Interrelated Bank Strategies, Financial Fragility and Credit Expansion: a Post Keynesian Approach

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Abstract: This paper aims at clarifying the relationship between individual bank and banking industry behavior in credit expansion. We argue that the balance sheet structure of an individual bank is only partially determined by its management decision about how aggressively to expand credit; it is also determined by the balance sheet positions of other banks. This relationship is explicitly shown by a disaggregation of the variable that enters into the simple money multiplier. The approach developed here opens a way to integrating the micro and macro levels in a Keynesian banking-system analysis.

Key-words: banks; business cycle; Post-keynesian theory

JEL classification: E12; E32; E44

Resumo: Este artigo objetiva esclarecer a relação entre o banco individual e o comportamento do setor bancário no processo de expansão do crédito. Argumenta-se que a estrutura do balanço de um banco individual é apenas parcialmente determinada pelas suas decisões estratégicas, sendo também determinada pelas políticas de expansão de crédito dos demais bancos. Esta relação é explicitamente mostrada pela desagregação das variáveis que compõem um multiplicador monetário simples e abre a possibilidade de integrar os níveis macro e micro que fazem parte da análise keynesiana do sistema bancário.

Palavras-chaves: bancos; ciclo econômico; teoria pós-keynesiana

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1. Introduction

What determines the limits to the asset growth of an individual bank over the business cycle? Is there any connection between an individual bank's strategy and the behavior of the banking system as a whole – and in particular, what are the macroeconomic effects of bank behavior? How does banking strategy affect business-cycle outcomes?

In order to answer these questions, this paper aims at:

- Clarifying and extending a remark by Keynes in his *Treatise on Money*, concerning the relationship between individual-bank and banking industry behavior in credit expansion.
- Focusing on banks' strategic incentives in different credit-expansion environments to develop a clearer understanding of how bank behavior affects business cycle dynamics.
- Understanding better how micro and macro levels can be integrated into one model of bank behavior, to see the mutual causality between banking strategy and business-cycle outcomes. The key micro dimension introduced here is banks' loan-making behavior.

This paper argues that the bank's balance sheet is only partially determined by management decisions; as stressed by Keynes (1960, published originally in 1930), it is also determined by the balance sheet positions of other banks. This relationship can be explicitly shown by disaggregating the variables that enter into the simple money multiplier. This opens the way to an integration of the micro and macro levels in Keynesian banking-system analysis, and sheds light on the impact of banking strategy on business cycle dynamics.

2. Keynesian and Post Keynesian ideas about banking: what remains undone?

One of the most fertile fields of analysis opened by Keynes and the Post Keynesian economists is the study of the relations between banks and economic activity. From the *Treatise on Money*, to the *General Theory*, to the controversy with Robertson and Ohlin after the publication of the *General Theory*, Keynes pointed out the key importance of the bank system in supporting investment. Following Keynes, Minsky (1982, 1986) developed his financial fragility hypothesis (FFH). Minsky's writings highlight the relation between the banking system and the trend to financial fragility during the upturn of the business cycle, illustrating how crisis can occur as an endogenous result of these units' own economic dynamics. Indeed, the term financial fragility is now used freely within the economics literature.

Minsky's framework, and many other works on banking, asserts that banks are special, in that they perform activities that are non-substitutable with other economic units, and thus are especially important in macroeconomic outcomes. The challenge is then posed: appropriating banks' special role introduces the need to connect micro and macroeconomic analysis. In virtually all studies, this connection between micro and macro analysis is handled by investigating the actions of a representative bank.

Studies on financial fragility are an exception. Virtually all of these studies analyze the impact of the bankruptcy or credit problems of some highly exposed banks on the fragility of banking system as a whole, and consequently, on systemic risk. Contagion effects are the primary . A vast literature is concerned with this subject and most part of it is concentrated into the negative externality that a bankruptcy causes to the bank system as a whole into an asymmetric informational environment.

2.1. Keynes' ideas about banking

Keynes never wrote an extended tract on banking. Nonetheless, his works over the years are littered with occasional comments and analyses of banks' behavior. One of his later papers contains the comment that banks hold the key position in the shift of the economic system from a lower to a higher level of economic activity (Keynes, 1973). This point had not been developed much in the General Theory (GT). The GT presented a schema for understanding the extent of economic activity at any point in time, using a comparative static approach. The GT appreciated the impact of real time and uncertainty on decision-making, but paid little attention to the dynamics of movement through time. Discussions of financial issues in the GT thus focus on the links between the liquidity role of money, investment decisions, and uncertainty.

What Keynes meant by his relatively cryptic post-GT comment is perhaps revealed in a passage in the *Treatise on Money* which concerns banks' financing of investment activity. There, Keynes wrote that banks' volume of reserves depends to a large extent on other banks' finance policies – that is, on the growth rate of other banks' loans. Consequently, an individual bank can grow much faster than other banks only if it increases its market share of total banking-sector deposits. But this bank's rapid-growth strategy will, at the same time, reduce its reserves and strengthen other banks' lending capacity by providing them with more available funds (free reserves). As Keynes (1960, p. 26-7) stated:

> There can be no doubt that, in the most convenient use of language, all deposits are 'created' by the bank holding them. It is certainly not the case that the banks are limited to that depositors should come on their own initiative bringing cash or checks. But it is equally clear that the rate at which an individual bank creates deposits on its own initiative is subject to certain rules and limitations;- it must keep step with the other banks and cannot raise its own deposits relatively to the total deposits out of proportion to its quota of the banking business of the country. Finally, the 'pace' common to all the member banks is governed by the aggregate of their reserve resources.

This analytical point finds an echo in Keynes' famous comment that 'bankers would rather hang together than hang separately.' These interrelated points were registered well before the GT was written; and in any case, Keynes' post-GT comment about the role of banks in determining the level of economic activity does not refer back to them explicitly.

2.2. Post Keynesian ideas about banking

The problem of banking behavior and its impact on economic outcomes has received substantial attention among Post Keynesian economists. Two lines of thought have predominated: one concerns banks' role in business cycles, the other banks' role in money endogeneity.[1]

The Post Keynesian approach to banking and financial intermediation in business-cycle fluctuations views the banking system as a channel through which agents' perceptions of risks, and hence business-cycle fluctuations, both influence and are strongly influenced by non-probabilistic uncertainty. Current data influence the forecasts and confidence of bank and non-bank firms concerning returns from investment. In a monetary economy, even the best forecasts of the future provide agents with no degree of certainty about what decisions (made in advance of outcomes) will best reflect their preferences. Incorporating more data will improve forecast algorithms but not make them less certain; the data needed to make agents forecasts more certain in an absolute sense simply do not exist.

[1] Key contributions to this literature are Minsky (1982), Dymski (1988), Wray (1990), and Kregel (1997).

Different perspectives over banks' role in an economy operating under uncertainty have emerged. In the theory of money endogeneity as developed by Moore (1988) and Lavoie (1992), banks accommodate the demand for credit by the non-financial corporate and household sectors. As long as central bank policy is expansionary, banks' key role is to serve as a reliable transmission mechanism for other sectors' pursuit of consumption and investment spending.

