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Stock Market Booms, Endogenous Credit Creation and the Implications of Broad and Narrow Banking for Macroeconomic Stability

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Abstract

In this paper we study the implications of the present broad banking system for macroeconomic stability. Commercial banks are allowed to trade in financial assets (here equities) as a substitute for lending and we show that such a system is likely to be an unstable one. We then consider narrow banking that is defined by a Fisherian 100% reserve ratio for checkable deposits and the exclusion of trade in stocks and other assets by commercial banks. Within the stylized theoretical framework set up here, we show that in the second system macroeconomic stability is guaranteed by some weak assumptions on the behavior of economic agents. Moreover, while a sufficient loan supply can be guaranteed in such a framework, the rationale for bank runs can be eliminated, in contrast to what is likely to happen under traditional broad banking. Though narrow banking is an extreme banking system it highlights the stability and efficiency properties of the separation between commercial and investment banking.

Keywords: Financial Markets, Credit Creation, Broad and Narrow Banking, Instability

JEL classifications: E12, **E24**, **E31**, **E52**.

1 Introduction

Over the last 25 years a great deal of research has demonstrated both theoretically and empirically how the financial markets, and especially the commercial banking sector amplify – through the financial accelerator mechanism put forward by Bernanke and Gertler (1989) – developments that originated in the real side of the economy. However, as pointed out by Bordo (2007), the prominent role of credit in the amplification of shocks has been acknowledged for a long time. According to Kindleberger and Aliber (2005), it is the instability of credit what leads to macrofinancial instability, while for Minsky (1982, 1986) it is the way financing becomes de-linked from collateral that contributes to a downward spiral once large real or financial shocks occur. In recent times, however, the role and extent of commercial banking itself and the issue of whether it adds to macroeconomic instability is currently the focus of a large body of literature, see Adrian and Shin (2010), Brunnermeier and Sannikov (2010), and Gorton (2009, 2010).

In this paper we pursue a rather traditional root and model in the first instance a broad banking system characterized by the non-separation of commercial and investment banking. Such a system was put in place by the partial repeal of the Glass-Steagall Act of 1933 and the Bank Holding Company Act of 1956 through the Gramm-Leach-Bliley Act of 1999.[1] Thereafter we contrast such a system with a narrow banking system, characterized in turn by a Fisherian 100 percent reserve ratio for checkable deposits and the exclusion of trade in stocks and other assets for commercial banks. We use a minimal structure of financial assets to reconsider the issue of broad versus narrow banking: a risky asset (equities E) and two types of deposits, checkable and time (saving) deposits D_1 and D_2 respectively, besides high powered money H supplied by the central bank. In particular we focus on the destabilizing credit channel effect that comes into operation if commercial banks are strongly stock market oriented in their decision on new loan supplies.[2]

In contrast, we explore what it means for macroeconomic stability if the banking sector of the economy is simply a narrowly defined depository institution with respect to pure money holdings and is primarily concerned with channeling the flow of savings (time

[1] The Glass-Steagall Act prohibited any one institution from acting as any combination of an investment bank, a commercial bank, and an insurance company. The Gramm-Leach-Bliley Act abolished this prohibition by allowing commercial banks, investment banks, securities firms, and insurance companies to consolidate.

[2] Note we will see in our model that as banks go into capital assets they reduce the loan supply. One might argue that empirically one observes a comovement of credit expansion and rising asset or equity prices. We will come back to this issue at the end of the paper.

deposits) into investment flows where they act as credit creators, generating endogenous credit, but not endogenous money. As we will show, such an economy is characterized by strong stability features. In our view this situation is to be preferred that of broad or excessive banking, commercial bank money and credit creation that may sometimes be more flexible with respect to large upturns in investment booms, but that may be dangerous in opposite situations, where risk management has failed to work, and in cases where large bankruptcy scenarios (banks, firms and also governments) can have dramatic chain effects on the working of the national and the world economy.

The remainder of this paper is organized as follows: In the next section the general theoretical framework featuring a broad banking system is introduced by means of the discussion of the balance sheets and flow accounts of the different sectors of the economy. In section 3 the stability properties of a broad banking macrofinancial system are discussed. Thereafter, in section 4 the model is modified towards a narrow banking system and its stability properties are analyzed. Finally, section 5 concludes.

