMU1	LMU1
INDEPENDENT VARIABLE	LIQT1	TERM1	BA1
COEFFICIENT	0.0839	-0.0040	-0.0178
STANDARD ERROR	0.5376	0.0061	0.0041
T-STATISTIC	0.1561	-0.6524	-4.3220 *

R^2 ADJ 0.1586 DW 2.1031

TABLE 3(d)

REGRESSION: LMU1 = f(LIQT1, BA1)

DEPENDENT VARIABLE	LMU1	LMU1
INDEPENDENT VARIABLE	LIQT1	BA1
COEFFICIENT	0.0547	-0.0195
STANDARD ERROR	0.5349	0.0032
T-STATISTIC	0.1023	-6.0360 *

R^2 ADJ 0.1613 DW 2.0954

Since commercial banks rarely borrow from the Central Bank, perhaps using the bank rate as the base from which to measure the markup is not correct. To test the possibility that the discrepancy between the bank rate (BR) and the prime rate (PR) is not an adequate representation of commercial bank's reaction to liquidity, the bank rate was interchanged with other interest rates. The first difference of the natural logs of these interest rates was taken. Some of the tests that had no autocorrelation (except when PR/OVER was used) are produced in Table 4. The overnight rate (OVER) was chosen as a substitute for the bank rate because it is used by the Bank of Canada as a policy tool. The Bank of Canada changes its range for the overnight rate in order to indirectly impact the exchange rate. It can alter the overnight rate through the supply of settlement balances to direct clearers, or through purchase and resale agreements, or through the buying or selling of 3-month treasury bills. As evident in Table 4, the conclusion is that no interest rate in relation to the prime rate has a relationship with L/D[24].

TABLE 4

ITEM	SPECIFICATION/VALUE				
DEPENDENT VARIABLE	LMU1 [MU= PR/OVER]	LMU1 [MU= PR/TERM]	LMU1 [MU= PR/TERM]	LMU1 [MU= PR/5YEAR]	LMU1 [MU= PR/5YEAR]
INDEPENDENT VARIABLE	LLD1	LLD1	LLD1, 3	LLD1	LLD1, 3
COEFFICIENT	-1.6951	0.5630	-0.6123	1.0438	-0.6388
STANDARD ERROR	0.8633	0.4076	0.4104	0.3889	0.3939
T-STATISTIC	-1.9640	1.3810	-1.4920	2.6840 *	-1.6220
R^2 ADJ	0.0152	0.0049	0.0067	0.0324	0.0089
DW	2.4069 ^^	1.8648	1.8822	1.7838	1.7696

[24] No amount of interchanging interest rates can result in a relationship between the markup and the loans to deposits ratio because L/D does not have a relationship with either the prime rate or the bank rate (see Appendix B, Tables III and IV).

Continuing with this study, the relationship between MU and BA, L/D, DEBT/E, and GDP were tested using quarterly data. Equation (1) was modified to[25]:

(4) $$MU = \alpha_0 + \alpha_1 (BA) + \alpha_2 (L/D) + \alpha_3 (DEBT/E) + \alpha_4 (GDP)$$

Stationarity tests were conducted on all variables, and again the natural logs of all variables were taken to reduce the trend in variance. The first difference of the logs of all variables were taken to reduce the trend in mean, so that changes in the endogenous variable are a function of changes in the exogenous variables. Consistent with this procedure, all series were found to be DSP (see Appendix B, Table II) and, according to ADF testing, all were stationary when first differenced (see Appendix B, Stationarity Tests). None of the variables exhibited significant spikes at every fourth interval, and therefore, seasonal differencing was not required. The results of estimations based on equation (4) are presented in Tables 5(a) through 5(e).

TABLE 5(a)[26]

REGRESSION: LMU1 = f(LLD1, LDEBTE1, LGDP1)

INDEPENDENT VARIABLE	LLD1	LDEBTE1	LGDP1
COEFFICIENT	-0.0263	-0.3300	-0.7118
STANDARD ERROR	0.4495	0.2746	0.5661
T-STATISTIC	-0.0584	-1.2010	-1.2570

R^2 ADJ 0.0056 DW 1.9867

[25] It is not necessary to estimate equation (2) simultaneously with equation (4) since no significant relationship can be found between MU and L/D.

[26] In Tables 5(a) through 7(b), **L** denotes the logarithmic transformation of the variable, **1**, indicates that the first difference of the variable has been taken, and x indicates that the variable has been lagged by x number of periods. The symbol * is used to indicate t-statistics corresponding to significant coefficients at α=0.05. The symbol ^ is used to indicate evidence of positive autocorrelation at α=0.05.

TABLE 5(b)

REGRESSION: LMU1 = f(LBA1, LLD1, LDEBTE1, LGDP1)

INDEPENDENT VARIABLE	LBA1	LLD1	LDEBTE1	LGDP1
COEFFICIENT	-0.2573	0.2835	-0.1493	0.2799
STANDARD ERROR	0.0423	0.3419	0.2087	0.4559
T-STATISTIC	-6.0890 *	0.8292	-0.7153	0.6140

R^2 ADJ 0.4374 DW 2.0739

TABLE 5(c)

REGRESSION: LMU1 = f(LBA1, LDEBTE1, LGDP1)

INDEPENDENT VARIABLE	LBA1	LDEBTE1	LGDP1
COEFFICIENT	-0.2521	-0.0755	0.3314
STANDARD ERROR	0.0416	0.1882	0.4501
T-STATISTIC	-6.0530 *	-0.4014	0.7362

R^2 ADJ 0.4412 DW 2. 0452

TABLE 5(d)

REGRESSION: LMU1 = f(LBA1, LLD1, 1, LDEBTE1, 1, LGDP1, 1)
[Equation (4) with a one quarter lag of DEBT/E, L/D, and GDP]

INDEPENDENT VARIABLE	LBA1	LLD1, 1	LDEBTE1, 1	LGDP1, 1
COEFFICIENT	-0.2640	0.3430	0.0192	0.6668
STANDARD ERROR	0.0463	0.3454	0.2041	0.5159
T-STATISTIC	-5.6990 *	0.9930	0.0941	1.2920

R^2 ADJ 0.4645 DW 2.1587

TABLE 5(e)

REGRESSION: LMU1 = f(LBA1, LLD1, 2, LDEBTE1, 2, LGDP1, 2)
[Equation (4) with a two quarter lag of DEBT/E, L/D, and GDP]

INDEPENDENT VARIABLE	LBA1	LLD1, 2	LDEBTE1, 2	LGDP1, 2
COEFFICIENT	-0.2719	-0.0848	1.1150	0.1404
STANDARD ERROR	0.0394	0.3201	0.4234	0.1968
T-STATISTIC	-6.9030 *	-0.2648	2.6330 *	0.7133

R^2 ADJ 0.5025 DW 2.2071

The relationship between L/D and GDP, and DEBT/E and GDP was further studied. These results are presented below in Table 6.

TABLE 6

DEPENDENT VARIABLE	LLD1	LLD1, 1	LLD1, 2	LDEBTE1	LDEBTE1,1	LDEBTE1,2
INDEPENDENT VARIABLE	LGDP1	LGDP1	LGDP1	LGDP1	LGDP1	LGDP1
COEFFICIENT	0.1986	-0.0123	-0.2450	-0.2135	-0.4852	-0.8014
STANDARD ERROR	0.1971	0.2021	0.1977	0.3226	0.3214	0.3111
T-STATISTIC	1.0070	-0.0610	-1.2390	-0.6617	-1.5100	-2.5760 *
R^2 ADJ	0.0003	-0.0208	0.0110	-0.0114	0.0254	0.1050
DW	1.8269	1.7299	1.8172	1.3975 ^	1.4799 ^	1.5352 ^

It is evident from Tables 5(a) through 5(e) that neither DEBT/E nor GDP is significant in impacting on MU (see also, Appendix D, Graph I). Consistent with the results obtained using monthly data, L/D is not significant in determining MU. Any relationship found in the equations tested is largely due to the BA variable. As evident in Table 6, contrary to evidence in favour of financial fragility, DEBT/E is independent of GDP, except when an eight month lag of DEBT/E is used. This result was expected because DEBT/E did not appear to be pro-cyclical when graphed (see Appendix D, Graph I). Moreover, the firm failure rate does not appear to fluctuate countercyclically when graphed (see Appendix D, Graph II).

The markup did not move with GDP. There is no evidence to suggest that MU varies with changes in demand. However, it is worth noting that PR and BR, when tested individually, were found to be determined by changes in GDP [see Tables 7(a) and 7(b)]. GDP being significant in determining PR is a fairly obvious result since, as previously mentioned in this section, the prime rate reflects changes in business activity, and therefore, its level would be related to production. Why GDP is significant in determining BR may be due to the Bank of Canada's commitment to price stability. During a boom, as production increases, the Bank of Canada may increase the base rate out of fear of inflation. This result is favourable to the structuralist position since it indicates the case of non-accommodation. However, it must be noted that despite the significant results, the R^2 adjusted values associated with the tests involving PR and BR were only 0.1415 and 0.1271 respectively.

TABLE 7(a)

REGRESSION: LPR1 = f(LLD1, LDEBTE1, LGDP1)

INDEPENDENT VARIABLE	LLD1	LDEBTE1	LGDP1
COEFFICIENT	1.3673	0.4765	2.8387
STANDARD ERROR	0.9607	0.5869	1.2100
T-STATISTIC	1.4230	0.8118	2.3460 *

R^2 ADJ 0.1415 DW 1.7620

TABLE 7(b)

REGRESSION: LBR1 = f(LLD1, LDEBTE1, LGDP1)

INDEPENDENT VARIABLE	LLD1	LDEBTE1	LGDP1
COEFFICIENT	1.3935	0.8064	3.5505
STANDARD ERROR	1.2340	0.7538	1.5550
T-STATISTIC	1.1290	1.0700	2.2850 *

R^2 ADJ 0.1271 DW 1.7302

From the series of tests conducted, using both monthly data and quarterly data, including various tests which were performed that are not presented in this document, it is obvious that relationships between MU and L/D (or LIQ/T), MU and DEBT/E, MU and GDP, L/D and GDP, DEBT/E and GDP, and MU and L/D and DEBT/E and GDP are completely random. There is no evidence of any demand factors placing pressure on the markup, no evidence of any financial fragility, and thus, no evidence of an upward sloping money supply curve.

4.2 Econometric Testing: Discussion

The tests performed did not find evidence of a markup being determined by cyclical factors or of financial fragility. Thus, the results are favourable to horizontalism. A relationship between L/D and MU does not appear to exist. The lack of a relationship between MU and L/D was unanticipated since both horizontalists and non-horizontalists would suggest these variables for use in econometric testing. In addition, neither a relationship between L/D and BR, nor a relationship between L/D and PR could be found (see Appendix B, Tables III and IV). Using the data series involved in this study, it is not possible to obtain relationships between the variables Using this particular data, there is no further analysis that can be conducted in order to resolve the issue concerning the nature of the money supply curve[27].

It can be argued that the variables used in this study are inadequate in accurately representing the nature of the Canadian monetary system. One argument that can be made is that the prime rate does not accurately represent the loan rate associated with the majority of bank loans. There are a large quantity of loans offered to a bank's most credit-worthy customers at rates below that of the prime. Goldberg specifies that these 'below prime rate lending activities' have no feedback effect to the prime rate (Goldberg, 1984, 277). Therefore, the impact of loans offered at rates below the prime rate cannot be captured through PR. Goldberg adds that "the prime rate is an average of current and past issued liability costs that lags behind changes in current money market conditions"

[27] One other argument that can be made is that it is preferable to use microeconomic data for such an analysis (Wray, 1995). Wray states that it is 'dangerous' to draw conclusions based on aggregated data. To study bank lending behaviour using aggregate data is to disregard the institutional behaviour of individual banks. Wray argues that a single bank will encounter an increase in lender's risk if borrowers request loans that constitute a greater proportion of their net worth because of the greater risk of default. On an aggregate level, the money supply curve may be horizontal, but individual banks face an upward sloping money supply curve. This scenario cannot be represented in studies which utilize aggregate data. Wray states that using aggregate data in testing procedures implies that individual banks do not care about their balance sheets (Wray, 1995, 278).

(Goldberg, 1984, 279). This statement questions the choice of PR as a reliable variable. Niggle states that, since the 1970s, the majority of loans have been made at these lower rates which are usually linked to the 90-day CD rate and other money market rates (Niggle, 1987, 630; Goldberg, 1984, 277). Moreover, Niggle states that the Federal Funds rate (U.S. base rate) only represents the cost of funds in the very short-run which spans approximately a month (Niggle, 1987, 630). Both these points question the choice of the base rate and the prime rate as variables to best represent the markup. In addition, L/D may not accurately represent the liquidity position of commercial banks since banks extend different types of loans, and some are more, or less, liquid than others.

5. Concluding Remarks

According to horizontalists, the base interest rate is exogenously determined by the central bank, and is not the product of endogenous forces. The central bank has complete authority over the base interest rate, and the base rate can effectively impact all other interest rates. The discrepancy between the cost faced by the commercial bank and its price does not vary according to changes in demand due to the monetary system's ability to accommodate increases in the demand for credit. According to non-horizontalists, the money supply function does not remain completely elastic because the interest rate cannot remain independent of changes in the demand for funds. The central bank cannot anticipate future changes in demand as reflected in changes in liquidity preference, and thus, commercial banks are limited in their ability to lend. This results in the interest rate partly being endogenously determined.