An approach developed by Dymski (1988), Wray (1990), and Kregel (1997), based more explicitly on Minsky (1982), banks in uncertain environments seek to base their behavior on conventions rooted in their histories with their customers and also on the average behavior of other banks. So if the banking system as a whole is expanding credit, most individual banks will follow this course of action. Under uncertainty, this is the safe way to compete with other banks, since it guarantees both market-share and institutional reputation. Because of this "hang together" mentality, banks' behavior tends to amplify the scale of economic upswings and downturns. When banks instead face liquidity shocks and adverse conditions in their borrowing markets, banks face and react to the same liquidity pressures as do other economic units. In this perspective, the state of the interbank and borrowed-funds markets is crucial in determining banks' role in expanding or contracting credit (and hence in determining the amplitude of cyclical fluctuations).

This debate on the proper characterization of banks – as either reliable transmission mechanisms or as units sometimes constrained by liquidity risk – is unresolved. Under either interpretation, bank behavior has the effect of widening cyclical swings. In the upturn, banks' accommodative behavior – their willingness to make loans that increase other units' leverage, combined with their relative unconcern about liquidity risk – is a factor that increases cyclical volatility. Bankers' optimistic views about the viability of firms' debt structures, typical of a period of euphoria, leads them to increase their loans in response to firms' rising credit demand. In the downturn, quite the opposite sequence unfolds.

This literature has paid little attention to how banks' strategies and banking-system dynamics can work to amplify business cycle dynamics. Minsky's model and the work of Moore and others focus on representative banks. The notion of diverse behaviors among banks have not been introduced, nor have the implications of strategic diversity for the link between micro and macro processes. We return to the question of banks' cyclical role in section 4 after exploring these topics in section 3.

3. Are bank balance sheets exclusively the result of their own strategic decisions?

In this section we argue that the balance sheet structure of an individual bank is only partially determined by its management decision, because it is also determined by the balance sheets positions of other banks, as first stressed by Keynes (1960). This relationship can be explicitly shown by a disaggregation of the variables that enter into the simple money multiplier, thus opening a way to integrating the micro and macro levels that comprise Post Keynesian banking system analysis. This relation is suggested by what we will call the 'Money Multiplier Approach.'

3.1. The Money Multiplier Approach (MMA)

The MMA shows how an initial increase in the monetary base can generate a bigger increase in the amount of means of payment narrowly defined (that is, M1 = cash + demand deposits). The variables in the money multiplier express the idea that the volume of money depends on the fraction of deposits to M1 that the public wishes to hold, and also on the loan/reserve ratio that banks desire. Following the conventional approach in this literature, this money multiplier is defined as ζ, where $\zeta = 1/(1-D(1-R))$ –

and where consequently, $\Delta M1 = \zeta \Delta B$ – given that B = monetary base (cash + reserves); D = demand deposits/M1; and R = reserves/demand deposits.

For a representative bank that holds only cash and loans as assets, and maintains only deposits as liabilities, the impact of the money multiplier is readily summarized in Table 1:

Table 1. Representative bank balance sheet

Δ Assets	**Δ Liabilities**
Cash: R D ζ ΔB	Deposits: D ζ ΔB
Loans: (1 – R) D ζ ΔB	Net Worth: Δ NW = 0

For our purpose, the key point here is another process, which occurs together with the money expansion and involves the operation of the banking system. The money multiplier's behavioral coefficients – that is, D and R – not only determine the amount of the increase in M1 from an initial increase in monetary base (B): they also settle the dimensions of each item of the balance sheet of the representative bank. For example, the amount of cash that a representative bank or the bank system holds is a function of D and R.

Note that the conventional view of the money multiplier, which suggests some automatism in the way that money is created, implicitly admits that the structure of the bank system's balance sheet changes during the growth process of M1. This can happen due to an increase in the monetary base or due to a change in the behavioral coefficient. This sort of balance-sheet change is triggered in particular when the rate of growth of money exceeds that of the bank's net worth. As the banking system begins to make loans, banks' overall assets begin to grow. Given that net worth is stable in the short run, bank leverage grows as a result of the money multiplier process. Indeed, it is reasonable to expect that net worth will remain stable in the short run, since the financial results of credit operations – such as net interest revenues – will only have an impact on bank profits (and hence net worth) sometime later.

3.2. The disaggregated bank multiplier: the case of different bank strategies

The former section showed how an increase in the monetary base or a change in behavioral coefficients can change the characteristics of banks' balance sheets. This section points out another factor that can alter banks' balance sheets: *banks' adoption of different strategies.*[2] Here we suppose that each bank, seeking to enhance its prospects for profitability given its own pools of savers and prospective borrowers, sets its own reserve/deposit ratio. Strategic choice here then measures how aggressively each bank is in loan-making, given its deposit base. The more aggressively loans are made, the more risks the bank takes on.

To embody this approach, we allow for the possibility that each bank has a different capacity to obtain deposits. That is, each bank has a deposit base, which is distinct from its total deposits. Total deposits include deposits created in the process of loan creation as well as deposits received when the bank accepts

[2] We introduce only the simplest notion of bank strategy here, as this is sufficient for our analytical purposes. In the real world, bank strategic choices extend well beyond the pace of loan growth, and encompass choices regarding branch networks, whether to offer new kinds of financial services, whether to segment loan markets, whether to merge with other banks or non-bank firms, which deposit customers to target, whether to reduce credit risk through securitization, and so on. See Dymski (1999).

reserves from its liability-holders. The bank's deposit base equals deposits of the latter type – that is, deposits received on the basis of ongoing savings and transaction customer relationships. The bank's deposit base is linked to its market power: its size depends on the bank's branch network, its marketing policy, its policies regarding interest rates on loans and deposits, and so on. In this conception, then, the variables that express the strategies of each individual bank are:

Ri – reserve policy of bank "i"

Γi - deposit attraction of bank "i" (fraction of total deposits D).

Note that $\Sigma\ \Gamma i = 1$, derived from the fact that each bank will absorb Γi of total deposits. Each Γi is considered a constant.

Here, then, each bank initially establishes its desired reserve/deposit ratio based on how aggressive its strategy is.[3] Supposing net worth is constant, as this ratio falls for any specific bank, that bank increases its leverage and also takes on higher liquidity risk. Note that loan-making involves a reduction of reserves (R) and hence higher leverage and liquidity risk.

As individual banks make loans and reduce their reserves, the multiplier process begins to run, amplifying total deposits. These increases in demand deposits increase both total liabilities and total assets. The multiplier process also facilitates more loan growth, since loan volume is given at any point in time by $(1 - R)\ D\ \zeta\ \Delta B$ and since both ζ and $(1 - R)$ are growing. For the individual bank involved in this process, its capacity to absorb any adverse shocks falls as this process proceeds and, at the same time, its exposure to liquidity risk rises.

The multiplier (ζ) does not change with the introduction of the individual-bank variables. Suppose, for example, there is an exogenous increase in the monetary base, ΔB. Each bank will then receive an initial increment in deposits of $\Gamma_i\ D\ \Delta B$. Total deposits in the first round of the multiplier will then be $D\ \Delta B\ \Sigma\Gamma_i$ (or $D\ \Delta B$, as $\Sigma\ \Gamma_i = 1$). The next step will include new loans $(1 - Ri)\ \Gamma_i\ D\ \Delta B$ for each bank; total loans for all banks will be $D\ \Delta B\ \Sigma(1 - R_i\ \Gamma_i)$. So, new deposits, $\Gamma_i\ D^2 \Delta B\ \Sigma(1 - R_i)$, will be credited to bank i in the next round, and so on.