2 The Theoretical Framework

For the sake of expositional clarity we introduce the theoretical model by way of balance sheets and flow accounts for the four sectors of the economy considered here: firms, commercial banks, households and the central bank. We model the economy first with a completely passive central bank and commercial banks that create loans by selling equities on the stock market to the household sector (and v.v. with respect to credit reduction). Moreover they can create new deposits by providing loans through what we shall call "ink stroke money", which they generate when loans reappear at first as checkable deposits in the household sector. This latter process of credit creation will however only concern us when the concept of a narrow banking system is introduced.

We denote in the following by $\dot{x}$ the time derivative of a variable x, by $\hat{x}$ the growth rate of x and by f' the first derivative of a function $f(\cdot)$. We do not consider goods price inflation and normalize the corresponding price level at 1. The only variable price of the model is the share price p_e.

2.1 The entrepreneurial sector

We assume that firms finance their investment in capital stock K through the issue of equities E and the additional use of loans L as external sources. In the analysis of this paper, however, we will abstract from the feedback effects of the accumulation of assets $\dot{E}$ and $\dot{K} = I$ (investment) and therefore assume for notational simplicity in this case that $K = E$ holds (until E is considered explicitly via its law of motion). Further, since the Metzlerian inventory adjustment process is not incorporated into the present framework, inventories V are adjusted passively to the difference between aggregate demand and supply $Y^d - Y = -\dot{V}$, the latter being in turn determined by a dynamic multiplier process to be discussed later. These variables are summarized in Table 1.

Table 1: Balance Sheet of the Firms (f)

Assets	***Liabilities***
capital stock $pK \quad [p = 1]$	loans L
Inventories V	Equities $p_e E$
	Net Worth

Let us now consider the firms' production and investment behavior in more detail. As usual, we assume that firms produce an output good using labor N and capital K (in form of loans L) as input factors. A specific formulation of such a production function is however not needed here: For our argument, it is sufficient to define the firms' profits (net of depreciation) as

$$\Pi_f = Y - wN - i_l L - r(Y)E - \delta K,$$

where w denotes the wage rate, N the level of employment (which is assumed to be a function of output with $N'(Y) > 0$), i_l the loan rate and δ the depreciation rate of capital, and assume that the dividend rate r per unit of equity is a positive function of the level of output Y, so that

$$r = r(Y) \quad \text{with } r'(Y) > 0. \tag{1}$$

Retained profits Π_f are thus determined residually.

The direct transfer of income from firms to the household sector consists of labor compensation and dividend payments, that is

$$Y_{hf} = wN + rE_h, \tag{2}$$

where E_h is the stock of equities held by the household sector. Retained profits are calculated on the basis of output (not demand) as is customarily done in the literature.

Table 2: Flow Account of the Entrepreneurial Sector

Uses	***Resources***
depreciation δK	
wage payments $wN > 0$	
loan payments $i_l L$	
dividends rE	
retained profits or losses Π_f	output $Y = Y^d + \mathcal{I} = Y^d + \dot{V}$
investment $I + \delta K$	investment financing $\dot{L} + \Pi_f + p_e \dot{E}_f^s + \delta K$

As for net investment I, we assume that it depends positively on capacity utilization and thus on Y and also positively on the state of confidence in the economy which we measure by the deviation of the share price p_e from its steady state value p_{eo}, and negatively on the firms' level of leverage, thus

$$I(Y, p_e, L) = \nu_y Y + \nu_e (p_e - p_{eo}) E + \nu_l (L_o - L) + \bar{I} \tag{3}$$

with $\nu_y > 0$, $\nu_e > 0$ and $\nu_l > 0$.

The three sources for the financing of new investment activities are retained profits Π_f (which are assumed to be determined residually), new loans $\dot{L}$ and the issue of equities. Concerning the demand of firms for loans, we assume that it is determined by[3]

$$\dot{L}(Y, i_l) \quad = \quad l_y \, (Y - Y_o) - l_i (i_l - i_{lo}) \qquad (l_y > 0, \, l_i > 0), \tag{4}$$

where i_l is the loan interest rate (the determinants of which will be discussed in Section 2.2 below) and that this demand is fully served by the commercial banking sector. Table 2 summarizes the flow account of the entrepreneurial sector.