It is the horizontalist view that an exogenously determined base interest rate can be maintained in the presence of changes in liquidity preference, risk and uncertainty, financial innovations, and liability management. Thus, graphically, in an interest-money space, the money supply curve remains horizontal, without becoming upward sloping. This dissertation has isolated both the variability of the markup and the presence of financial fragility as being the two relevant issues when distinguishing between horizontalism and non-horizontalism. Econometric analysis was aimed at identifying these two relevant issues. A markup that varies through time as a result of demand-side factors, would indicate that the determination of the interest rate was not purely a supply-side phenomenon resulting from the actions of the central bank. The presence of financial fragility would imply that the financial system can only accommodate credit demand to a certain limit, and beyond that limit excess demand would cause the interest rate to increase. Both a markup varying with gross domestic product, and evidence of the presence of

financial fragility, as consistent with an upward sloping money supply curve, indicate the presence of scarcity which is contrary to both horizontalism and post Keynesian theory.

Analysis of data relating to the Canadian economy for the period from 1980 to 1995 presents no evidence to suggest that there exists constraints at a given interest rate. Econometric testing did *not* confirm either a markup which varied with cyclical factors, or limits of lending being reached. Thus, there is no evidence to refute the view that the Canadian monetary system is capable of satisfying increases in loan demand without altering the central bank's authority over the base rate.

It is worth noting the fact that the econometric results presented in this dissertation are not conclusive enough to dismiss the argument for an upward sloping money supply curve. Reason being that the choice of proxies may be subjective. It is unwise to state that the results obtained in this dissertation are either conclusive evidence against non-horizontalism, or strong evidence in favour of horizontalism. Further testing concerning the nature of the variability of the markup is required since this is the crucial element in making the distinction between horizontalists and non-horizontalists.

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Appendix A

FIGURE I

The Upward Sloping Money Supply Curve

- The Non-Horizontalist Position -

The base interest rate is initially set by the central bank at level i_0. This interest rate cannot remain independent of demand-side pressures. As the demand for funds increases from D_0 to D_1 to D_2, the quantity of funds demanded cannot continue to be supplied at the base interest rate beyond point E_0. Thus, the interest rate increases independently of central bank actions to i_1 and i_2. Consequently, the money supply function is best represented by an upward sloping curve (i_0E_2).

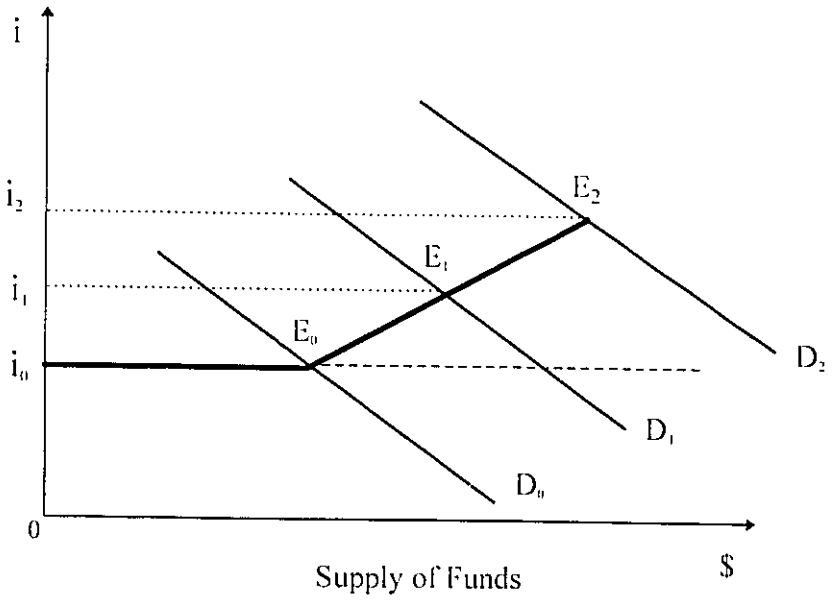
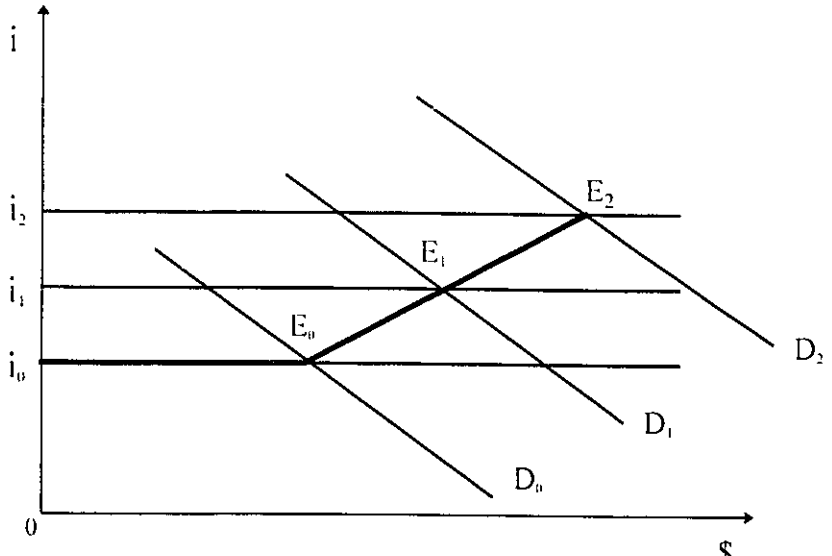


FIGURE II

The Set of Horizontal Lines

- The Horizontalist Position -

The base interest rate is initially set by the central bank at level i_0. As demand continues to increase from D_0 to D_1 to D_2, the central bank intervenes by increasing the base interest rate from i_0 to i_1 to i_2. The interest rate remains exogenously determined and does not vary from forces other than the central bank. Consequently, the money supply function is best represented by a set of horizontal lines (corresponding to i_0, i_1, and i_2). However, the three static money supply functions *appear* to form an upward sloping curve when equilibrium points E_0, E_1, and E_2 are joined. This dynamic money supply curve (i_0E_2) does not violate the horizontalist position.



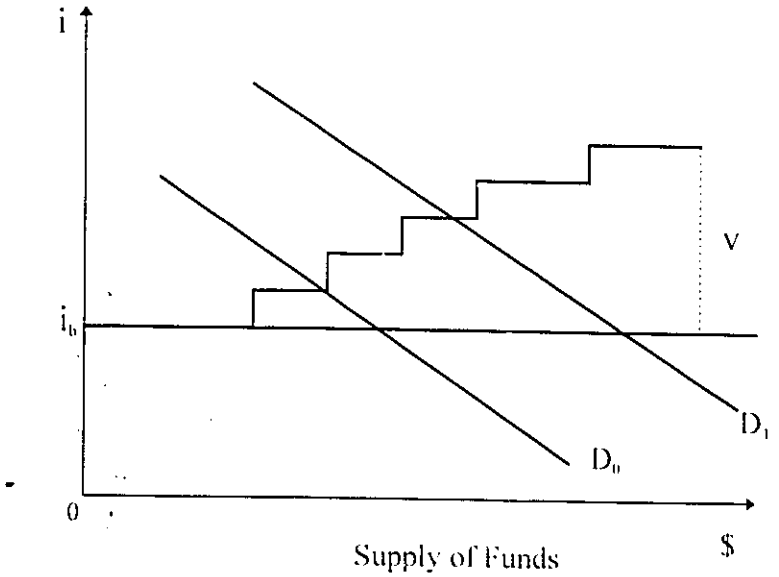
Supply of Funds

FIGURE III

The Variability of the Markup

- The Non-Horizontalist Position -

The base interest rate is initially set by the central bank at level i_b. All other interest rates vary as a markup over this base rate. This variation is represented a '*step-wise*' function. The magnitude of the variation V, (i.e., the discrepancy between the horizontal base rate and the step-wise function) is due to demand-side factors.



Appendix B

TABLE I

RESULTS OF DETRENDING TESTS
- Monthly Data -

VARIABLE	U-STATISTIC	DSP/TSP
MU PR/BR	6.24	DSP
L/D	4.38	DSP
TERM	3.13	DSP
BA	3.92	DSP
LIQ/T	3.24	DSP
PR/OVER	5.71	DSP
PR/TERM	4.81	DSP
PR/5YEAR	4.20	DSP
PR	3.09	DSP
BR	4.79	DSP

Notes: (i) All data are in logs.
(ii) DSP = Difference Stationary Process
TSP = Trend Stationary Process
$u = (SSE_R - SSE_U) / (2*SSE_U/df)$. U = unrestricted & R = restricted
$\alpha = 0.05$ critical u value: sample size 100 = 6.49, sample size ∞ = 6.25
Source: Griffiths, 1993, 699.

TABLE II

RESULTS OF DETRENDING TESTS
- Quarterly Data -

VARIABLE	U-STATISTIC	DSP/TSP
MU=PR/BR	2.17	DSP
L/D	2.08	DSP
BA	0.23	DSP
DEBT/E	1.04	DSP
GDP	3.94	DSP

Notes: (i) All data are in logs.
(ii) DSP = Difference Stationary Process
TSP = Trend Stationary Process
$u = (SSE_R - SSE_U) / (2*SSE_U/df)$. U = unrestricted & R = restricted
$\alpha = 0.05$ critical u value: sample size 50 = 6.73.
Source: Griffiths, 1993, 699.

TABLE III

REGRESSION RESULTS
THE PRIME RATE AND THE LOANS TO DEPOSITS RATIO

TABLE III(i)
- Prime Rate As The Dependent Variable -

DEPENDENT VARIABLE	LPR1	LPR1	LPR1	LPR1	LPR1
INDEPENDENT VARIABLE	LLD1	LLD1, 3	LLD1, 6	LLD1, 9	LLD1, 12
COEFFICIENT	0.8688	-0.5219	-0.2483	0.2983	-0.3096
STANDARD ERROR	0.4994	0.5051	0.4974	0.5010	0.4720
T-STATISTIC	1.7400	-1.0330	-0.4991	0.5955	-0.6558
R-SQUARE (ADJUSTED)	0.0108	0.0004	-0.0042	-0.0037	-0.0033
DURBIN-WATSON	1.6753	1.5212	1.5639	1.5675	1.6137

TABLE III(ii)
- Loans To Deposits Ratio As The Dependent Variable -

DEPENDENT VARIABLE	LLD1	LLD1	LLD1	LLD1
INDEPENDENT VARIABLE	LPR1, 3	LPR1, 6	LPR1, 9	LPR1, 12
COEFFICIENT	0.0128	0.0074	-0.0090	0.0266
STANDARD ERROR	0.0109	0.0110	0.0114	0.0112
T-STATISTIC	1.1790	0.6788	-0.7917	2.3830
R-SQUARE (ADJUSTED)	0.0021	-0.0030	-0.0021	0.0263
DURBIN-WATSON	1.5845	1.5784	1.5622	1.6420

TABLE IV

REGRESSION RESULTS
THE BANK RATE AND THE LOANS TO DEPOSITS RATIO

TABLE IV(i)
- Bank Rate As The Dependent Variable -

DEPENDENT VARIABLE	LBR1	LBR1	LBR1	LBR1	LBR1
INDEPENDENT VARIABLE	LLD1	LLD1, 3	LLD1, 6	LLD1, 9	LLD1, 12
COEFFICIENT	0.9605	-0.5111	0.4451	-0.1291	-0.7577
STANDARD ERROR	0.6079	0.6155	0.5979	0.6014	0.5758
T-STATISTIC	1.5800	-0.8304	0.7444	-0.2147	-1.3160
R-SQUARE (ADJUSTED)	0.0080	-0.0017	-0.0025	-0.0054	0.0042
DURBIN-WATSON	1.4058	1.2533	1.3112	1.3222	1.3546

TABLE IV(ii)
- Loans To Deposits Ratio As The Dependent Variable -

DEPENDENT VARIABLE	LLD1	LLD1	LLD1	LLD1
INDEPENDENT VARIABLE	LBR1, 3	LBR1, 6	LBR1, 9	LBR1, 12
COEFFICIENT	0.0094	0.0040	-0.0029	0.0224
STANDARD ERROR	0.0090	0.0090	0.0094	0.0092
T-STATISTIC	1.0520	0.4464	-0.3087	2.4410
R-SQUARE (ADJUSTED)	0.0006	-0.0045	-0.0052	0.0279
DURBIN-WATSON	1.5915	1.5733	1.5722	1.6504

STATIONARITY TESTS

- Monthly Data -

VARIABLE : MU = PR/BR

DICKEY-FULLER TESTS - NO.LAGS = 13 NO.OBS = 173

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.3168	-2.57
A(0)=A(1)=0	2.5696	3.78

VARIABLE : LOG (MU) = LOG (PR/BR)

DICKEY-FULLER TESTS - NO.LAGS = 13 NO.OBS = 173

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.3005	-2.57
A(0)=A(1)=0	2.5402	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (MU)

DICKEY-FULLER TESTS - NO.LAGS = 10 NO.OBS = 175

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-5.4832	-2.57
A(0)=A(1)=0	14.009	3.78

VARIABLE : L/D

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-125.50	-11.2
A(1)=0 T-TEST	-23.121	-2.57
A(0)=A(1)=0	266.88	3.78

VARIABLE : LOG (L/D)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-9.9847	-11.2
A(1)=0 T-TEST	-2.3133	-2.57
A(0)=A(1)=0	2.6520	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (L/D)

DICKEY-FULLER TESTS - NO.LAGS = 1 NO.OBS = 184

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-10.245	-2.57
A(0)=A(1)=0	51.633	3.78

VARIABLE : TERM

DICKEY-FULLER TESTS - NO.LAGS = 1 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-1.6604	-2.57
A(0)=A(1)=0	1.5032	3.78

VARIABLE : LOG (TERM)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-52.650	-11.20
A(1)=0 T-TEST	-7.7314	-2.57
A(0)=A(1)=0	29.897	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (TERM)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-174.27	-11.20
A(1)=0 T-TEST	-42.209	-2.57
A(0)=A(1)=0	886.12	3.78

VARIABLE : BA

DICKEY-FULLER TESTS - NO.LAGS = 4 NO.OBS = 182

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-1.5669	-2.57
A(0)=A(1)=0	1.2523	3.78