Taking the entire multiplier process into account, the money multiplier is $\mathbf{M} = 1/[1- D((\Sigma\ (1-R_i))\Gamma_i)$, a disaggregated version of the conventional aggregate multiplier, $\boldsymbol{\zeta} = 1/[1- D\ (1-R))]$. [4] The disaggregated multiplier M highlights the fact that the general reserve fraction is an average of the reserve fraction established by each bank firm, taking into account the relative marginal ability of each bank to attract deposits, Γ_i.

[3] We are considering as bank reserves not only primary reserves (cash) but also secondary reserves, that is, other liquid assets that can be converted rapidly into cash without significant losses. See for a more precise definition of liquidity, Davidson (1992).

[4] The formula for **M** results from the summation $(1 + D\ (1 - \boldsymbol{\Sigma}\ R_i\ \Gamma_i) + D^2\ (1 - \boldsymbol{\Sigma}\ R_i\ \Gamma_i)^2 + ... + D^n\ (1 - \boldsymbol{\Sigma}\ R_i\ \Gamma_i)^n)$; that is, $1/\ (1 - D\ (1 - \boldsymbol{\Sigma}\ R_i\ \Gamma_i))$.

Table 2. Balance sheet of bank "i" at the end of the multiplier process

Assets	Liabilities
Cas h: $R_i\ \Gamma_i\ D\ \Delta B\ \Sigma D^z\ (1 - (\Sigma\ R_i\ \Gamma_i))^z$, or $R_i\ \Gamma_i\ D\ \Delta B\ \mathbf{M}$	Deposits: $\Gamma_i\ D\ \Delta B\ \Sigma D^z\ (1 - (\Sigma\ R_i\ \Gamma_i))^z$, or $\Gamma_i\ D\ \Delta B\ \mathbf{M}$
Loans: $(1 - R_i)\ \Gamma_i\ D\ \Delta B\ \Sigma D^z\ (1 - (\Sigma\ R_i\ \Gamma_i))^z$, or $(1 - R_i)\ \Gamma_i\ D\ \Delta B\ \mathbf{M}$	Net Worth: $\Delta\ NW_i$

This disaggregated approach to the money multiplier shows clearly that the balance sheet of each bank is affected by the strategies adopted by the other ones -- the point stressed by Keynes (1930). Table 2 shows the balance sheet of bank i at the end of the multiplier process. The balance sheet of bank "i" will be a function of the public preference's for deposits (D), of the ability of bank "i" to attract deposits (Γ_i), and of other banks' reserve/deposit ratios.

3.3 A simulation of a change in bank behavior

It is common in Post Keynesian studies of bank behavior to conceptualize banks that change their portfolios in search of perceived profit opportunities. This approach views banks as active firms, which manage their liabilities – they lend before receiving deposits when they decide to accommodate the demand for credit.[5] Banks in this position plan to obtain reserves through borrowing, if needed, to meet their financial commitments.[6] So at least during some time periods, banks manage imbalances between reserves and deposits. What are the limits for this kind of action?

To illustrate the consequences of liability-managing behavior, we suppose that a bank "k" increase its loans in an amount **E**. We also suppose that other banks do not change their R_i. So, part of the loans will be deposited in each bank, in an amount $D\ \Gamma i\ \mathbf{M}\ \mathbf{E}$. At the end of the multiplier process, the bank k will have a balance sheet as described in Table 3:

Table 3. Bank "k" balance sheet

Assets	Liabilities
Cash: $R_k\ D\ \Gamma_k\ M\ (\underline{E}) - (\underline{E} - \Gamma_k\ M(\underline{E}))$	Deposits: $D\ \Gamma_k\ M\ (\underline{E})$
Loans: $(1 - R_k)\ D\ \Gamma_k\ M\ (\underline{E}) + \underline{E}$	NW_k

In making its loan, bank k loses reserves ($\underline{E} - \Gamma_k\ M(\underline{E})$) to other banks. For the banking system as a whole, this loan-making expands the monetary base at the expense of bank k's reserves. From this point, bank k's reserves begin to grow in proportion to the increase of money that it initiated. At the end of the

[5] For example, Minsky (1994, p. 156) states: "In contrast to the orthodox quantity theory of money, the financial instability hypothesis takes banking seriously as a profit-seeking activity. Banks seek profits by financing activity; like all entrepreneurs in a capitalist economy, bankers are aware that innovation assures profits. Thus using the term generically for all intermediaries in finance (whether they be brokers or dealers), bankers are merchants of debt who strive to innovate in the assets they acquire and the liabilities they market".

[6] The level of reserves needed depends on the prevailing institutional and regulatory environment. See, in this connection, Keynes (1930) and Goodhart (1979).

process, the reserve variation will be (R_k D Γ_k - 1) **E**. Since 0 < R_i < 1, 0 < D < 1 e 0 < Γ_k < 1, the changes in reserves will be negative, but not as great in magnitude as -1. Consequently, if bank k expands its loans while other banks do not, it will lose reserves to the remaining ones, though less than the total amount it first lent.

Conversely, the other banks gain the reserves that bank k loses. Suppose that the remaining banks do not change their $R_{i's}$ and that the $\Gamma_{i's}$ are constant; in this case, other banks' financial structures still change due to the growth in their leverage. As Table 4 shows, bank "i" loans will raise by the effect of the increase in bank k loans (E). And, since by assumption NW_i does not change, both leverage of loans and leverage of assets will grow.

Table 4. Bank "i" balance sheet

Assets	Liabilities
Cash: R_i D Γ_i **M** (ΔB + **E**)	Deposits: D Γ_i **M** (ΔB + **E**) + D_i
Loans: (1 – R_i) D Γ_i **M** (ΔB + **E**)	NW_i

3.4. Financial fragility and the interaction between banks' balance sheets

As Minsky (1982) pointed out, financial fragility can be understood as a measure of the resistance of the bank system to shocks. Balance sheet indicators of bank susceptibility to specific shocks have two distinct dimensions: (i) how much a bank can lose in the event of a shock; (ii) how losses originating from shocks will be absorbed. In this connection, two indicators connected to this paper's themes are suggested. The first is an index of liquidity, defined as the ratio of reserves plus securities to deposits. The second is an index of solvency, that is, bank leverage.

The liquidity index shows how much money a bank has to cover withdrawals from the public or from other banks during check clearing. The formula used here is:

V_1 = (reserves + securities)/deposits

This leverage formula indirectly shows how losses could be covered by bank net worth. When a bank's leverage ratio is high, given the value of Ri, its likelihood of problems with bad loans is higher, for any given proportion of bad loans to total loans.

V_2 = loans / net worth

We introduce now the accounts in absolute value terms in the bank balance sheet, foregoing the approach emphasizing variations in each account, have been shown to this point. In this representation, the bank balance sheet has the following structure:

Table 5. Representative bank balance sheet

Assets	Liabilities
Cash (C)	Deposits (D)
Securities (T)	Interbank and borrowed funds (AFL)
Loans (E)	Net worth (NW)

In Table 6, the two indexes (V_1 and V_2) are shown for two stylized banks, i and k, with different expansion strategies. This depiction is sufficient to capture the effects of strategic variability in the banking system as a whole. Table 6 shows the results of a comparative statics exercise. The balance-sheet situation of the banks is shown at three points in time: (1) before the initial expansion of monetary base; (2) after the expansion of monetary base; and (3) after bank k autonomously increase its loans in an amount **E**.