2.2 The Banking Sector

As previously mentioned, the term "broad banking" characterizes a financial system where the activities of commercial banks are not restrained to their classical role of channeling

[3]Note here that this is a net demand function so that $\dot{L}$ can also be negative if the principal of the currently repaid contracted debt exceeds the new borrowing decisions of firms.

the households' savings as sources of finance for real investment activities to be performed by the entrepreneurial sector, but where the commercial banks also engage (themselves) in financial investment activities. As it was already acknowledged through the creation of the second Glass-Steagall Act of 1933, if the same entity (in this case, the commercial banks) is engaged in both lending (the granting of credit) and investment (the use of credit) activities, a conflict of interest is quite likely to occur.[4]

In order to reflect such a broad banking system within our theoretical framework, we thus assume that commercial banks do not provide firms with new loans $\dot{L}$ out of checkable and time deposits D_1 and D_2 at a rate i_l (a rate which they set and control), but rather that they use their equities of the entrepreneurial sector $p_e E_b$, as illustrated in the balance sheet of the commercial banking sector, see Table 3. We thus consider primarily a process of asset substitution under broad banking and leave the generation of deposits that finance loans to later sections on narrow banking (which of course also apply to the situation where broad banking is considered).

Table 3: Balance Sheet of the Commercial Banking Sector (b)

Assets	***Liabilities***
reserves $R\ (= H_b = \rho_b D_1)$	households' $c-$deposits D_1
loans L	households' $t-$deposits D_2
equities (from firms) $p_e E_b$	net worth

Apart from assuming that the loan interest rate set by commercial banks depends positively on the state of the business cycle, we model the conflict of interest of the commercial banks arising from the non-separation between commercial and investment banking activities by assuming that as the prospective returns in the equity markets increase, banks demand a higher interest rate on loans from firms to equalize the profits of the two investment activities, so we write

$$i_l(Y, r_e^e) = i_{lo} + i_y\,(Y - Y_o) + \gamma_e(r_e^e - r_{eo}^e) \tag{5}$$

where $i_y(> 0)$ represents the reaction of the loan rate with respect to the relative level of economic activity (measured by the difference between actual and steady state output)

[4] As was previously mentioned, the Glass-Steagall Act of 1933 greatly restricted the ability of banks to conduct the activities associated with securities firms, insurance companies, merchant banks, and other financial companies. Such a separation between commercial and investment banking institutions was abolished by the Gramm-Leach-Bliley Act of 1999, see Barth et al. (2000).

and $\gamma_e(> 0)$ reflects the extent of stock-market orientation of the commercial banks and r_e^e is the expected rate of return on equities (to be defined below). The effect of such a specification of the loan rate is straightforward: if for example a stock market boom takes place, the commercial banks will increase the loan rate, which is likely to reduce the entrepreneurial sector demand for loans and thus the level of economic activity.[5]

To keep our model as parsimonious as possible we consider the interest rate on time deposits i_d as a given magnitude. Checkable deposits represent money endogenously generated by the commercial banking system through their loans (a process we will investigate later in the paper). With respect to central bank money it is important to note that in the present framework the money multiplier is given by

$$M = D_1 + H_h = \frac{1 + \rho_h}{\rho_b + \rho_h} H \equiv \alpha_m H,$$

where $H(= H_h + R)$ denotes the high powered money issued by the central bank, and $H_h = \rho_h D_1$, and $R = \rho_b D_1$ represent the cash holdings of households and the reserve requirements of commercial banks, respectively (a positive reserve requirement ratio $\rho_b > 0$ is assumed on $c-$deposits, but none on $t-$deposits), even though this money multiplier is however assumed for the time being as inactive in the flow account of banks, as well as the changes in checkable deposits in this account.

As previously mentioned, commercial banks serve the loan demand of firms derived from their setting of the loan rate. This creates temporarily checkable deposits for firms which when the circuit on money is finished are checkable deposits of households. This money generation process is here assumed to happen instantaneously and for the time being we also assume that households instantaneously transfer this money into time deposits which allow us to keep the reserves of the commercial banks constant. This is done in order to concentrate on the money creation process in its simplest form.