VARIABLE : LOG (BA)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-42.707	-11.2
A(1)=0 T-TEST	-6.4750	-2.57
A(0)=A(1)=0	21.005	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (BA)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-177.04	-11.2
A(1)=0 T-TEST	-32.861	-2.57
A(0)=A(1)=0	536.78	3.78

VARIABLE : LIQ/T

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-26.224	-11.2
A(1)=0 T-TEST	-4.7523	-2.57
A(0)=A(1)=0	11.918	3.78

VARIABLE : LOG (LIQ/T)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-70.146	-11.20
A(1)=0 T-TEST	-10.683	-2.57
A(0)=A(1)=0	57.016	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (LIQ/T)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-79.405	-11.20
A(1)=0 T-TEST	-11.808	-2.57
A(0)=A(1)=0	69.606	3.78

VARIABLE : PR/OVER
DICKEY-FULLER TESTS - NO.LAGS = 5 NO.OBS = 181

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.7128	-2.57
A(0)=A(1)=0	3.6443	3.78

VARIABLE : LOG (PR/OVER)
DICKEY-FULLER TESTS - NO.LAGS = 5 NO.OBS = 181

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.9593	-2.57
A(0)=A(1)=0	4.3709	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (PR/OVER)
DICKEY-FULLER TESTS - NO.LAGS = 5 NO.OBS = 180

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-9.5501	-2.57
A(0)=A(1)=0	43.829	3.78

VARIABLE : PR/TERM
DICKEY-FULLER TESTS - NO.LAGS = 5 NO.OBS = 181

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.9170	-2.57
A(0)=A(1)=0	4.0952	3.78

VARIABLE : LOG (PR/TERM)
DICKEY-FULLER TESTS - NO.LAGS = 5 NO.OBS = 181

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.9182	-2.57
A(0)=A(1)=0	4.0985	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (PR/TERM)
DICKEY-FULLER TESTS - NO.LAGS = 3 NO.OBS = 182

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-7.0642	-2.57
A(0)=A(1)=0	24.272	3.78

VARIABLE : PR/5YEAR
DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-12.392	-11.20
A(1)=0 T-TEST	-2.6174	-2.57
A(0)=A(1)=0	3.4027	3.78

VARIABLE : LOG (PR/5YEAR)
DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-11.765	-11.20
A(1)=0 T-TEST	-2.5403	-2.57
A(0)=A(1)=0	3.2033	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (PR/5YEAR)
DICKEY-FULLER TESTS - NO.LAGS = 11 NO.OBS = 174

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-3.6381	-2.57
A(0)=A(1)=0	6.1278	3.78

VARIABLE : PR
DICKEY-FULLER TESTS - NO.LAGS = 10 NO.OBS = 176

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.8430	-2.57
A(0)=A(1)=0	3.9639	3.78

VARIABLE : LOG (PR)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-51.065	-11.2
A(1)=0 T-TEST	-7.4795	-2.57
A(0)=A(1)=0	28.021	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (PR)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-178.24	-11.2
A(1)=0 T-TEST	-42.993	-2.57
A(0)=A(1)=0	919.26	3.78

VARIABLE : BR

DICKEY-FULLER TESTS - NO.LAGS = 10 NO.OBS = 176

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.8760	-2.57
A(0)=A(1)=0	4.0425	3.78

VARIABLE : LOG (BR)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 186

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-43.188	-11.20
A(1)=0 T-TEST	-6.5453	-2.57
A(0)=A(1)=0	21.464	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (BR)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 185

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-172.89	-11.20
A(1)=0 T-TEST	-34.588	-2.57
A(0)=A(1)=0	594.90	3.78

STATIONARITY TESTS

- Quarterly Data -

VARIABLE : MU = PR/BR

DICKEY-FULLER TESTS - NO.LAGS = 2 NO.OBS = 49

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.8226	-2.57
A(0)=A(1)=0	3.6774	3.78

VARIABLE : LOG (MU)

DICKEY-FULLER TESTS - NO.LAGS = 2 NO.OBS = 49

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.8417	-2.57
A(0)=A(1)=0	3.7288	3.78

VARIABLE : LOG OF FIRST DIFFERENCE (MU)

DICKEY-FULLER TESTS - NO.LAGS = 2 NO.OBS = 48

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-4.7829	-2.57
A(0)=A(1)=0	10.485	3.78

VARIABLE : L/D

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 51

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-42.555	-11.2
A(1)=0 T-TEST	-22.732	-2.57
A(0)=A(1)=0	254.96	3.78

VARIABLE : LOG (L/D)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 51

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-8.0978	-11.2
A(1)=0 T-TEST	-2.1808	-2.57
A(0)=A(1)=0	2.3015	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (L/D)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 50

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-45.148	-11.2
A(1)=0 T-TEST	-10.643	-2.57
A(0)=A(1)=0	55.249	3.78

VARIABLE : DEBT/E

DICKEY-FULLER TESTS - NO.LAGS = 1 NO.OBS = 50

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-2.0967	-2.57
A(0)=A(1)=0	2.4168	3.78

VARIABLE : LOG (DEBT/E)

DICKEY-FULLER TESTS - NO.LAGS = 1 NO.OBS = 50

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-1.9698	-2.57
A(0)=A(1)=0	2.1452	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (DEBT/E)

DICKEY-FULLER TESTS - NO.LAGS = 7 NO.OBS = 43

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-3.1811	-2.57
A(0)=A(1)=0	4.4458	3.78

VARIABLE : GDP

DICKEY-FULLER TESTS - NO.LAGS = 6 NO.OBS = 45

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 T-TEST	-0.4991	-2.57
A(0)=A(1)=0	2.3154	3.78

VARIABLE : LOG (GDP)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 51

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-47.5970	-11.20
A(1)=0 T-TEST	-47.3030	-2.57
A(0)=A(1)=0	1100.40	3.78

VARIABLE : FIRST DIFFERENCE OF LOG (GDP)

DICKEY-FULLER TESTS - NO.LAGS = 0 NO.OBS = 50

NULL HYPOTHESIS	TEST STATISTIC	ASY. CRITICAL VALUE 10%
CONSTANT, NO TREND		
A(1)=0 Z-TEST	-49.6070	-11.20
A(1)=0 T-TEST	-206.550	-2.57
A(0)=A(1)=0	20904.0	3.78

Appendix C

AUTOCORRELATION FUNCTIONS

- Monthly Data -

VARIABLE: MU

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **MU=PR/BR**

```
 1 0.77 .                              +    RRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 2 0.51 .                             +     RRRRRRRRRRRRRRRRRR               .
 3 0.30 .                            +      RRRRRRRRRRR                      .
 4 0.15 .                            +      RRRRRR  +                        .
 5 0.09 .                           +       RRRR     +                       .
 6 0.16 .                           +       RRRRRR   +                       .
 7 0.27 .                           +       RRRRRRRRRR                       .
 8 0.27 .                           +       RRRRRRRRRR                       .
 9 0.23 .                           +       RRRRRRRRR+                       .
10 0.17 .                           +       RRRRRRR  +                       .
11 0.10 .                           +       RRRR     +                       .
12 0.02 .                           +       RR       +                       .
13  .00 .                           +       R        +                       .
14 0.05 .                           +       RRR      +                       .
15 0.10 .                           +       RRRR     +                       .
16 0.13 .                           +       RRRRR    +                       .
17 0.14 .                           +       RRRRRR   +                       .
18 0.09 .                           +       RRRR     +                       .
19 -.01 .                           +       R        +                       .
20 -.10 .                           +    RRRR        +                       .
21 -.17 .                           + RRRRRRR        +                       .
22 -.20 .                          + RRRRRRRR         +                      .
23 -.17 .                          +  RRRRRRR         +                      .
24 -.13 .                          +    RRRRR         +                      .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **LOG(MU)**

```
 1 0.77 .                              +    RRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 2 0.52 .                             +     RRRRRRRRRRRRRRRRRRR              .
 3 0.31 .                            +      RRRRRRRRRRRR                     .
 4 0.16 .                            +      RRRRRR  +                        .
 5 0.08 .                           +       RRRR     +                       .
 6 0.14 .                           +       RRRRRR   +                       .
 7 0.25 .                           +       RRRRRRRRR+                       .
 8 0.26 .                           +       RRRRRRRRRR                       .
 9 0.22 .                           +       RRRRRRRR +                       .
10 0.16 .                           +       RRRRRRR  +                       .
11 0.10 .                           +       RRRR     +                       .
12 0.02 .                           +       RR       +                       .
13 -.01 .                           +       R        +                       .
14 0.05 .                           +       RRR      +                       .
15 0.09 .                           +       RRRR     +                       .
16 0.12 .                           +       RRRRR    +                       .
17 0.12 .                           +       RRRRR    +                       .
18 0.08 .                           +       RRRR     +                       .
19 -.02 .                           +      RR        +                       .
20 -.10 .                           +    RRRRR       +                       .
21 -.18 .                           + RRRRRRR        +                       .
22 -.21 .                           +RRRRRRRR        +                       .
23 -.18 .                          +   RRRRRRR        +                      .
24 -.14 .                          +    RRRRRR        +                      .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ALOG(MU)

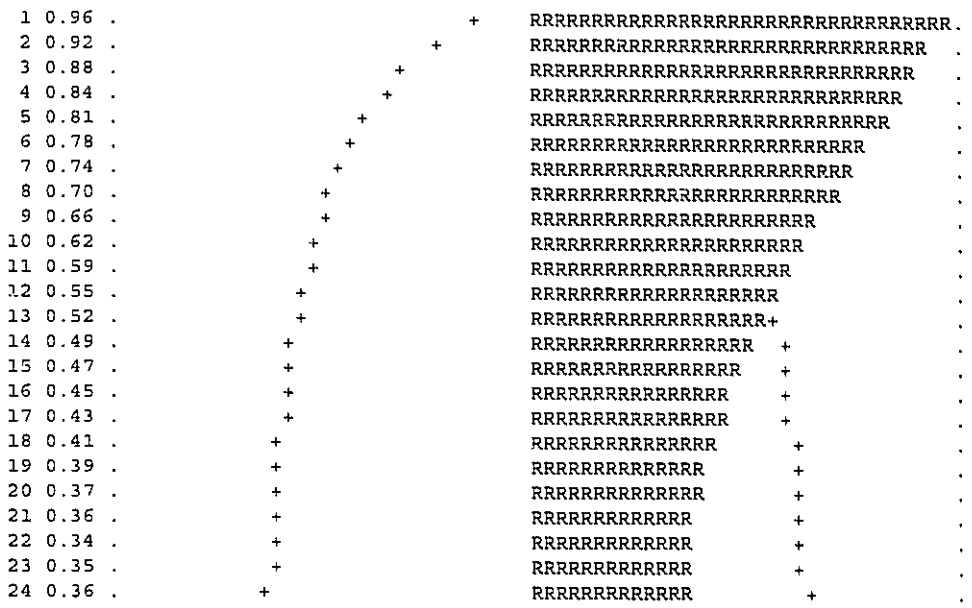
```
 1 0.05 .                          +    RRR  +                    .
 2 -.11 .                          +RRRRR    +                    .
 3 -.11 .                          +RRRRR    +                    .
 4 -.16 .                         RRRRRR     +                    .
 5 -.27 .                      RRRRRRRRRR    +                    .
 6 -.11 .                        + RRRRR     +                    .
 7 0.22 .                        +     RRRRRRRRR                  .
 8 0.08 .                        +     RRRR  +                    .
 9 0.02 .                        +     RR    +                    .
10 0.01 .                        +     R     +                    .
11 0.03 .                        +     RR    +                    .
12 -.10 .                        +  RRRR     +                    .
13 -.18 .                       RRRRRRR      +                    .
14 0.05 .                       +     RRR   +                    .
15 0.03 .                       +     RR    +                    .
16 0.04 .                       +     RR    +                    .
17 0.07 .                       +     RRR   +                    .
18 0.09 .                       +     RRRR  +                    .
19 0.00 .                       +     R     +                    .
20 -.02 .                       +    RR     +                    .
21 -.09 .                       +  RRRR     +                    .
22 -.11 .                       + RRRRR     +                    .
23 -.01 .                       +     R     +                    .
24 -.01 .                       +     R     +                    .
```

VARIABLE: L/D

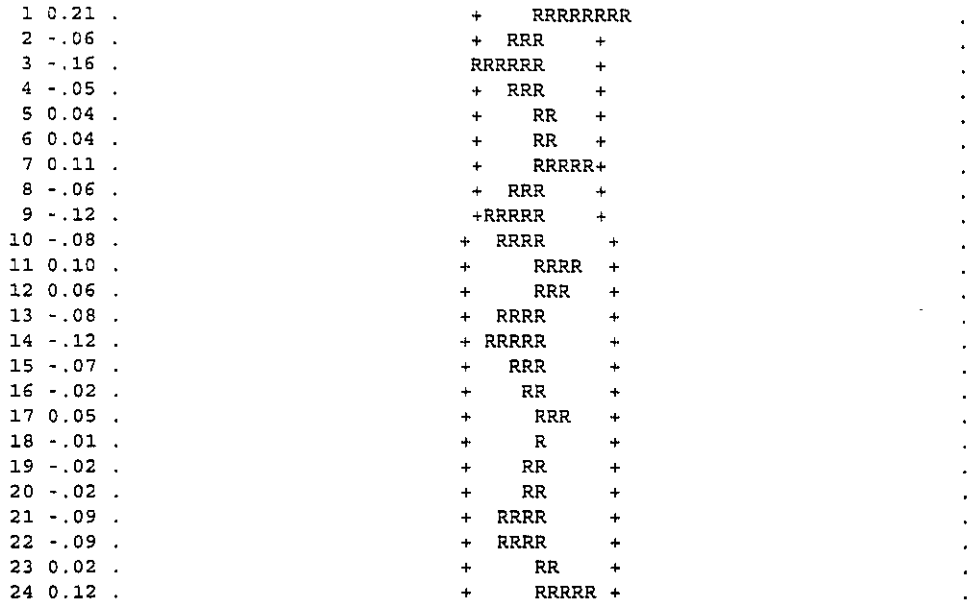
AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) L/D

```
 1 0.96 .                                 +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.92 .                              +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.88 .                           +          RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 4 0.84 .                        +             RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 5 0.81 .                     +                RRRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 6 0.78 .                    +                 RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 7 0.74 .                   +                  RRRRRRRRRRRRRRRRRRRRRRRRRRR        .
 8 0.70 .                  +                   RRRRRRRRRRRRRRRRRRRRRRRRRR         .
 9 0.66 .                  +                   RRRRRRRRRRRRRRRRRRRRRRRRR          .
10 0.63 .                 +                    RRRRRRRRRRRRRRRRRRRRRRR            .
11 0.60 .                 +                    RRRRRRRRRRRRRRRRRRRRRR             .
12 0.56 .                +                     RRRRRRRRRRRRRRRRRRRRR              .
13 0.53 .                +                     RRRRRRRRRRRRRRRRRRRR+              .
14 0.50 .               +                      RRRRRRRRRRRRRRRRRRR  +             .
15 0.48 .               +                      RRRRRRRRRRRRRRRRRR   +             .
16 0.46 .               +                      RRRRRRRRRRRRRRRRRR   +             .
17 0.44 .              +                       RRRRRRRRRRRRRRRRR      +           .
18 0.42 .              +                       RRRRRRRRRRRRRRRR       +           .
19 0.40 .              +                       RRRRRRRRRRRRRRRR       +           .
20 0.38 .              +                       RRRRRRRRRRRRRR         +           .
21 0.37 .              +                       RRRRRRRRRRRRRR         +           .
22 0.35 .             +                        RRRRRRRRRRRRR            +        .
23 0.36 .             +                        RRRRRRRRRRRRR            +        .
24 0.37 .             +                        RRRRRRRRRRRRR            +        .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(L/D)



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) Λ(LD)



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(L/D)