Table 6. Bank fragility indexes of bank "i" and bank "k"

	Moments					
Fragility Index	**(1)**		**(2)**		**(3)**	
	Bank i	Bank k	Bank i	Bank k	Bank i	Bank k
V_1	$(C_i + T_i)/D_i$	$(C_k+T_k)/D_k$	$[Ri\ D\ \Gamma i\ \mathbf{M}\ \Delta B + (C_i + T_i)]/(Di + D\ \Gamma i\ \mathbf{M}\ \Delta B)$	$[R_k\ D\ \Gamma_k\ \mathbf{M}\ \Delta B + (C_k + T_k)]/[Dk+ D\ \Gamma_k \mathbf{M}\ \Delta B]$	$[R_i\ D\ \Gamma_i\ \mathbf{M}(\Delta B + \underline{\mathbf{E}}) + C_i + T_i]/\ [D_i + D\ \Gamma_i\ \mathbf{M}\ (\Delta B + \underline{\mathbf{E}})\ ]$	$[R_k\ D\ \Gamma k\ \mathbf{M}\ (\Delta B + \underline{\mathbf{E}}) - \underline{\mathbf{E}} + C_k + T_k]/\ [D_i + D\ \Gamma_k\ \mathbf{M}\ (\Delta B + \underline{\mathbf{E}})\ ]$
V_2	E_i/NW_k	E_k/NW_k	$[(1 - Ri)\ D\ \Gamma i\ \mathbf{M}\Delta B + E_i]/\ NW_k$	$[(1 - R_k)\ D\ \Gamma_k\ \mathbf{M}\ \Delta B + E_k]\ /\ NW_k$	$[(1 - R_i)\ D\ \Gamma_i\ \mathbf{M}\ (\Delta B + \underline{\mathbf{E}}) + E_i]\ /\ NW_i$	$[(1 - R_i)\ D\ \Gamma k\ \mathbf{M}\ (\Delta B + \underline{\mathbf{E}}) + \underline{\mathbf{E}} + E_k]\ /\ NW_k$

The *first moment*, the starting point of the exercise, shows the autonomous behavioral strategy adopted by each bank. The V_1 and V2 of banks i and k are not shown as explicit functions of another banks' influence, since they consider the effects of neither monetary-base expansion nor changes in bank strategies.

The *second moment* shows exactly how the expansion of monetary base modifies the liquidity index and leverage for both banks. Loans are expanded on the basis of each bank's R and Γ; it is assumed here that securities (T) and net worth (NW) do not change. Changes in V_1 depend on the magnitude T as part of total liquid assets (C + T). Concerning V_2, as assets grow, the risk of insolvency increases, as the index of leverage shows. [7]

The *third moment* evaluates the impact of a one-time increase in loans **E** by bank k. This action by bank k increases its exposure more than that of bank i. Bank k ends up with *lower* V_1 and *higher* V_2 than the rest of the banking system, represented here by bank i. In other words, both the liquidity and solvency risk of bank k increases. Also note that while bank i remains more conservative than bank k, the impact of bank

[7] We maintain here and in section 3.5 the assumption that net worth is constant in the short run.

k's aggressive loan-making is to make it too more leveraged than before, despite its passive strategy of credit expansion.

One can conclude from this analysis that:

(1) *The banking system balance sheet is affected by the multiplier expansion of money, since its net worth does not change in the same way as does the monetary base*. So, the conventional multiplier supposes, implicitly, that banks become more fragile (and accept this change in their status) during the monetary expansion as the risks of liquidity and insolvency increase.

(2) *The balance sheet of the individual bank and the risks that each bank faces depend partially from other banks' portfolio decisions*. This result does not depend on the effects of bank refinancing of outstanding defaults (that is on the ratio of bad loans to total loans), but from banks' own process of money creation.

(3) *If banks have different rhythms of loan expansion, then* ceteris paribus*, the more aggressive bank will lose reserves to other banks, and at the same time it will take on higher liquidity and insolvency risks.* In other words, more aggressive banks will be more financially fragile than other banks, a factor that might impose a limit on its loan growth strategy.

3.5 A numerical simulation of a change in the credit strategy of bank "k"

The approach developed in the former section can be exemplified with a simulation. Let us consider a bank system with only two groups of banks, denominated as bank i and bank k. As Table 7 denotes, both banks initially have the same figures in their balance sheets. [8]

Table 7. Bank "k" and bank "i"'s balance sheet

Reserves	333.33	Demand Deposits	666.7
Cash	200.00		
Securities	133.33		
Loans	333.33	Net Worth	100.0
Fixed Assets	100.00		
Total Assets	766.67	Total Liabilities	766.67

Bank "k" and "i"'s financial policy		Macroeconomic parameters	
reserve-to-deposit ratio	0.5	cash/M1	0.2
deposit absorption of each bank	0.5	Monetary Base	1000
		DD/M1	0.8

[8] The data used for this simulation are shown in Appendix 1.

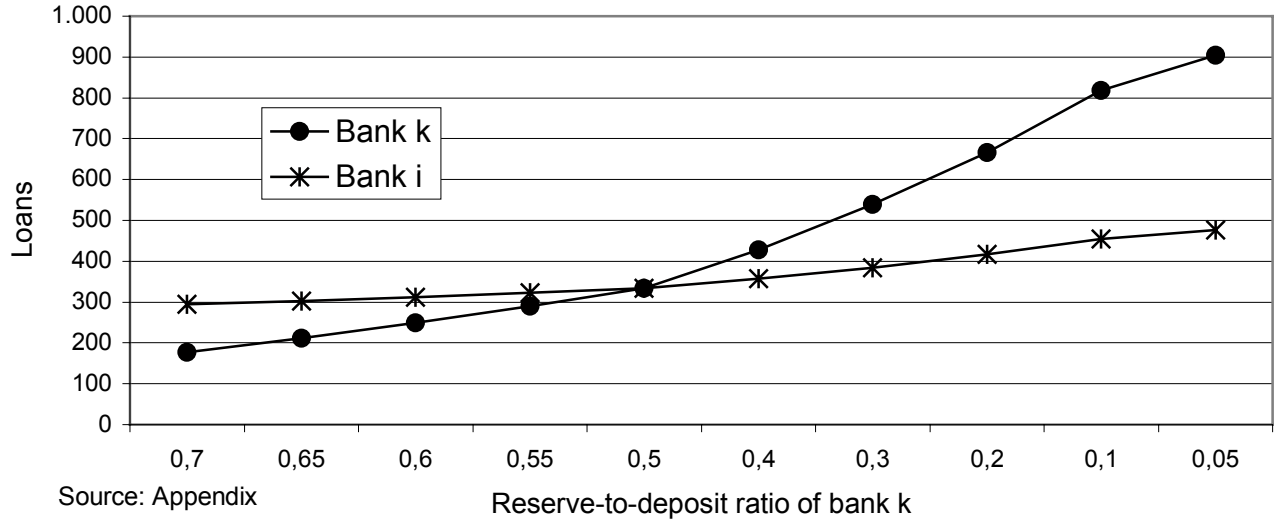
The simulation assumes that the deposit absorption of the two groups of banks are autonomously determined and equal to 0.5. It means that each bank has an equal share of any new deposit created or destroyed in the banking system.