Finally, we assume that the profits

$$\Pi_{bh} = i_l L + r E_b - i_d D_2 \tag{6}$$

made by the commercial banks remain positive in this paper and are transferred to their owners, the household sector. The flow account of the commercial banking sector is shown in Table 4.

[5] The modeling of the commercial banks' conflict of interest through the loan interest rate is a result of the assumption that the actual level of new loans is fully determined by the entrepreneurial sector. See Flaschel et al. (2011) for an alternative specification where banks directly control the amount of loans granted.

Table 4: Flow Account of the Commercial Banking Sector

Uses	***Resources***
interest rate payments $i_d D_2$	loan rate payments $i_l L$
reserve adjustment $\dot{R} = 0$	change in $c-$deposits $\dot{D}_1 = \dot{L} - \dot{p}_e E_b^s = 0,\ \rho_b > 0$
distributed profits Π_{bh}	dividends rE_b
loans (credit demand of firms) $\dot{L} = p_e E_b^s$	change in $t-$deposits $\dot{D}_2 = 0, \quad (\rho_{b2} = 0)$

2.3 The Household Sector

The balance sheet of households is also self-explanatory and shown in Table 5.

Table 5: Balance Sheet of the Household Sector

Assets	***Liabilities***
cash H_h	
$c-$deposits D_1	
$t-$deposits D_2	
Equities $p_e E_h$	

Furthermore, for simplicity we assume that private consumption is a function of the households' income and thus of the activity level of the economy, and as in the investment function, of the measure of the state of confidence $(p_e - p_{eo})E$. Thus we write

$$C = c_y Y + c_e(p_e - p_{eo})E + \bar{C} \qquad (c_y > 0, c_e > 0). \tag{7}$$

The flow account of the household sector (Table 6) mirrors these different activities and moreover shows again how loans are financed through the creation of time deposits. Due to these operations we assume that the savings of households go into the new equity supply of firms and the time deposits generated by the banking system. The aggregate income of households consists of wage income, dividend income and loan rate income (which comprise of time-deposit income, but is reduced by the defaulting loans).

Note that we simplify dividend distribution by assuming that all dividends are channeled back (one way or the other) into the household sector, and that the savings of households is

Table 6: Flow Account of The Household Sector

Uses	***Resources***
Consumption C	wages wN
change in cash holdings $\dot{H}_h = 0$	interest on $t-$deposits $i_d D_2$
$c-$deposits change $\dot{D}_1 = 0$	dividends $r(E_h + E_c)$
$t-$deposit change $\dot{D}_2 = 0$	banks' profit $\Pi_{bh} = i_l L + rE_b - i_d D_2$
households equity demand $\dot{p}_e E_h^d$	
income Y_h	$wN + rE + i_l L$

directed towards the demand of new equities solely and that their portfolio is also modified by the loan - equity exchange of commercial banks. Finally, note also that dividends are paid per unit of equity and not per unit of value of the stocks and are thus independent of the occurrence of stock market rallies.

2.4 The Monetary Authority

It is currently assumed that the monetary authority is completely inactive, but has accumulated through its open market operations (which in this model can only concern the equity market) financial assets in the past. Table 7 shows the balance sheet of the central bank.

Table 7: Balance Sheet of the Central Bank (c)

Assets	***Liabilities***
Equities of firms $p_e E_c$	high powered money (cash) $H = H_h + R$
	net worth

Table 8: Monetary Policy (Flows)

Uses	***Resources***
equity demand 0	Open Market Policies 0
CB Surplus: $rE_c \rightarrow$ household sector	dividends rE_c

2.5 Stock Market Price Dynamics

Concerning the dynamics of equity prices we assume for simplicity that they are determined by the portfolio choice (desired portfolio readjustment) between money plus $t-$deposits $M + D_2$ and equities E at the aggregate level.[6] Here we use a dynamic approach in place of a Tobinian equilibrium determination of the share price by assuming that a stock imbalance in the economy's gross portfolio, $p_e E^d - p_e E$, leads to a fractional flow demand for equities $\alpha_e(p_e E^d - p_e E)$, $\alpha_e \in (0,1)$,[7] which in turn generates a share price inflation (or deflation) according to

$$\hat{p}_e = \beta_e \alpha_e \left(\frac{p_e E^d - p_e E}{p_e E} \right), \tag{8}$$

with β_e the adjustment speed of share prices whereby equilibrium in the stock market is reestablished.