```
 1 0.21 .                          +    RRRRRRRR                          .
 2 -.06 .                          +  RRR     +                          .
 3 -.15 .                         RRRRRR     +                          .
 4 -.05 .                          +  RRR     +                          .
 5 0.04 .                          +    RR    +                          .
 6 0.04 .                          +    RR    +                          .
 7 0.11 .                          +    RRRRR+                           .
 8 -.07 .                          +  RRR     +                          .
 9 -.12 .                          +RRRRR     +                          .
10 -.06 .                         +   RRR      +                         .
11 0.10 .                         +     RRRR   +                         .
12 0.05 .                         +     RRR    +                         .
13 -.09 .                         +  RRRR      +                         .
14 -.11 .                         + RRRRR      +                         .
15 -.07 .                         +   RRR      +                         .
16 -.03 .                         +    RR      +                         .
17 0.05 .                         +     RRR    +                         .
18 -.02 .                         +    RR      +                         .
19 -.03 .                         +    RR      +                         .
20 -.03 .                         +    RR      +                         .
21 -.08 .                         +  RRRR      +                         .
22 -.09 .                         +  RRRR      +                         .
23 0.02 .                         +     RR     +                         .
24 0.11 .                         +     RRRRR  +                         .
```

VARIABLE: TERM

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) TERM

```
 1 0.97 .                                  +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.94 .                                +      RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 3 0.90 .                               +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 4 0.85 .                              +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 5 0.81 .                             +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 6 0.78 .                            +          RRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 7 0.74 .                           +           RRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 8 0.71 .                          +            RRRRRRRRRRRRRRRRRRRRRRRRRR        .
 9 0.67 .                          +            RRRRRRRRRRRRRRRRRRRRRRRRR         .
10 0.62 .                         +             RRRRRRRRRRRRRRRRRRRRRRR           .
11 0.58 .                        +              RRRRRRRRRRRRRRRRRRRRR             .
12 0.53 .                        +              RRRRRRRRRRRRRRRRRRR+              .
13 0.49 .                        +              RRRRRRRRRRRRRRRRR +               .
14 0.45 .                       +               RRRRRRRRRRRRRRRR     +            .
15 0.41 .                       +               RRRRRRRRRRRRRR       +            .
16 0.38 .                       +               RRRRRRRRRRRRR        +            .
17 0.35 .                       +               RRRRRRRRRRRR         +            .
18 0.31 .                      +                RRRRRRRRRRR           +          .
19 0.27 .                      +                RRRRRRRRR             +          .
20 0.23 .                      +                RRRRRRRR              +          .
21 0.20 .                      +                RRRRRRR               +          .
22 0.18 .                      +                RRRRRR                +          .
23 0.16 .                      +                RRRRR                 +          .
24 0.15 .                      +                RRRRR                 +          .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **LOG(TERM)**

```
 1 0.97 .                                +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.94 .                             +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 3 0.89 .                          +          RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 4 0.85 .                         +           RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 5 0.81 .                       +             RRRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 6 0.78 .                      +              RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 7 0.75 .                    +                RRRRRRRRRRRRRRRRRRRRRRRRRR         .
 8 0.72 .                   +                 RRRRRRRRRRRRRRRRRRRRRRRRR          .
 9 0.68 .                 +                   RRRRRRRRRRRRRRRRRRRRRRR            .
10 0.64 .                 +                   RRRRRRRRRRRRRRRRRRRRRR             .
11 0.59 .               +                     RRRRRRRRRRRRRRRRRRRR               .
12 0.56 .               +                     RRRRRRRRRRRRRRRRRR                 .
13 0.52 .             +                       RRRRRRRRRRRRRRRRRR +               .
14 0.49 .             +                       RRRRRRRRRRRRRRRRR  +               .
15 0.46 .             +                       RRRRRRRRRRRRRRRR   +               .
16 0.43 .             +                       RRRRRRRRRRRRRRR    +               .
17 0.40 .           +                         RRRRRRRRRRRRRR      +              .
18 0.36 .           +                         RRRRRRRRRRRR        +              .
19 0.31 .           +                         RRRRRRRRRRR         +              .
20 0.27 .           +                         RRRRRRRRR           +              .
21 0.24 .           +                         RRRRRRRR            +              .
22 0.21 .           +                         RRRRRRR             +              .
23 0.18 .           +                         RRRRRR              +              .
24 0.16 .           +                         RRRRR               +              .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) Δ**(TERM)**

```
 1 0.22 .                                +    RRRRRRRR                           .
 2 0.12 .                                +    RRRRR+                             .
 3 0.06 .                                +    RRR  +                             .
 4 0.00 .                                +    R    +                             .
 5 -.03 .                                +   RR    +                             .
 6 -.05 .                                +  RRR    +                             .
 7 -.05 .                                +  RRR    +                             .
 8 0.00 .                                +    RRRR +                             .
 9 0.02 .                                +    RR   +                             .
10 0.05 .                                +    RRR  +                             .
11 -.03 .                                +   RR    +                             .
12 -.06 .                                +  RRR    +                             .
13 -.01 .                                +    R    +                             .
14 -.08 .                                + RRRR    +                             .
15 -.21 .                               RRRRRRRR   +                             .
16 -.06 .                                +   RRR     +                           .
17 -.05 .                                +   RRR     +                           .
18 0.05 .                                +     RRR   +                           .
19 -.13 .                                +RRRRRR     +                           .
20 -.15 .                                +RRRRRR     +                           .
21 -.10 .                                +  RRRR     +                           .
22 -.04 .                                +    RR     +                           .
23 -.08 .                                +  RRRR     +                           .
24 -.01 .                                +    R      +                          .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(TERM)

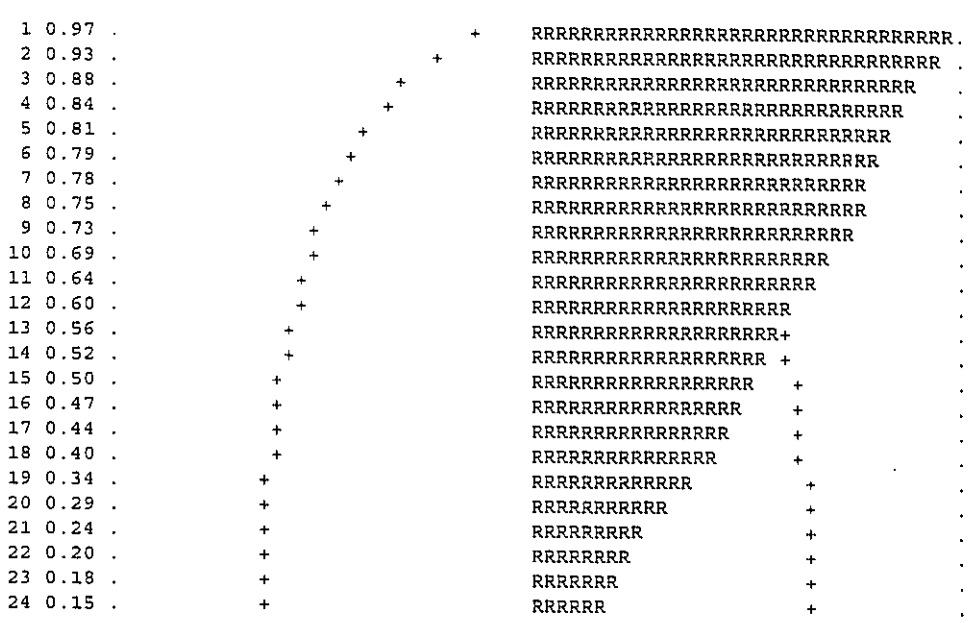
```
 1 0.25 .                          +    RRRRRRRRR                          .
 2 0.09 .                          +    RRRR +                             .
 3 0.07 .                          +    RRR  +                             .
 4  .00 .                          +    R    +                             .
 5 -.08 .                          + RRRR    +                             .
 6 -.02 .                          +   RR    +                             .
 7 0.01 .                          +    R    +                             .
 8 0.05 .                          +    RRR  +                             .
 9 -.01 .                          +    R    +                             .
10 0.06 .                          +    RRR  +                             .
11 -.09 .                          + RRRR    +                             .
12 -.09 .                          + RRRR    +                             .
13 -.05 .                          +  RRR    +                             .
14 -.09 .                          + RRRR    +                             .
15 -.17 .                         RRRRRRR     +                            .
16 -.02 .                         +    RR     +                            .
17 0.05 .                         +     RRR   +                            .
18 0.05 .                         +     RRR   +                            .
19 -.11 .                         + RRRR      +                            .
20 -.09 .                         +  RRRR     +                            .
21 -.12 .                         + RRRR      +                            .
22 -.03 .                         +    RR     +                            .
23 -.08 .                         +  RRRR     +                            .
24 0.01 .                         +     R     +                            .
```

VARIABLE: BA

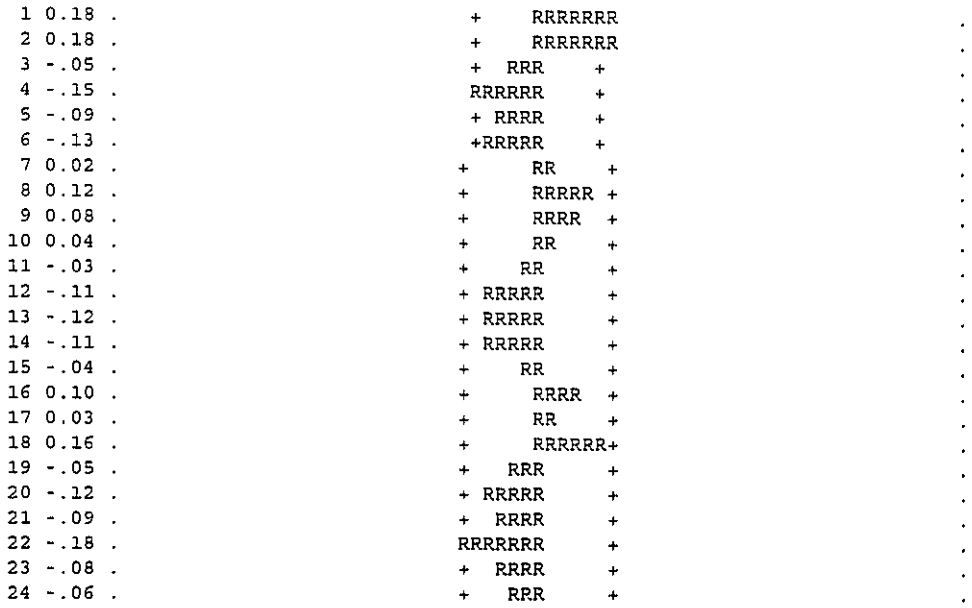
AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) BA

```
 1 0.97 .                                +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.93 .                             +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.87 .                          +          RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 4 0.82 .                         +           RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 5 0.79 .                       +             RRRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 6 0.76 .                      +              RRRRRRRRRRRRRRRRRRRRRRRRRRRR        .
 7 0.74 .                     +               RRRRRRRRRRRRRRRRRRRRRRRRRRR         .
 8 0.71 .                     +               RRRRRRRRRRRRRRRRRRRRRRRRRR          .
 9 0.68 .                    +                RRRRRRRRRRRRRRRRRRRRRRRRR           .
10 0.64 .                   +                 RRRRRRRRRRRRRRRRRRRRRRRR            .
11 0.60 .                   +                 RRRRRRRRRRRRRRRRRRRRRR              .
12 0.55 .                  +                  RRRRRRRRRRRRRRRRRRRRR               .
13 0.50 .                  +                  RRRRRRRRRRRRRRRRRRR +               .
14 0.47 .                 +                   RRRRRRRRRRRRRRRRRR   +              .
15 0.44 .                 +                   RRRRRRRRRRRRRRRRR    +              .
16 0.41 .                 +                   RRRRRRRRRRRRRRRR     +              .
17 0.37 .                 +                   RRRRRRRRRRRRRRR      +              .
18 0.33 .                 +                   RRRRRRRRRRRRR        +              .
19 0.27 .                +                    RRRRRRRRRR             +           .
20 0.22 .                +                    RRRRRRRR               +           .
21 0.18 .                +                    RRRRRRR                +           .
22 0.14 .                +                    RRRRRR                 +           .
23 0.12 .                +                    RRRRR                  +           .
24 0.10 .                +                    RRRR                   +           .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(BA)



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) Δ(BA)



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(BA)