The financial policies of the two groups of banks are summarized by their reserve (that is, reserve-to-deposit) ratios. These ratios are equal to 0.5 at the starting point of the simulation. The reserve ratio is the sum of required reserve ratio (0.3 of demand deposits), in cash, with voluntary ratio (0.2 of demand deposits), held as securities. It is assumed that since a bank has more reserves than are required, some reserves will be used to purchase securities. In the case that a bank has fewer reserves than required it will sell securities.

By exploring the interactions among loans, leverage, assets and reserves, the simulation shows how the two groups of banks and the whole bank system will behave if bank k changes its financial policy -- that is, its reserve-to-deposit ratio -- while bank i maintain the same reserve ratio (0.5). The basic idea is that bank k changes its reserve ratio according to its credit policy. As bank k seeks to increase its loans, it reduces its reserves. Furthermore, the simulation assumes the following systemic parameters concerning the preferences of the public: cash/M1= 0.2 and DD/M1 = 0.8.

Figure 1 shows what happen to banks loans as bank k shifts its reserve ratio. If the reserve ratio increases (as it does along the horizontal dimension of Figure 1), the loans of the two groups of banks grow due to the increase in the money multiplier. However, loans of bank k will grow faster than loans of bank i, increasing bank k's loan-market share. Conversely, if bank k reduces the reserve ratio, the loans of both banks decreases, with bank k loans diminishing more than those of bank i.

Figure 1. Loans of banks k and i for different reserve-to-deposit ratios of bank k

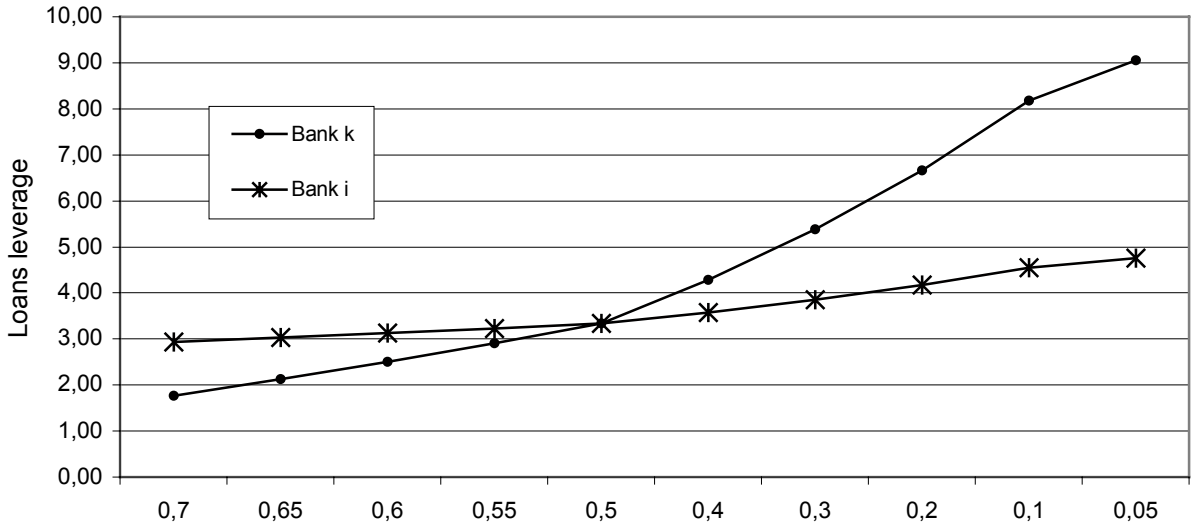


Source: Appendix

This first result illustrates that even if the financial policy of bank i does not change, its loans will grow. Of course, there are other possibilities not explored in this simulation. For example, if bank i maintained a constant volume of loans, the reserve ratio of bank i would increase; its assets would grow as the bank increased the volume of securities in its portfolio.

Figure 2 shows that banks' exposure to credit risk will vary with their loan volume. As bank k increases its reserve-to-deposit ratio, the loan-related leverage of both banks grows – though bank k's leverage increases more than bank i's. Conversely, if bank k's reserve ratio falls, both banks' leverage will decrease, but that of bank k will decrease more. In other words, although both banks increase their insolvency risk (V2) when bank k decreases its reserve ratio, insolvency risk is bigger for bank k than for bank i.

Figure 2. Leverage of loans (loans/net worth) for different reserve-to-deposit ratios of bank k



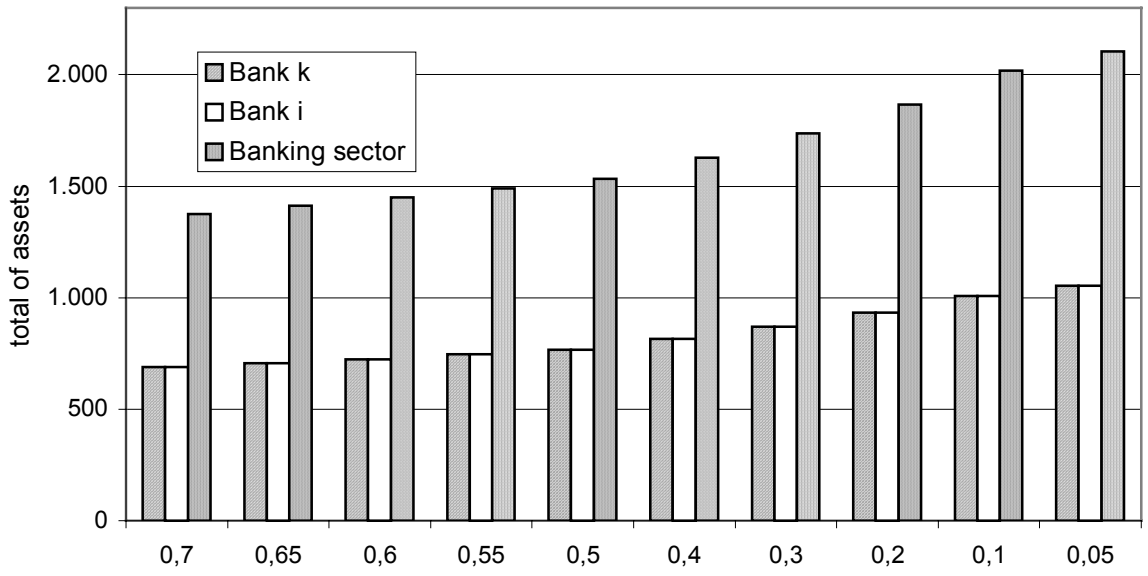
Source: Annex 1

Figure 3 shows that shifts in bank k's reserve ratio lead to changes in total banking-sector assets. As bank k's reserve ratio decreases, the assets of both banks increases in the same rhythm, due to increasing loan volume. This result follows because, by assumption, both banks have the same rate of deposit absorption; if deposit absorption rates differed, so would banks' asset growth rates. This simulation also shows that the banking sector's total assets change with a change in any bank's finance policy. Even banks that maintain a fixed reserve ratio (bank "i," here) experience an increase in assets. This result conforms with the simple multiplier model.

Of course, bank i is not compelled to expand or reduce its loans as an automatic response to expansions or reductions in bank k's loan volume. Suppose instead that bank i maintains a constant loan volume. In this event, when bank k increases its loan volume, bank i will increase its reserve-to-deposit ratio, weakening the monetary multiplier effect. But at the same time, bank i will experience an increase in its assets (just equal the growth in its reserve volume) due to bank k's loan-volume expansion.

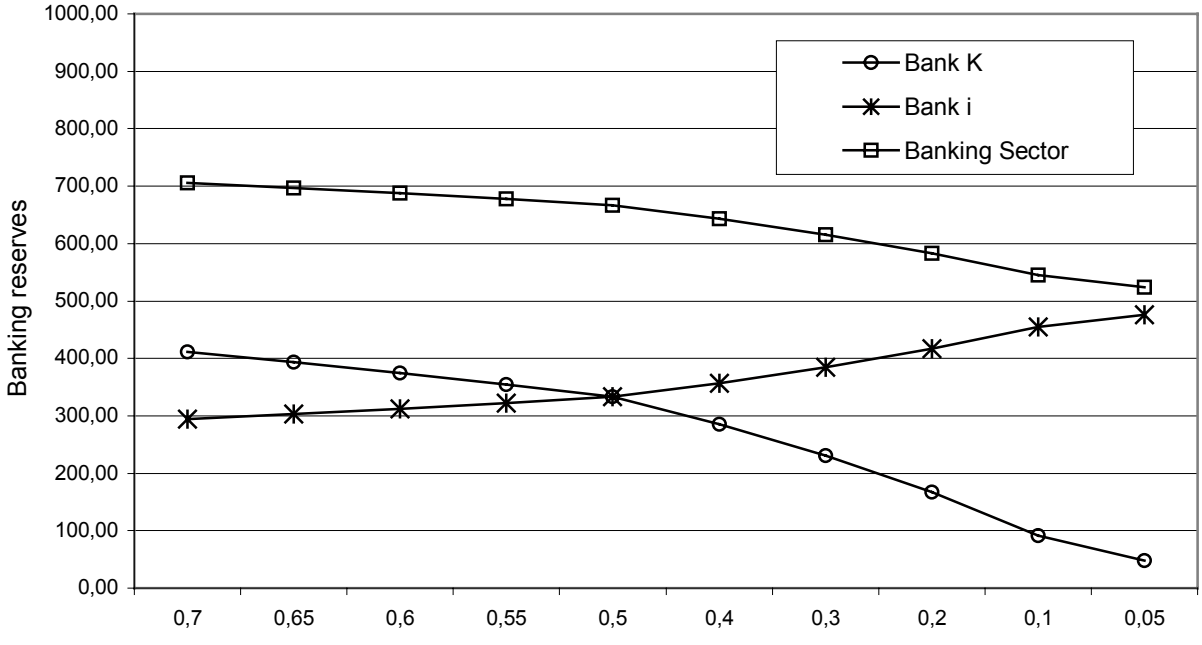
The increase (or reduction) in bank k's reserve ratio causes a transfer of reserves between banks. If bank k's reserve ratio diminishes because it is increasing loan volume, these reserves are released to the public and to banks (here, bank i) that have not changed their reserve ratios. This situation pushes bank k to borrow money in the market for reserves, in the interbank market, and from the central bank. In this case, bank k will have to sell securities (and/or issue new securities) obtain needed new reserves.

Figure 3. Banking assets of bank k and i for different reserve-to-deposit ratios of bank k



Source: Annex 1

Figure 4. Banking reserves of bank k and i for differents reserve-to-deposit ratios of bank k



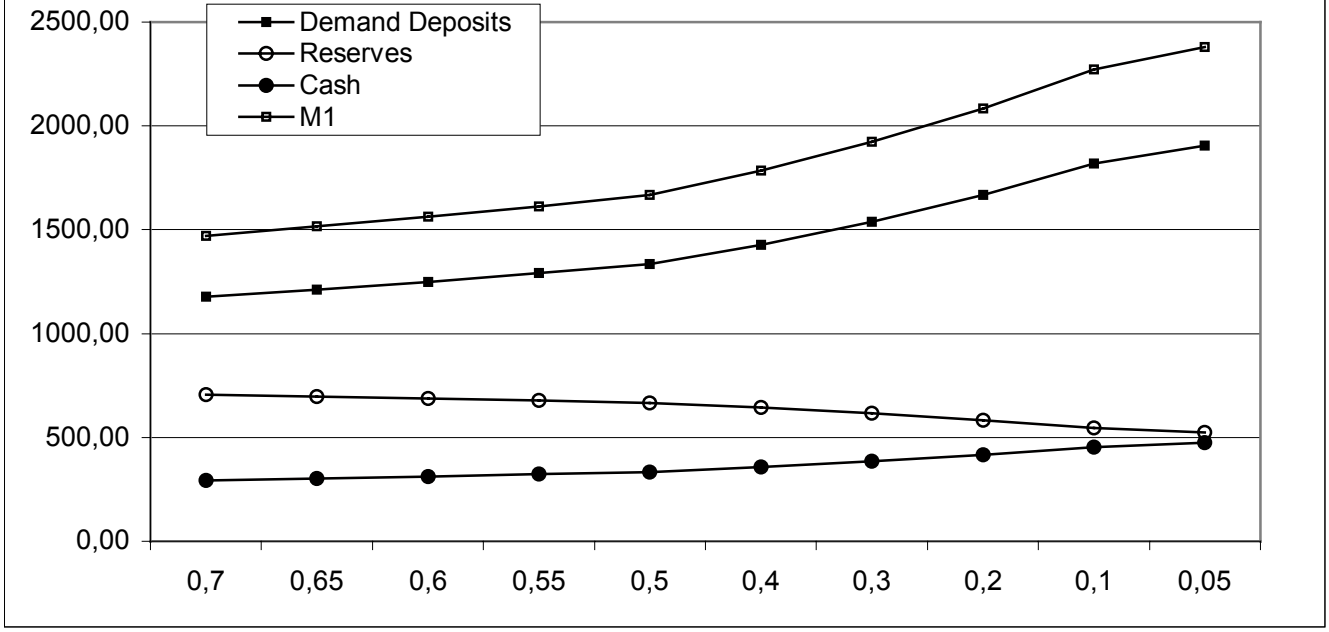
Source: Annex 1

So, bank k's reducing its reserve ratio increases the banking system's exposure to liquidity risk (by generating more demand deposits with total reserves constant); and the liquidity risk of the aggressive bank k increases *pari passu* as it increases its loans and loses reserves (Figure 4). Conversely, when bank k's reserve ratio increases, reserves elsewhere in the banking system (as well as those held by the public) are absorbed by bank k; so this bank's exposure to liquidity risk diminishes.