```
 1 0.07 .                          +    RRR  +                          .
 2 0.21 .                          +    RRRRRRRR                        .
 3 -.11 .                          +RRRRR    +                          .
 4 -.16 .                          RRRRRR    +                          .
 5 -.11 .                          +RRRRR    +                          .
 6 -.11 .                          +RRRRR    +                          .
 7 0.10 .                         +     RRRR  +                         .
 8 0.03 .                         +     RR    +                         .
 9 0.18 .                         +     RRRRRRR                         .
10 0.00 .                         +     R     +                         .
11 0.03 .                         +     RR    +                         .
12 -.08 .                         +  RRRR     +                         .
13 -.15 .                         +RRRRRR     +                         .
14 -.11 .                         + RRRRR     +                         .
15 -.06 .                         +   RRR     +                         .
16 0.10 .                         +     RRRR  +                         .
17 0.02 .                         +     RR    +                         .
18 0.21 .                         +     RRRRRRRR                        .
19 -.01 .                         +     R     +                         .
20 -.09 .                         +  RRRR     +                         .
21 -.06 .                         +   RRR     +                         .
22 -.19 .                        RRRRRRRR     +                         .
23 -.08 .                         +  RRRR     +                         .
24 -.06 .                         +   RRR     +                         .
```

VARIABLE: LIQ/T

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LIQ/T

```
 1 0.97 .                                +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.93 .                              +      RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 3 0.88 .                            +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 4 0.84 .                           +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 5 0.80 .                         +           RRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 6 0.77 .                        +            RRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 7 0.73 .                       +             RRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 8 0.69 .                      +              RRRRRRRRRRRRRRRRRRRRRRRRRR        .
 9 0.64 .                      +              RRRRRRRRRRRRRRRRRRRRRRRRR         .
10 0.61 .                     +               RRRRRRRRRRRRRRRRRRRRRRR           .
11 0.58 .                     +               RRRRRRRRRRRRRRRRRRRRRR            .
12 0.54 .                    +                RRRRRRRRRRRRRRRRRRRR+             .
13 0.51 .                    +                RRRRRRRRRRRRRRRRRR +              .
14 0.48 .                    +                RRRRRRRRRRRRRRRRR  +              .
15 0.45 .                   +                 RRRRRRRRRRRRRRRR    +             .
16 0.42 .                   +                 RRRRRRRRRRRRRRR     +             .
17 0.40 .                   +                 RRRRRRRRRRRRRRR     +             .
18 0.37 .                   +                 RRRRRRRRRRRRRR      +             .
19 0.33 .                  +                  RRRRRRRRRRRR          +           .
20 0.30 .                  +                  RRRRRRRRRRR           +           .
21 0.26 .                  +                  RRRRRRRRRR            +           .
22 0.23 .                  +                  RRRRRRRRR             +           .
23 0.21 .                  +                  RRRRRRRR              +           .
24 0.19 .                  +                  RRRRRRRR              +           .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(LIQ/T)

```
 1 0.97 .                                +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.92 .                             +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.87 .                          +          RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 4 0.83 .                         +           RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 5 0.79 .                       +             RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 6 0.75 .                      +              RRRRRRRRRRRRRRRRRRRRRRRRRR         .
 7 0.71 .                     +               RRRRRRRRRRRRRRRRRRRRRRRRR          .
 8 0.66 .                     +               RRRRRRRRRRRRRRRRRRRRRRR            .
 9 0.61 .                    +                RRRRRRRRRRRRRRRRRRRRR              .
10 0.57 .                   +                 RRRRRRRRRRRRRRRRRRR                .
11 0.53 .                   +                 RRRRRRRRRRRRRRRRR                  .
12 0.50 .                   +                 RRRRRRRRRRRRRRRRR+                 .
13 0.46 .                  +                  RRRRRRRRRRRRRRRR  +                .
14 0.42 .                  +                  RRRRRRRRRRRRRR    +                .
15 0.39 .                  +                  RRRRRRRRRRRRR     +                .
16 0.37 .                  +                  RRRRRRRRRRRR      +                .
17 0.34 .                 +                   RRRRRRRRRRR       +               .
18 0.32 .                 +                   RRRRRRRRRR        +               .
19 0.28 .                 +                   RRRRRRRRR         +               .
20 0.25 .                 +                   RRRRRRRR          +               .
21 0.22 .                 +                   RRRRRRR           +               .
22 0.19 .                 +                   RRRRRRR           +               .
23 0.18 .                 +                   RRRRRR            +               .
24 0.16 .                 +                   RRRRR             +               .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) Δ(LIQ/T)

```
 1 0.27 .                                +    RRRRRRRRRR                         .
 2 0.00 .                                +    R    +                             .
 3 -.07 .                                +  RRR    +                             .
 4 -.04 .                                +   RR    +                             .
 5 -.09 .                                + RRRR    +                             .
 6 0.04 .                                +    RR   +                             .
 7 0.13 .                                +    RRRRR+                             .
 8 0.07 .                                +    RRR  +                             .
 9 -.14 .                               +RRRRRR     +                             .
10 -.06 .                               +   RRR     +                             .
11 0.02 .                               +     RR    +                             .
12 0.09 .                               +     RRRR  +                             .
13 -.09 .                               +  RRRR     +                             .
14 -.07 .                               +   RRR     +                             .
15 -.14 .                               +RRRRRR     +                             .
16 -.04 .                               +    RR     +                             .
17 0.10 .                               +     RRRR  +                             .
18 0.12 .                               +     RRRRR +                             .
19 0.06 .                               +     RRR   +                             .
20 0.04 .                               +     RR    +                             .
21 -.11 .                               + RRRRR     +                             .
22 -.10 .                               +  RRRR     +                             .
23  .00 .                               +     R     +                             .
24 0.21 .                               +     RRRRRRRR                          .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ALOG(LIQ/T)

```
 1 0.26 .                          +    RRRRRRRRRR                    .
 2 -.02 .                          +   RR    +                        .
 3 -.08 .                          + RRRR    +                        .
 4 -.02 .                          +   RR    +                        .
 5 -.08 .                          + RRRR    +                        .
 6 0.05 .                          +    RRR  +                        .
 7 0.15 .                          +    RRRRRR                        .
 8 0.08 .                          +    RRRR +                        .
 9 -.16 .                         +RRRRRR     +                        .
10 -.06 .                         +   RRR     +                        .
11 -.01 .                         +     R     +                        .
12 0.09 .                         +     RRRR  +                        .
13 -.12 .                         + RRRRR     +                        .
14 -.09 .                         +  RRRR     +                        .
15 -.14 .                         +RRRRRR     +                        .
16 -.06 .                         +   RRR     +                        .
17 0.07 .                         +     RRR   +                        .
18 0.11 .                         +     RRRRR +                        .
19 0.03 .                         +     RR    +                        .
20 0.03 .                         +     RR    +                        .
21 -.13 .                         + RRRRR     +                        .
22 -.08 .                         +  RRRR     +                        .
23 0.00 .                         +     R     +                        .
24 0.22 .                         +     RRRRRRRR                       .
```

VARIABLE: PR/OVER

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) PR/OVER

```
 1 0.51 .                           +    RRRRRRRRRRRRRRRRRR            .
 2 0.30 .                          +     RRRRRRRRRR                    .
 3 0.25 .                          +     RRRRRRRRR                     .
 4 0.22 .                         +      RRRRRRRRR                     .
 5 0.28 .                         +      RRRRRRRRRR                    .
 6 0.35 .                         +      RRRRRRRRRRRR                  .
 7 0.33 .                        +       RRRRRRRRRRR                   .
 8 0.28 .                        +       RRRRRRRRRR                    .
 9 0.29 .                        +       RRRRRRRRRR                    .
10 0.20 .                        +       RRRRRRRR+                     .
11 0.18 .                       +        RRRRRRR  +                    .
12 0.19 .                       +        RRRRRRR  +                    .
13 0.14 .                       +        RRRRRR   +                    .
14 0.13 .                       +        RRRRRR   +                    .
15 0.22 .                       +        RRRRRRR  +                    .
16 0.15 .                       +        RRRRRR   +                    .
17 0.09 .                       +        RRRR     +                    .
18 0.07 .                       +        RRRR     +                    .
19 0.06 .                       +        RRR      +                    .
20 -.07 .                       +      RRR        +                    .
21 -.06 .                       +      RRR        +                    .
22 0.04 .                       +        RR       +                    .
23 -.03 .                       +       RR        +                    .
24 -.02 .                       +       RR        +                    .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(PR/OVER)

```
 1 0.50 .                          +    RRRRRRRRRRRRRRRRRR                .
 2 0.28 .                         +     RRRRRRRRRRR                       .
 3 0.23 .                         +     RRRRRRRRR                         .
 4 0.21 .                        +      RRRRRRRR                          .
 5 0.27 .                        +      RRRRRRRRRR                        .
 6 0.33 .                        +      RRRRRRRRRRRR                      .
 7 0.31 .                        +      RRRRRRRRRRR                       .
 8 0.28 .                       +       RRRRRRRRRR                        .
 9 0.28 .                       +       RRRRRRRRRR                        .
10 0.20 .                       +       RRRRRRRR+                         .
11 0.18 .                       +       RRRRRRR +                         .
12 0.18 .                       +       RRRRRRR +                         .
13 0.14 .                       +       RRRRRR  +                         .
14 0.13 .                      +        RRRRR    +                        .
15 0.21 .                      +        RRRRRRRR +                        .
16 0.15 .                      +        RRRRRR   +                        .
17 0.10 .                      +        RRRR     +                        .
18 0.08 .                      +        RRRR     +                        .
19 0.06 .                      +        RRR      +                        .
20 -.07 .                      +     RRRR        +                        .
21 -.07 .                      +      RRR        +                        .
22 0.03 .                      +        RR       +                        .
23 -.03 .                      +       RR        +                        .
24 -.03 .                      +       RR        +                        .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(PR/OVER)

```
 1 -.26 .                     RRRRRRRRRR    +                              .
 2 -.17 .                        RRRRRRR    +                              .
 3 -.05 .                         + RRR     +                              .
 4 -.08 .                         + RRRR    +                              .
 5 0.01 .                        +     R     +                             .
 6 0.08 .                        +     RRRR  +                             .
 7 0.01 .                        +     R     +                             .
 8 -.03 .                        +    RR     +                             .
 9 0.07 .                        +     RRR   +                             .
10 -.06 .                        +   RRR     +                             .
11 -.03 .                        +    RR     +                             .
12 0.05 .                        +     RRR   +                             .
13 -.03 .                        +    RR     +                             .
14 -.08 .                        +  RRRR     +                             .
15 0.14 .                        +     RRRRRR+                             .
16 -.01 .                        +     R     +                             .
17 -.03 .                        +    RR     +                             .
18 -.01 .                        +     R     +                             .
19 0.13 .                        +     RRRRR +                             .
20 -.15 .                        +RRRRRR     +                             .
21 -.09 .                        +  RRRR     +                             .
22 0.16 .                        +     RRRRRR+                             .
23 -.05 .                        +   RRR     +                             .
24 -.02 .                        +    RR     +                             .
```

VARIABLE: PR/TERM

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **PR/TERM**

```
 1 0.88 .                          +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 2 0.74 .                        +      RRRRRRRRRRRRRRRRRRRRRRRRRR        .
 3 0.62 .                       +       RRRRRRRRRRRRRRRRRRRRRR            .
 4 0.51 .                      +        RRRRRRRRRRRRRRRRRR                .
 5 0.40 .                     +         RRRRRRRRRRRRRRR                   .
 6 0.34 .                     +         RRRRRRRRRRRRR                     .
 7 0.32 .                    +          RRRRRRRRRRRR+                     .
 8 0.31 .                    +          RRRRRRRRRR +                      .
 9 0.28 .                    +          RRRRRRRRR  +                      .
10 0.26 .                    +          RRRRRRRRR  +                      .
11 0.27 .                    +          RRRRRRRRR  +                      .
12 0.26 .                   +           RRRRRRRRR   +                     .
13 0.24 .                   +           RRRRRRRR    +                     .
14 0.24 .                   +           RRRRRRRR    +                     .
15 0.23 .                   +           RRRRRRRR    +                     .
16 0.20 .                   +           RRRRRRR     +                     .
17 0.19 .                   +           RRRRRRR     +                     .
18 0.18 .                   +           RRRRRR      +                     .
19 0.15 .                   +           RRRRRR      +                     .
20 0.10 .                   +           RRRR        +                     .
21 0.07 .                   +           RRR         +                     .
22 0.04 .                   +           RR          +                     .
23 0.01 .                   +           R           +                     .
24 -.01 .                   +           R           +                     .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **LOG(PR/TERM)**