The previous paragraph has an important consequence regarding the determination of banking- system liquidity risk. The monetary multiplier suggests that expanding the average reserve ratio diminishes M1. So, if the public's preference for cash/M1 is constant, the public demand for cash also declines. The reserves of the banking system as a whole increase as well. This guarantees a natural defense against bank runs. Alternatively, the reduction of the reserve ratio increases M1. So, if the cash/M1 is maintained constant, the public demand for cash increases (Figure 5). As a result, banking system – as a whole - will be more exposed to liquidity risk, *ceteris paribus*.

In sum, this simulation highlights the fact that individual banks' balance sheets are hardly the result of these banks' choices. The behavior of the set of all banks – of aggregate bank behavior -- is an essential element in determining the size and composition of bank balance sheets.

Figure 5. Monetary Aggregates



4. Banking strategy and the business cycle: insights from the simulation model

In this section, we discuss the impact of bank behavior on business cycle dynamics by focusing on the relationship between banking-system and individual banks' behavior in different credit-expansion

environments. For this purpose we explore the analytical structure developed in the former section during four phases of the business cycle: stagnation, upturn, downturn and crisis.

According to the financial fragility hypothesis (Minsky, 1982, 1986), the dynamic of the economic growth induces firms to become increasingly indebted to expand their investment. In this connection, cyclical fluctuations result from the way that firms finance their asset positions: increasing macroeconomic financial fragility in the upturn, for example, is associated with an increase in the number of speculative units. The decision to invest (alternatively, to take an asset position) runs hand-in-hand with the choice of the means of financing. Both decisions, taken together, define the extent of the economy's vulnerability to adverse changes in the economic situation. An economy will be more or less fragile in the aggregate according to the preponderance of hedge or speculative units. As Dymski and Pollin (1992, p.40) state: "Minsky argues that there is an inherent tendency for capitalist financial structures to move from states of robustness to fragility over time. This is due to the shift in expectations that occurs over the course of a business cycle, and the way this shift is transmitted through the financial system."

Cyclical fluctuations are then affected and even triggered by the influence of current data on bank and non-bank firms' states of expectations and confidence regarding future returns from investment projects. As we have already stressed, banks have an important and contradictory role in the business cycle: their accommodative behavior amplifies economic growth during the cyclical upturn; and it also amplifies the downturn, due to banks' increasing liquidity preference as their expectations about the future, and their borrowers' expectations, become pessimistic.[9]

4.1. Stagnation

At the trough of the business cycle, when the state of confidence is especially infected with uncertainty about the future, current information is dominated by the bankruptcies of indebted firms, while banks (like their borrowers) must contend with delays in contractual payments. Realized profits and profit expectations are still low. Indebtedness is viewed as extremely risky because economic agents still perceive a high degree of uncertainty. Since agents' expectations have deteriorated, given their low state of confidence in the future, *the aggregate demand for credit is low*. Healthy firms tend to adopt a hedge posture: that is, safety margins between profits and financial commitments are sufficient to ensure that, in all future periods, profits will exceed interest expense and amortization payments (here, expected gross revenue affords some margin over debt payment commitments).[10]

Under these conditions, what would happen if the growth rate of loans of an individual bank were to increase faster than the average growth rate of other banks? In this phase of the business cycle, the individual bank (bank k, per section 3) that increases its loans faster than others (bank i), without a respective change in its market share of deposits (measured by Γ_i) would loose reserves. As a result,, the risk of liquidity (V1) of the individual bank would increase. On the other hand, as bank leverage increases due to the expansion of bank k's loans, its insolvency risk (V2) tends to increase as well. In this case, it would not be possible to maintain an aggressive finance policy for a longer term, since the demand for

[9] The liquidity preference approach explains banks' balance-sheet strategies as due more fundamentally to perceptions of risks and profit opportunities than to choices over individual liabilities: "For a given state of expectations, bank's liquidity preference will determine the desired profile of the assets they purchase and their prices, that is, the rate of returns each type of asset must offer to compensate for their degree of iliquidity". (Carvalho, 1999, p. 132)

[10] For a hedge unit the margin of safety is positive for any probable increase in the rate of interest once it is completely hedged in relation to its cash flow from future commitments.

credit is low. Therefore, the bank could find borrowers that would accept its credit offer only for a very short period, despite reducing its interest rate on loans and the spread on their credit operations. Furthermore, credit risk would tend to grow rapidly as a consequence of the bank's aggressive finance policy: this firm would not be able to generate enough profits to meet its financial commitments, due to the stagnant state of the economy. Under these conditions, convention instructs banks to be cautions, that is, to adopt a more conservative strategy; as a result, they tilt their asset portfolio toward short term and/or more liquid assets. High liquidity preference prevails in banking strategy.

4.2. Upturn

The beginning of the boom depends crucially on the sharing of improved expectations regarding the economy's future prospects by non-bank and bank agents. As agents' state of confidence improves, overall perceptions of risks decline. More profits and growing utilization of production capacity stimulate new investments. As a result, *the demand for credit tends to increase*. Firms tend to adopt a speculative posture -- that is, they maintain smaller margins of safety than hedge units, reckoning that financial costs will not increase so much as to make their plans unworkable. In this situation, the expected gross capital income obtained in initial periods is generally insufficient to fully amortize the debt that is initially taken on; but the expectation is that subsequent years will see a revenue surplus sufficient to offset this initial deficit.

In the case of banks, improving expectations lead to shifts in liquidity preference, from a more to a less conservative and defensive posture; consequently, banks adopt a more accommodative posture in supplying credit. Bankers react to non-bank firms' own optimistic views regarding the viability of these firms' debt structures, increasing loans in order to respond to these firms' heightened credit demand. The banks' search for more profits in the upturn can induce them to adopt a more speculative posture: a bank may not only seek the larger monetary returns associated with riskier assets, but also increase their loan leverage and offer their customers special guarantees.

In this context, what happens to the balance sheet of an individual bank that increases the growth rate of its loans faster than the average loan growth rate? As section 3 has shown, the level of reserves at this bank (k) declines and its liquidity risk increases. Bank k can sustain an aggressive finance policy only at the risk of increasing raise its liquidity risk (V1) and insolvency risk (V2), that is, heightening its own financial fragility. Further, as section 3 has illustrated, the rest of the banking sector (bank i) too becomes more fragile (though less than bank k's increased fragility): its leverage increases as its balance sheet growth rate is quickened due to its being pulled along by bank k's faster pace of credit expansion. This simulation model illustrates very starkly the interaction between individual banks' strategic choices and the underlying conventional behavior of the banking system: *individual banks with especially aggressive growth strategies can influence the average growth rate of the entire banking sector; and individual banks don't have their own distinct strategies, but which follow the average loan growth rate of the banking sector as a whole, are pulled along when the sectoral growth rate changes.*

So if the banking system as a whole is expanding credit, we should expect that any individual bank will expand in the same direction – unless it makes a strategic choice to be contrarian. Under uncertainty, gearing a bank's expansion strategy to the trend in the banking sector is safer, since this guarantee both the bank's market share and its institutional reputation. This analytical situation illustrates precisely the material basis of Keynes' famous comment that "bankers would rather hang together than hang separately."

4.3. Downturn

The collapse of asset values that occurs during the downturn, because of the position-making problems of units engaged in speculative and Ponzi finance, leads to a collapse of investment. Such a collapse will lead to a shortfall in the profit flows generated by capital assets, which in turn makes the fulfillment of business financial commitments more difficult, if not impossible. Many reliable payers become bad borrowers: falling profits force some hedge and speculative units become Ponzi units, as the cash flows needed to validate even initially hedge-financing arrangements may not be forthcoming.[11] Non-bank firms' declining profits and increasing financial commitments reduce their safety margins. Banks consequently reevaluate borrowers' risks upward, and incorporate these expectations into loan risk premia, leading to higher loan rates. These higher rates increase firms' borrowing costs just when refinancing is most needed. The banking system as a whole refuses to roll over firm debts whenever possible: credit rationing tightens and bad loans grow rapidly in volume.

So the shocks that trigger cyclical downturns lead banks to revise their expectations just as their state of confidence is shaken. Financial institutions' liquidity preference increases, and leads them to make fewer loans and seek out less profitable but more liquid assets. The search for more liquidity leads banks to reduce the average term on their assets, to maintain more surplus reserves, and to purchase assets with high liquidity, such as government securities.

Our simulation experiment suggests that *ceteris paribus,* the overall decrease in loan volume results in deposit losses for all banks. This moderates the rising liquidity risk of the banking sector (which involves both higher open-market borrowing costs and the threat of a run on deposits). Bank k, which has a more stable asset target than banks as a whole (bank i), and which is slower to change, will take on a disproportionate share of bad loans and of the adjustment problems associated with the downturn. It will face problems related to heightened liquidity risk (V1), to declining reserves, and to credit risk problems because of a rising volume of bad loans. Again, the strategic commitment of bank k to a stable asset target pulls other banks into taking on more bad loans than they otherwise would, and toward increasing liquidity and credit risk. As a consequence, *as all banks tend to contract their credit supply, the volume of bad loans in the banking system increases, causing a deterioration in the quality of overall bank credit portfolios*.

4.4. Crisis

The outbreak of a crisis depends on the occurrence of shocks that the economy cannot absorb.
So one element in a crisis is the magnitude of any shock. A second element is the situation of firms: for example, how large are firms' margins of safety relative to the prospective shock; and how many speculative and Ponzi finance units are there in the economy's financial structure? As safety margins decline and more units become Ponzi, the range of interest-rate increases that can trigger crisis rises. Once the structure of financial payments obligations is punctured, a spiral of decline among investment, profits and asset prices can readily result.

[11] *Ponzi* units can be understood as extreme cases of units with speculative financial postures. Units can be *Ponzi* due to an unrelenting (and even irrational) tendency to gamble, or due to the collapse of their ability to generate cash flows (even without any proclivity toward gambling). In the immediate future, *Ponzi* units' incomes are insufficient to cover their outstanding interest payments; they must take out additional loans even to meet their financial commitments. Their indebtedness grows even when interest rates do not rise.

Whether a fully-fledged financial crisis takes place when a sizeable shock occurs depends upon the efficacy of central bank lender-of-last-resort behavior, and on whether gross profit flows are sustained by countercyclical government expenditure.[12] The question of countercyclical policy and its continuing effectiveness is beyond the scope of this paper. Regarding central-bank intervention, several points can be made. The central bank can stabilize asset prices (and block the debt deflation spiral) by increasing the volume and types of eligible assets that it can buy from banks, and also by increasing the volume of financial assistance to banks. This impedes debt deflation by limiting the liquidity and default risks that banks face and checking any impulse toward panic.

The disaggregated multiplier model suggests another way to understand how the central bank works: it maintains macroeconomic conditions that allow banks to make needed adjustments without experiencing bankruptcies. The central bank can operate like bank k during the downturn – that is, it can expand loans even when the bank system as a whole (bank i) reduces the pace of its loan growth. In effect, the central bank increases its loan volume (its liquidity assistance), increases its purchase of securities (via open market and rediscount operations) and inject reserves into the banking system. Thus, expansionary central bank policy generates more liquid balance sheets for banks, and provides more liquid assets for loans – as bank i does – without generating a bank crisis.

This central bank action allows banks to make balance-sheet adjustment without more critical macroeconomic side effects. From the microeconomic point of view, this balance-sheet adjustment results in low banking profitability, as the relative share of liquid and less profitable assets in total assets reduces. So a central bank of the type discussed here, when successful, puts the banking system in 'stand-by' mode, waiting for signals of better economic prospects before expanding loans again.

5. Conclusion

This paper aimed at clarifying the relationship between individual-bank and banking industry behavior in credit expansion. We argued that the balance sheet structure of an individual bank is only partially determined by its management decision, as it is also determined by the balance sheets positions of other banks. Indeed, according to our analysis, if banks present different rhythm of loan expansion, *ceteris paribus*, the more aggressive banks will lose reserves to the others, and at the same time will present higher liquidity and insolvency risks. This relationship was explicitly shown by disaggregating the variables that enter into the simple money multiplier. This opens at least one way to integrate the micro and macro levels that comprise Keynesian banking analysis.

The paper also focused on the role of banking in the business cycle. It showed that banks have an important and contradictory role in the business cycle: banks' accommodative behavior can amplify economic growth during the upturn of a cycle; banks' contractionary loan-market behavior, due to their rising liquidity preference, can also amplify the cyclical downturn.

Further research is needed to answer some questions that this paper did not address: in particular, does the suggested model of banking strategy pertain to an earlier time, when strategic options were more one-dimensional; does this model remain relevant for the present era, in which banks can pursue diverse strategies that include not just loan-making but fee-based activities, securitization, and so on? These important questions can be taken up in future research.

[12] We might note that the shocks in question can originate with a severe tightening of monetary policy by the central bank (that is, with 'shock therapy') in response to inflationary pressures. In this event, the central bank appears analytically both as the cause of and the solution to the moment of crisis.

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Annex 1. Changes in some banking variables (bank k and i) for different reserve-to-deposit ratios

	Assets			Reserves		Loans		Loans/Net worth		Assets/Net worth	
Reserve-to-deposit ratios of bank k	Bank k	Bank i	Banking sector	Bank k	Bank i	Bank k	Bank i	Bank k	Bank i	Bank k	Bank i
0,70	688,24	688,24	1376,47	481,76	344,12	106,47	244,12	1,06	2,44	6,88	6,88
0,65	706,06	706,06	1412,12	458,94	353,03	147,12	253,03	1,47	2,53	7,06	7,06
0,60	725,00	725,00	1450,00	435,00	362,50	190,00	262,50	1,90	2,63	7,25	7,25
0,55	745,16	745,16	1490,32	409,84	372,58	235,32	272,58	2,35	2,73	7,45	7,45
0,50	766,67	766,67	1533,33	383,33	383,33	283,33	283,33	2,83	2,83	7,67	7,67
0,40	814,29	814,29	1628,57	325,71	407,14	388,57	307,14	3,89	3,07	8,14	8,14
0,30	869,23	869,23	1738,46	260,77	434,62	508,46	334,62	5,08	3,35	8,69	8,69
0,20	933,33	933,33	1866,67	186,67	466,67	646,67	366,67	6,47	3,67	9,33	9,33
0,10	1009,09	1009,09	2018,18	100,91	504,55	808,18	404,55	8,08	4,05	10,09	10,09
0,05	1052,38	1052,38	2104,76	52,62	526,19	899,76	426,19	9,00	4,26	10,52	10,52

Source: Authors' calculation based on Table 2.