```
 1 0.89 .                          +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 2 0.75 .                        +      RRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 3 0.64 .                       +       RRRRRRRRRRRRRRRRRRRRRRRR          .
 4 0.52 .                      +        RRRRRRRRRRRRRRRRRRR               .
 5 0.41 .                      +        RRRRRRRRRRRRRRR                   .
 6 0.34 .                     +         RRRRRRRRRRRRR                     .
 7 0.32 .                     +         RRRRRRRRRRRR+                     .
 8 0.30 .                     +         RRRRRRRRRR +                      .
 9 0.27 .                     +         RRRRRRRRR  +                      .
10 0.26 .                     +         RRRRRRRRR  +                      .
11 0.27 .                     +         RRRRRRRRR  +                      .
12 0.26 .                    +          RRRRRRRRR   +                     .
13 0.24 .                    +          RRRRRRRR    +                     .
14 0.24 .                    +          RRRRRRRR    +                     .
15 0.23 .                    +          RRRRRRRR    +                     .
16 0.21 .                    +          RRRRRRR     +                     .
17 0.20 .                    +          RRRRRRR     +                     .
18 0.19 .                    +          RRRRRR      +                     .
19 0.15 .                    +          RRRRRR      +                     .
20 0.10 .                    +          RRRR        +                     .
21 0.07 .                    +          RRR         +                     .
22 0.04 .                    +          RR          +                     .
23 0.01 .                    +          R           +                     .
24 -.01 .                    +          R           +                     .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) .\LOG(PR/TERM)

```
 1 0.07 .                          +    RRR  +                    .
 2 -.06 .                          +  RRR    +                    .
 3  .00 .                          +    R    +                    .
 4 -.01 .                          +    R    +                    .
 5 -.22 .                        RRRRRRRR    +                    .
 6 -.12 .                          +RRRRR    +                    .
 7 0.00 .                          +    R    +                    .
 8 0.06 .                          +    RRR  +                    .
 9 -.07 .                          +  RRR    +                    .
10 -.13 .                          +RRRRR    +                    .
11 0.06 .                          +    RRR  +                    .
12 0.04 .                          +    RR   +                    .
13 -.10 .                          + RRRR    +                    .
14 0.03 .                         +     RR    +                   .
15 0.11 .                         +     RRRRR +                   .
16 -.06 .                         +   RRR     +                   .
17 -.04 .                         +    RR     +                   .
18 0.09 .                         +     RRRR  +                   .
19 0.06 .                         +     RRR   +                   .
20 -.05 .                         +   RRR     +                   .
21 -.01 .                         +     R     +                   .
22 0.01 .                         +     R     +                   .
23 -.04 .                         +    RR     +                   .
24 -.06 .                         +   RRR     +                   .
```

VARIABLE: PR/5YEAR

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **PR/5YEAR**

```
 1 0.93 .                               +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.84 .                             +      RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 3 0.77 .                           +        RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 4 0.70 .                         +          RRRRRRRRRRRRRRRRRRRRRRRRR          .
 5 0.65 .                        +           RRRRRRRRRRRRRRRRRRRRRRR            .
 6 0.61 .                        +           RRRRRRRRRRRRRRRRRRRRRR             .
 7 0.58 .                       +            RRRRRRRRRRRRRRRRRRRR               .
 8 0.55 .                      +             RRRRRRRRRRRRRRRRRRR                .
 9 0.52 .                      +             RRRRRRRRRRRRRRRRR                  .
10 0.49 .                      +             RRRRRRRRRRRRRRRR                   .
11 0.47 .                     +              RRRRRRRRRRRRRRR                    .
12 0.43 .                     +              RRRRRRRRRRRRRRR+                   .
13 0.39 .                     +              RRRRRRRRRRRRR  +                   .
14 0.35 .                    +               RRRRRRRRRRRR     +                 .
15 0.31 .                    +               RRRRRRRRRRR      +                 .
16 0.27 .                    +               RRRRRRRRRR       +                 .
17 0.22 .                    +               RRRRRRRRR        +                 .
18 0.17 .                    +               RRRRRRR          +                 .
19 0.12 .                    +               RRRRR            +                 .
20 0.05 .                    +               RRR              +                 .
21 0.00 .                    +               R                +                 .
22 -.04 .                    +              RRR               +                 .
23 -.08 .                    +             RRRR               +                 .
24 -.12 .                    +            RRRRR               +                 .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(PR/5YEAR)

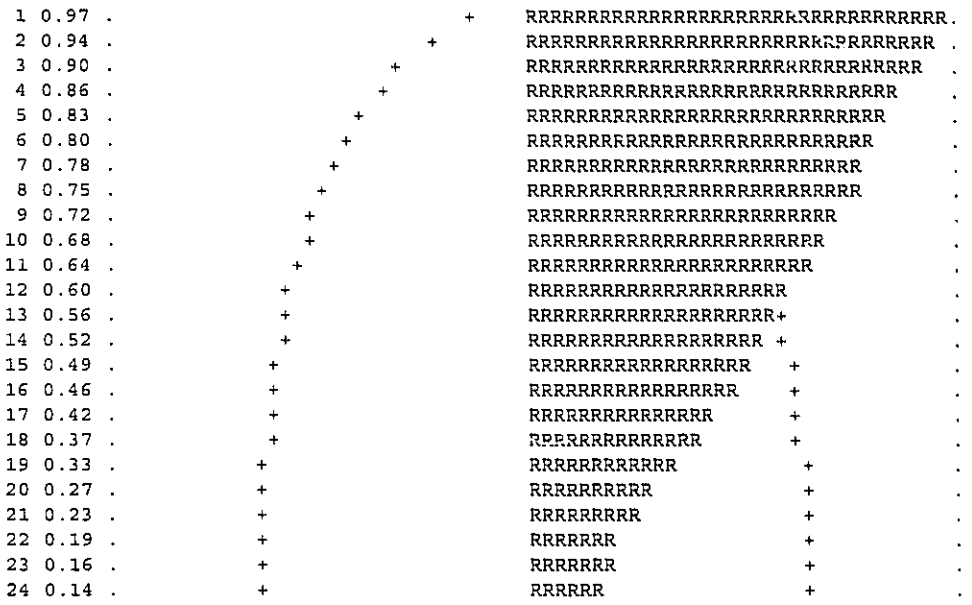
```
 1 0.93 .                                +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.85 .                             +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.78 .                          +          RRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 4 0.72 .                        +            RRRRRRRRRRRRRRRRRRRRRRRRR       .
 5 0.66 .                       +             RRRRRRRRRRRRRRRRRRRRRRR         .
 6 0.62 .                       +             RRRRRRRRRRRRRRRRRRRRRR          .
 7 0.60 .                      +              RRRRRRRRRRRRRRRRRRRRR           .
 8 0.57 .                     +               RRRRRRRRRRRRRRRRRRR             .
 9 0.53 .                     +               RRRRRRRRRRRRRRRRRR              .
10 0.51 .                    +                RRRRRRRRRRRRRRRRR               .
11 0.49 .                    +                RRRRRRRRRRRRRRRRR               .
12 0.46 .                    +                RRRRRRRRRRRRRRRR                .
13 0.42 .                   +                 RRRRRRRRRRRRRRR  +              .
14 0.38 .                   +                 RRRRRRRRRRRRR    +              .
15 0.34 .                   +                 RRRRRRRRRRRR     +              .
16 0.29 .                   +                 RRRRRRRRRR       +              .
17 0.25 .                  +                  RRRRRRRRR          +           .
18 0.20 .                  +                  RRRRRRR            +           .
19 0.15 .                  +                  RRRRR              +           .
20 0.08 .                  +                  RRRR               +           .
21 0.03 .                  +                  RR                 +           .
22 -.02 .                  +                 RR                  +           .
23 -.06 .                  +                RRR                  +           .
24 -.10 .                  +               RRRR                  +           .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(PR/5YEAR)

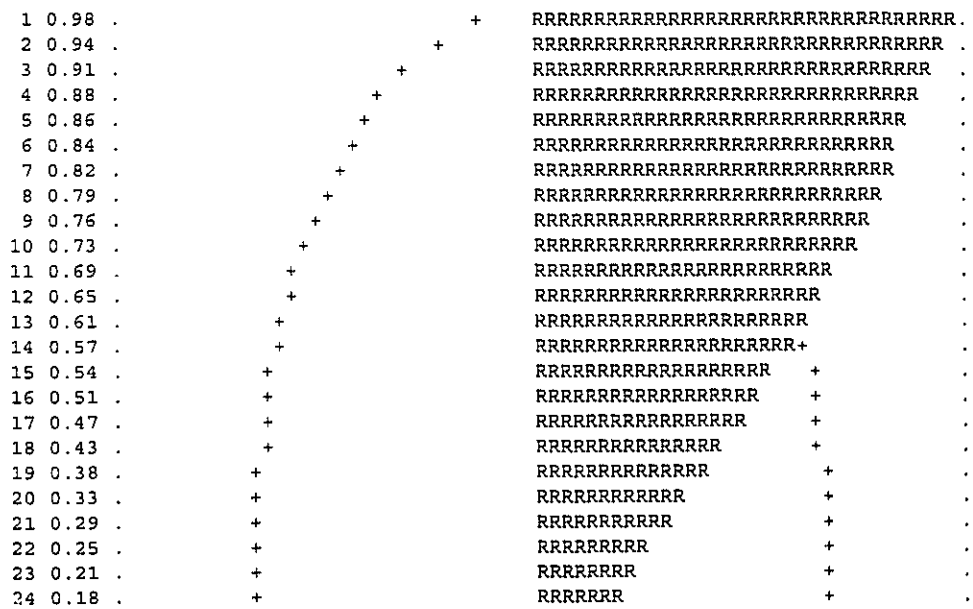
```
 1 0.13 .                                +    RRRRR+                          .
 2 -.05 .                                +  RRR    +                          .
 3 -.07 .                                +  RRR    +                          .
 4 -.07 .                                +  RRR    +                          .
 5 -.12 .                                +RRRRR    +                          .
 6 -.03 .                                +   RR    +                          .
 7 0.05 .                                +    RRR  +                          .
 8 0.10 .                                +    RRRR +                          .
 9 -.10 .                                + RRRR    +                          .
10 -.08 .                                + RRRR    +                          .
11 -.01 .                                +    R    +                          .
12 0.08 .                                +    RRRR +                          .
13 -.06 .                                +  RRR    +                          .
14 0.04 .                                +    RR   +                          .
15 0.12 .                                +    RRRRR+                          .
16 -.02 .                                +   RR    +                          .
17 0.02 .                                +    RR   +                          .
18 0.04 .                                +    RR   +                          .
19 0.14 .                                +    RRRRRR                          .
20 -.07 .                               +   RRR      +                        .
21 -.07 .                               +   RRR      +                        .
22 -.04 .                               +    RR      +                        .
23 -.04 .                               +   RRR      +                        .
24 -.10 .                               + RRRRR      +                        .
```

VARIABLE: PR

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **PR**



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **LOG(PR)**



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(PR)

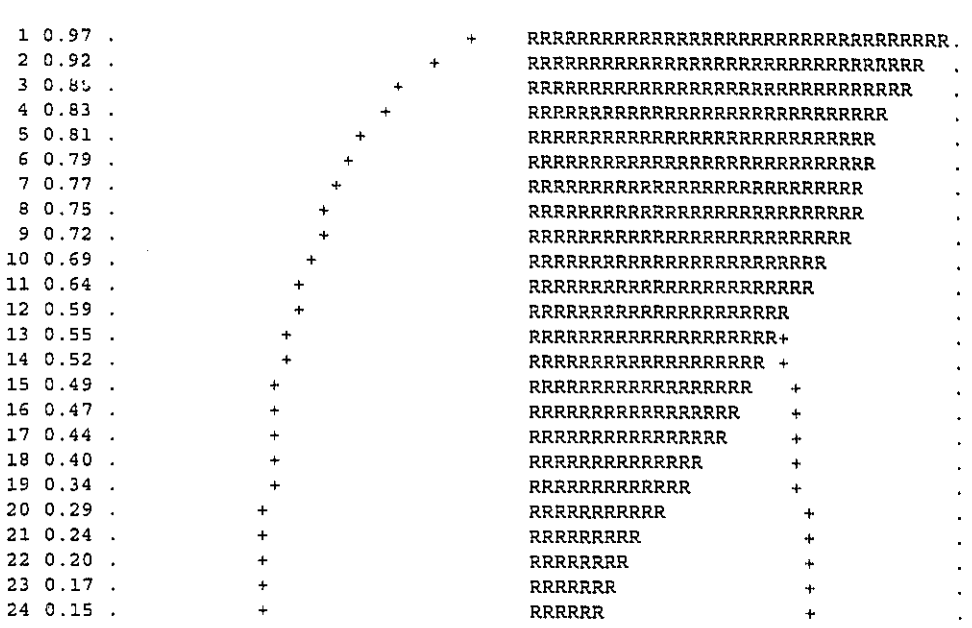
```
 1 0.20 .                          +    RRRRRRRR                          .
 2 0.00 .                          +    R     +                           .
 3 -.01 .                          +    R     +                           .
 4 -.09 .                          + RRRR     +                           .
 5 -.13 .                         +RRRRR     +                           .
 6  .00 .                          +    R     +                           .
 7 0.04 .                          +    RR    +                           .
 8 0.22 .                          +    RRRRRRRRR                         .
 9 0.03 .                        +      RR    +                           .
10 0.01 .                        +      R     +                           .
11 -.01 .                        +      R     +                           .
12 -.04 .                        +     RR     +                           .
13 -.12 .                        + RRRRR      +                           .
14 -.01 .                        +      R     +                           .
15 -.08 .                        +  RRRR      +                           .
16 0.06 .                        +      RRR   +                           .
17 0.05 .                        +      RRR   +                           .
18 -.02 .                        +     RR     +                           .
19 0.11 .                        +      RRRRR +                           .
20 -.01 .                        +      R     +                           .
21 -.14 .                       +RRRRRR      +                           .
22 -.10 .                       + RRRRR      +                           .
23 -.10 .                       +  RRRR      +                           .
24 -.11 .                       + RRRRR      +                           .
```

VARIABLE: BR

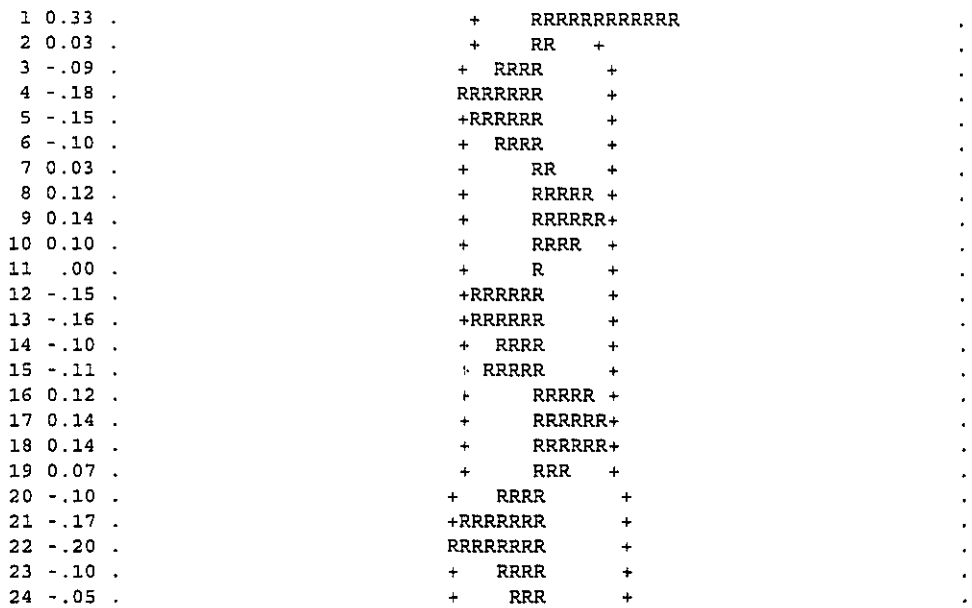
AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) BR

```
 1 0.97 .                                  +    RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR.
 2 0.92 .                                +      RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 3 0.87 .                               +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 4 0.82 .                              +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 5 0.78 .                             +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 6 0.75 .                            +          RRRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 7 0.73 .                           +           RRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 8 0.71 .                           +           RRRRRRRRRRRRRRRRRRRRRRRRRR        .
 9 0.68 .                          +            RRRRRRRRRRRRRRRRRRRRRRRRR         .
10 0.64 .                         +             RRRRRRRRRRRRRRRRRRRRRRRR          .
11 0.59 .                         +             RRRRRRRRRRRRRRRRRRRRRR            .
12 0.55 .                        +              RRRRRRRRRRRRRRRRRRRR              .
13 0.51 .                        +              RRRRRRRRRRRRRRRRRR +              .
14 0.47 .                        +              RRRRRRRRRRRRRRRRR  +              .
15 0.44 .                       +               RRRRRRRRRRRRRRRR     +            .
16 0.41 .                       +               RRRRRRRRRRRRRRR      +            .
17 0.37 .                       +               RRRRRRRRRRRRRR       +            .
18 0.33 .                       +               RRRRRRRRRRRR         +            .
19 0.28 .                      +                RRRRRRRRRR             +         .
20 0.22 .                      +                RRRRRRRR               +         .
21 0.17 .                      +                RRRRRRR                +         .
22 0.14 .                      +                RRRRRR                 +         .
23 0.11 .                      +                RRRRR                  +         .
24 0.10 .                      +                RRRR                   +         .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(BR)



AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(BR)



AUTOCORRELATION FUNCTIONS

- Quarterly Data -

VARIABLE: MU

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) MU

```
 1 0.41 .                        +         RRRRRRRRRRRRRRR                .
 2 0.09 .                       +           RRRR         +                 .
 3 0.17 .                       +           RRRRRRR      +                 .
 4 -.04 .                       +          RR            +                 .
 5 -.12 .                       +       RRRRR            +                 .
 6 -.12 .                       +       RRRRR            +                 .
 7 -.30 .                      +RRRRRRRRRRR              +                 .
 8 -.33 .                     +RRRRRRRRRRRR               +                .
 9 -.24 .                    +    RRRRRRRRR               +                .
10 -.11 .                    +         RRRRR              +                .
11 -.06 .                    +           RRR              +                .
12 0.04 .                    +             RR             +                .
13 0.12 .                    +             RRRRR          +                .
14 0.08 .                    +             RRRR           +                .
15 0.03 .                   +              RR              +                .
16 0.07 .                   +              RRR             +                .
17 0.10 .                   +              RRRRR           +                .
18 0.09 .                   +              RRRR            +                .
19 0.03 .                   +              RR              +                .
20 -.06 .                   +            RRR               +                .
21 0.08 .                   +              RRRR            +                .
22 0.00 .                   +              R               +                .
23 -.09 .                   +            RRRR              +                .
24 0.03 .                   +              RR              +                .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(MU)

```
 1 0.41 .                        +         RRRRRRRRRRRRRRR                .
 2 0.08 .                       +           RRRR         +                 .
 3 0.17 .                       +           RRRRRRR      +                 .
 4 -.04 .                       +          RR            +                 .
 5 -.12 .                       +       RRRRR            +                 .
 6 -.12 .                       +       RRRRR            +                 .
 7 -.30 .                      +RRRRRRRRRRR              +                 .
 8 -.33 .                     +RRRRRRRRRRRR               +                .
 9 -.24 .                    +    RRRRRRRRR               +                .
10 -.11 .                    +         RRRRR              +                .
11 -.06 .                    +           RRR              +                .
12 0.05 .                    +             RRR            +                .
13 0.12 .                    +             RRRRR          +                .
14 0.07 .                    +             RRRR           +                .
15 0.03 .                    +             RR             +                .
16 0.06 .                   +              RRR             +                .
17 0.10 .                   +              RRRR            +                .
18 0.09 .                   +              RRRR            +                .
19 0.03 .                   +              RR              +                .
20 -.06 .                   +            RRR               +                .
21 0.09 .                   +              RRRR            +                .
22  .00 .                   +              R               +                .
23 -.09 .                   +            RRRR              +                .
24 0.03 .                   +              RR              +                .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) .\LOG(MU)

```
 1 -.14 .                      +    RRRRRR          +                    .
 2 -.37 .                    RRRRRRRRRRRRRR        +                    .
 3 0.17 .                      +          RRRRRRR    +                    .
 4 -.10 .                      +        RRRR         +                    .
 5 -.07 .                      +         RRR         +                    .
 6 0.17 .                      +           RRRRRRR   +                    .
 7 -.10 .                      +        RRRR         +                    .
 8 -.13 .                     +        RRRRR          +                   .
 9 -.03 .                     +           RR          +                   .
10 0.05 .                     +            RRR        +                   .
11 -.01 .                     +            R          +                   .
12 0.04 .                     +            RR         +                   .
13 0.09 .                     +            RRRR       +                   .
14 -.01 .                     +            R          +                   .
15 -.08 .                     +         RRRR          +                   .
16 -.01 .                     +            R          +                   .
17 0.04 .                     +            RR         +                   .
18 0.05 .                     +            RRR        +                   .
19 0.04 .                     +            RR         +                   .
20 -.20 .                     +    RRRRRRRR           +                   .
21 0.17 .                     +          RRRRRRR      +                   .
22 0.03 .                     +          RR           +                   .
23 -.14 .                     +      RRRRRR           +                   .
24 0.12 .                    +           RRRRR         +                   .
```

VARIABLE: L/D

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) L/D

```
 1 0.91 .                          +       RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 2 0.81 .                    +             RRRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 3 0.69 .                 +                RRRRRRRRRRRRRRRRRRRRRRRRRR       .
 4 0.58 .              +                   RRRRRRRRRRRRRRRRRRRRR+           .
 5 0.50 .             +                    RRRRRRRRRRRRRRRRR    +           .
 6 0.43 .            +                     RRRRRRRRRRRRRRR        +         .
 7 0.37 .           +                      RRRRRRRRRRRRR            +       .
 8 0.36 .           +                      RRRRRRRRRRRR             +       .
 9 0.35 .          +                       RRRRRRRRRRRR               +     .
10 0.35 .          +                       RRRRRRRRRRRR               +     .
11 0.35 .         +                        RRRRRRRRRRRR                 +   .
12 0.34 .         +                        RRRRRRRRRRR                  +   .
13 0.30 .        +                         RRRRRRRRRR                     +  .
14 0.26 .        +                         RRRRRRRRR                      +  .
15 0.19 .        +                         RRRRRRR                        +  .
16 0.11 .        +                         RRRRR                          +  .
17 0.03 .        +                         RR                             +  .
18 -.05 .        +                       RRR                              +  .
19 -.11 .        +                      RRRRR                             +  .
20 -.14 .        +                     RRRRRR                             +  .
21 -.15 .        +                     RRRRRR                             +  .
22 -.15 .        +                     RRRRRR                             +  .
23 -.14 .       +                      RRRRRR                               + .
24 -.17 .       +                     RRRRRRR                               + .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(L/D)

```
 1 0.90 .                          +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 2 0.81 .                      +            RRRRRRRRRRRRRRRRRRRRRRRRRRRR    .
 3 0.69 .                  +                RRRRRRRRRRRRRRRRRRRRRRRR        .
 4 0.57 .              +                    RRRRRRRRRRRRRRRRRRRR +          .
 5 0.48 .             +                     RRRRRRRRRRRRRRRRR     +         .
 6 0.42 .            +                      RRRRRRRRRRRRRRR         +       .
 7 0.36 .           +                       RRRRRRRRRRRRR             +     .
 8 0.35 .           +                       RRRRRRRRRRRRR             +     .
 9 0.34 .          +                        RRRRRRRRRRRR                +   .
10 0.35 .          +                        RRRRRRRRRRRRR               +   .
11 0.35 .          +                        RRRRRRRRRRRRR               +   .
12 0.34 .         +                         RRRRRRRRRRRRR                +  .
13 0.31 .         +                         RRRRRRRRRRR                  +  .
14 0.26 .        +                          RRRRRRRRRR                     + .
15 0.20 .        +                          RRRRRRRR                       + .
16 0.12 .        +                          RRRRR                          + .
17 0.04 .        +                          RR                             + .
18 -.04 .        +                        RR                               + .
19 -.10 .        +                      RRRR                               + .
20 -.13 .        +                    RRRRRR                               + .
21 -.15 .        +                    RRRRRR                               + .
22 -.14 .        +                    RRRRRR                               + .
23 -.14 .        +                    RRRRRR                               + .
24 -.16 .        +                   RRRRRRR                               + .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(L/D)

```
 1 0.11 .                          +          RRRRR      +                  .
 2 0.05 .                          +          RRR        +                  .
 3 -.07 .                          +       RRRR          +                  .
 4 -.14 .                          +     RRRRRR          +                  .
 5 -.20 .                          +  RRRRRRRR           +                  .
 6 -.03 .                          +        RR           +                  .
 7 -.14 .                          +     RRRRRR          +                  .
 8 0.12 .                          +          RRRRR      +                  .
 9 -.11 .                         +       RRRRR          +                  .
10 -.09 .                         +       RRRR           +                  .
11 -.01 .                         +          R           +                  .
12 0.10 .                         +          RRRRR       +                  .
13 -.06 .                         +        RRR           +                  .
14 0.14 .                         +          RRRRRR      +                  .
15 0.05 .                         +          RRR         +                  .
16 0.16 .                         +          RRRRRRR     +                  .
17 0.06 .                         +          RRR         +                  .
18 -.19 .                         +   RRRRRRRR           +                  .
19 -.24 .                        +    RRRRRRRRR           +                 .
20 -.08 .                        +        RRRR            +                 .
21 -.07 .                        +         RRR            +                 .
22 0.02 .                        +           RR           +                 .
23 0.12 .                        +           RRRRR        +                 .
24 0.10 .                        +           RRRR         +                 .
```

VARIABLE: BA

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **BA**

```
 1 0.87 .                         +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.69 .                     +             RRRRRRRRRRRRRRRRRRRRRRRRRR     .
 3 0.55 .                   +               RRRRRRRRRRRRRRRRRRRR           .
 4 0.38 .                 +                 RRRRRRRRRRRRRR      +          .
 5 0.23 .               +                   RRRRRRRRR             +        .
 6 0.10 .               +                   RRRR                  +        .
 7 -.06 .               +                 RRR                     +        .
 8 -.13 .               +                RRRRR                    +        .
 9 -.13 .               +               RRRRRR                    +        .
10 -.13 .               +               RRRRRR                    +        .
11 -.11 .               +                RRRRR                    +        .
12 -.08 .               +                 RRRR                    +        .
13 -.07 .               +                  RRR                    +        .
14 -.06 .               +                  RRR                    +        .
15 -.06 .               +                  RRR                    +        .
16 -.05 .               +                  RRR                    +        .
17 -.03 .               +                   RR                    +        .
18 -.03 .               +                   RR                    +        .
19 -.06 .               +                  RRR                    +        .
20 -.08 .               +                 RRRR                    +        .
21 -.10 .               +                RRRRR                    +        .
22 -.14 .               +               RRRRRR                    +        .
23 -.13 .             +                 RRRRRR                      +      .
24 -.13 .             +                  RRRRR                      +      .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) **LOG(BA)**

```
 1 0.87 .                         +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.70 .                     +             RRRRRRRRRRRRRRRRRRRRRRRRRR     .
 3 0.55 .                   +               RRRRRRRRRRRRRRRRRRRR           .
 4 0.37 .                 +                 RRRRRRRRRRRRRR      +          .
 5 0.22 .               +                   RRRRRRRR              +        .
 6 0.08 .               +                   RRRR                  +        .
 7 -.08 .               +                 RRRR                    +        .
 8 -.16 .               +                RRRRRR                   +        .
 9 -.18 .               +               RRRRRRR                   +        .
10 -.18 .               +               RRRRRRR                   +        .
11 -.16 .               +                RRRRRR                   +        .
12 -.13 .               +                 RRRRR                   +        .
13 -.11 .             +                   RRRRR                     +      .
14 -.08 .             +                    RRRR                     +      .
15 -.06 .             +                     RRR                     +      .
16 -.03 .             +                      RR                     +      .
17 0.00 .             +                       R                     +      .
18 0.01 .             +                       R                     +      .
19 -.02 .             +                      RR                     +      .
20 -.03 .             +                      RR                     +      .
21 -.05 .             +                     RRR                     +      .
22 -.09 .             +                    RRRR                     +      .
23 -.09 .             +                    RRRR                     +      .
24 -.10 .             +                    RRRR                     +      .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(BA)

```
 1 0.18 .                        +          RRRRRRR   +                    .
 2 -.07 .                        +        RRR         +                    .
 3 0.09 .                        +          RRRR      +                    .
 4 -.17 .                        +    RRRRRRR         +                    .
 5 -.05 .                        +        RRR         +                    .
 6 0.04 .                        +          RR        +                    .
 7 -.22 .                        + RRRRRRRRR          +                    .
 8 -.24 .                       +  RRRRRRRRR           +                   .
 9 -.06 .                       +        RRR           +                   .
10 -.03 .                       +         RR           +                   .
11 0.02 .                       +          RR          +                   .
12 0.07 .                       +          RRR         +                   .
13 -.04 .                       +         RR           +                   .
14 0.05 .                       +          RRR         +                   .
15 -.06 .                       +        RRR           +                   .
16 -.11 .                       +      RRRRR           +                   .
17 0.04 .                       +          RR          +                   .
18 0.07 .                       +          RRR         +                   .
19 -.02 .                       +         RR           +                   .
20 0.03 .                       +          RR          +                   .
21 0.12 .                       +          RRRRR       +                   .
22 -.19 .                      +    RRRRRRRR            +                  .
23 -.06 .                      +          RRR           +                  .
24 0.07 .                      +          RRR           +                  .
```

VARIABLE: DEBT/E

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) DEBT/E

```
 1 0.91 .                          +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 2 0.77 .                     +             RRRRRRRRRRRRRRRRRRRRRRRRRRR      .
 3 0.61 .                  +                RRRRRRRRRRRRRRRRRRRRRR           .
 4 0.43 .               +                   RRRRRRRRRRRRRRRR     +           .
 5 0.24 .            +                      RRRRRRRRR             +          .
 6 0.09 .            +                      RRRR                  +          .
 7 -.02 .            +                     RR                     +          .
 8 -.09 .            +                   RRRR                     +          .
 9 -.15 .            +                  RRRRRR                    +          .
10 -.19 .            +                 RRRRRRR                   +          .
11 -.21 .            +                RRRRRRRR                   +          .
12 -.24 .           +                RRRRRRRRR                    +         .
13 -.28 .           +              RRRRRRRRRR                     +         .
14 -.30 .           +              RRRRRRRRRR                     +         .
15 -.32 .          +              RRRRRRRRRRR                       +       .
16 -.34 .          +              RRRRRRRRRRR                       +       .
17 -.34 .          +             RRRRRRRRRRRR                       +       .
18 -.32 .         +              RRRRRRRRRRRR                         +     .
19 -.30 .         +               RRRRRRRRRRR                         +     .
20 -.29 .        +                RRRRRRRRRRR                           +   .
21 -.25 .        +                 RRRRRRRRRR                           +   .
22 -.20 .        +                   RRRRRRRR                           +   .
23 -.15 .        +                     RRRRRR                           +   .
24 -.09 .        +                       RRRR                           +   .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(DEBT/E)

```
 1 0.90 .                          +         RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  .
 2 0.77 .                      +             RRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 3 0.61 .                   +                RRRRRRRRRRRRRRRRRRRRRR           .
 4 0.43 .                +                   RRRRRRRRRRRRRRRR     +           .
 5 0.23 .               +                    RRRRRRRRR            +          .
 6 0.08 .               +                    RRRR                 +          .
 7 -.02 .               +                   RR                    +          .
 8 -.10 .               +                 RRRR                    +          .
 9 -.16 .               +               RRRRRR                    +          .
10 -.19 .               +              RRRRRRRR                   +          .
11 -.22 .               +              RRRRRRRR                   +          .
12 -.25 .              +               RRRRRRRRR                    +         .
13 -.29 .              +             RRRRRRRRRRR                    +         .
14 -.31 .              +             RRRRRRRRRRR                    +         .
15 -.32 .             +              RRRRRRRRRRR                      +       .
16 -.34 .             +            RRRRRRRRRRRRR                      +       .
17 -.34 .             +            RRRRRRRRRRRRR                      +       .
18 -.32 .            +              RRRRRRRRRRR                        +      .
19 -.30 .            +               RRRRRRRRRR                        +      .
20 -.29 .           +                RRRRRRRRRR                          +    .
21 -.25 .           +                  RRRRRRRR                          +    .
22 -.19 .           +                  RRRRRRR                           +    .
23 -.14 .           +                    RRRRR                           +    .
24 -.07 .           +                    RRRR                            +    .
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) ΔLOG(DEBT/E)

```
 1 0.30 .                           +          RRRRRRRRRR                    .
 2 0.09 .                           +          RRRR       +                  .
 3 0.11 .                           +          RRRRR      +                  .
 4 0.08 .                          +           RRRR         +                .
 5 -.14 .                          +      RRRRRR            +                .
 6 -.26 .                          + RRRRRRRRR              +                .
 7 -.08 .                          +        RRRR            +                .
 8 0.13 .                          +           RRRRRR       +                .
 9 -.04 .                          +          RR            +                .
10 -.09 .                          +        RRRR            +                .
11 -.05 .                         +           RRR             +              .
12 0.10 .                         +             RRRRR         +              .
13 -.20 .                         +     RRRRRRRR              +              .
14 -.20 .                         +     RRRRRRRR              +              .
15 0.03 .                         +            RR             +              .
16 -.01 .                         +           RR              +              .
17 -.08 .                         +         RRRR              +              .
18 -.13 .                         +       RRRRRR              +              .
19 -.03 .                         +           RR              +              .
20 -.01 .                         +            R              +              .
21 -.16 .                         +      RRRRRRR              +              .
22 -.20 .                        +       RRRRRRRR               +            .
23 -.08 .                        +           RRRR               +            .
24 0.00 .                        +              R               +            .
```

VARIABLE: GDP

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) GDP

```
 1 0.95 .                          +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.90 .                      +            RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.85 .                  +                RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 4 0.80 .              +                    RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 5 0.75 .           +                       RRRRRRRRRRRRRRRRRRRRRRRRRR         .
 6 0.69 .        +                          RRRRRRRRRRRRRRRRRRRRRRRRR  +       .
 7 0.64 .      +                            RRRRRRRRRRRRRRRRRRRRRRR       +    .
 8 0.59 .    +                              RRRRRRRRRRRRRRRRRRRRR           +  .
 9 0.54 .   +                               RRRRRRRRRRRRRRRRRRR               + .
10 0.48 .  +                                RRRRRRRRRRRRRRRRR                 + .
11 0.42 .  +                                RRRRRRRRRRRRRRR                   + .
12 0.36 .+                                  RRRRRRRRRRRRR                      +.
13 0.30 .+                                  RRRRRRRRRRR                        +.
14 0.24 .+                                  RRRRRRRRR                          +.
15 0.18 +                                   RRRRRRR                             +
16 0.13 +                                   RRRRR                               +
17 0.07 +                                   RRRR                                +
18 0.02 +                                   RR                                  +
19 -.03 +                                 RR                                    +
20 -.07 +                                RRR                                    +
21 -.12 +                              RRRRR                                    +
22 -.16 +                             RRRRRR                                    +
23 -.20 +                           RRRRRRRR                                    +
24 -.23 +                          RRRRRRRRR                                    +
```

AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) LOG(GDP)

```
 1 0.94 .                          +        RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR .
 2 0.89 .                      +            RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR   .
 3 0.83 .                  +                RRRRRRRRRRRRRRRRRRRRRRRRRRRRRR     .
 4 0.77 .              +                    RRRRRRRRRRRRRRRRRRRRRRRRRRRR       .
 5 0.72 .           +                       RRRRRRRRRRRRRRRRRRRRRRRRRR         .
 6 0.67 .        +                          RRRRRRRRRRRRRRRRRRRRRRRRR  +       .
 7 0.62 .      +                            RRRRRRRRRRRRRRRRRRRRRRR       +    .
 8 0.57 .    +                              RRRRRRRRRRRRRRRRRRRRR           +  .
 9 0.52 .   +                               RRRRRRRRRRRRRRRRRRR               + .
10 0.46 .  +                                RRRRRRRRRRRRRRRRR                 + .
11 0.41 .  +                                RRRRRRRRRRRRRRR                   + .
12 0.35 .  +                                RRRRRRRRRRRRR                     + .
13 0.29 .  +                                RRRRRRRRRRR                       + .
14 0.23 .+                                  RRRRRRRRR                          +.
15 0.18 .+                                  RRRRRRR                            +.
16 0.13 .+                                  RRRRR                              +.
17 0.07 .+                                  RRRR                               +.
18 0.03 .+                                  RR                                 +.
19 -.02 .+                                RR                                   +.
20 -.06 .+                               RRR                                   +.
21 -.11 .+                             RRRRR                                   +.
22 -.15 .+                            RRRRRR                                   +.
23 -.18 .+                          RRRRRRR                                    +.
24 -.22 .+                         RRRRRRRR                                    +.
```

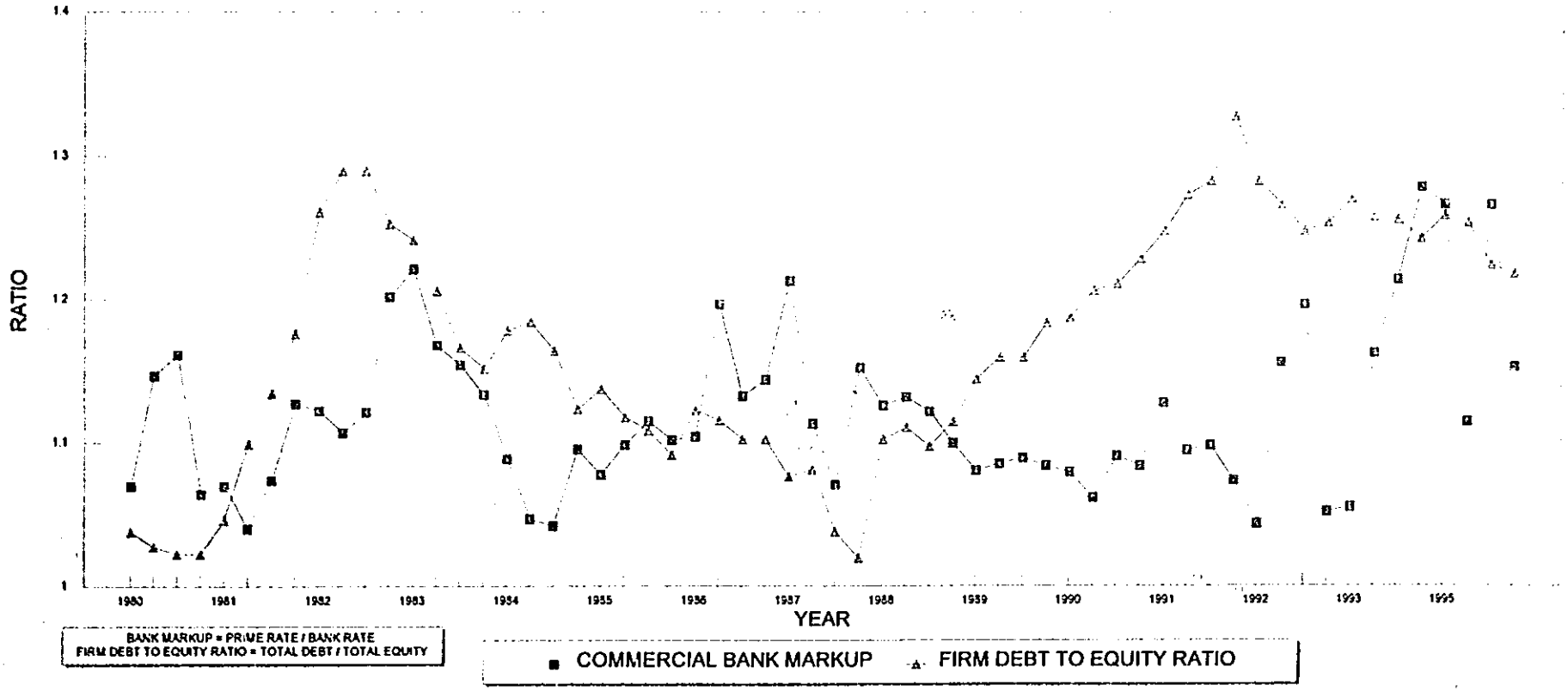
AUTOCORRELATION FUNCTION OF THE SERIES (1-B) (1-B) .\LOG(GDP)

```
 1 0.75 .                        +          RRRRRRRRRRRRRRRRRRRRRRRRRR          .
 2 0.50 .                      +            RRRRRRRRRRRRRRRRRR                  .
 3 0.32 .                     +             RRRRRRRRRRRR    +                   .
 4 0.13 .                    +              RRRRRR           +                  .
 5 0.05 .                    +              RRR              +                  .
 6  .00 .                    +              R                +                  .
 7 0.02 .                    +              RR               +                  .
 8 0.07 .                    +              RRR              +                  .
 9 0.13 .                    +              RRRRR            +                  .
10 0.07 .                    +              RRR              +                  .
11 -.01 .                    +              R                +                  .
12 -.01 .                    +              R                +                  .
13 -.03 .                    +             RR                +                  .
14 -.03 .                    +             RR                +                  .
15 0.01 .                    +              R                +                  .
16 0.03 .                    +              RR               +                  .
17 0.04 .                    +              RR               +                  .
18 0.03 .                    +              RR               +                  .
19 -.03 .                    +             RR                +                  .
20 -.11 .                    +          RRRRR                +                  .
21 -.15 .                    +         RRRRRR                +                  .
22 -.11 .                    +          RRRRR                +                  .
23 -.07 .                   +             RRR                  +               .
24 0.03 .                   +              RR                  +               .
```

Appendix D

GRAPH I: BANK MARKUP AND FIRM DEBT TO EQUITY

1980-1995



GRAPH II: FIRM FAILURE RATE (ANNUAL % CHANGE)

1981-1995