In the following we assume that the nominal demand for equities E^d is a function of the expected rate of return on this asset type, defined as

$$r_e^e = \frac{r(Y)}{p_e E} + \pi_e^e \tag{9}$$

where $r(Y)/(p_e E)$ denotes the dividend rate of return and π_e^e the expected capital gains, that is

$$p_e E^d = f_e(r_e^e)E, \qquad f_e(r_{eo}^e)E = p_e E, \quad f_e^{'} > 0.$$

After inserting these expressions it can be easily seen that share price inflation (or deflation) is given by

$$\hat{p}_e = \beta_e \alpha_e \left(\frac{f_e(r_e^e)E - p_e E}{p_e E} \right)$$

or, on making use of (9) and the definition of $\hat{p}_e$, by

$$\dot{p}_e = \beta_e \alpha_e \left[f_e \left(\frac{r(Y)}{p_e E} + \pi_e^e \right) - p_e \right]. \tag{10}$$

[6] Significantly more elaborate versions of the dynamics of the financial sector (and also of the real sector) are provided e.g. in Asada, Flaschel, Mouakil and Proaño (2011), there however on the basis of Tobin's portfolio equilibrium approach in place of the delayed disequilibrium adjustment processes we consider in the present section.

[7] This specification implies that when the households observe a stock imbalance in their gross portfolio, they will adjust their equity holdings in a gradual manner, correcting in each (infinitesimal) period only a percentage α_e of the total imbalance $p_e E^d - p_e E$.

In order to model the trend-chasing feature of expected capital gains observable in the real world on the theoretical level one could use the scheme of nested adaptive expectations

$$\dot{\pi}_e^e = \beta_{\pi_e^e}(\hat{p}_e - \pi_e^e) = \beta_{\pi_e^e}\left(\beta_e \alpha_e f_e\left(\frac{r(Y)}{p_e} + \pi_e^e\right) - \pi_e^e\right) \tag{11}$$

as is done for instance in Flaschel et al. (2011), or other backward looking mechanisms, but this would increase the dimension of the dynamics under consideration, without leading really to any increase in insight. On the other hand, adding fundamentalist behavior could be used to add stabilizing elements to the considered expectations formation, but again this would not lead to any real change in what we shall show below.[8]

In the next section we analyze the feedback mechanisms and the stability properties of the theoretical model discussed above.

[8] Viewed in isolation, the two laws of motion given by eqs. (10) and (11) – which show the dynamics of financial markets as primarily driven by the interaction between actual capital gains and expected ones – give rise to a two-dimensional system with the following Jacobian matrix (evaluated at the steady state)

$$J_o = \begin{pmatrix} \beta_e \alpha_e [-f_e^{'}(\cdot)\frac{r(\cdot)}{p_e^2}]p_e & \beta_e \alpha_e f_e^{'}(\cdot)p_e \\ \beta_{\pi_e^e}\beta_e \alpha_e [-f_e^{'}(\cdot)\frac{r(\cdot)}{p_e^2}] & \beta_{\pi_e^e}[\beta_e \alpha_e f_e^{'}(\cdot) - 1] \end{pmatrix} = \begin{pmatrix} - & + \\ - & \pm \end{pmatrix}$$

Since the determinant of this matrix J is always positive, the local stability of this system depends solely on the trace of J. This gives rise to the critical stability condition

$$\beta_{\pi_e^e}^H = \frac{\beta_e \alpha_e f_e^{'}(\cdot)\frac{r(\cdot)}{p_e}}{\beta_e \alpha_e f_e^{'}(\cdot) - 1} > 0.$$

Asymptotic stability becomes lost at the Hopf-bifurcation point $\beta_{\pi_e^e}^H$, where the system loses its stability in a cyclical fashion, in general through the disappearance of a stable corridor around the steady or the birth of an attracting limit cycle (persistent fluctuations in share prices) if the system is a non-linear one (where degenerate Hopf-bifurcations are of measure zero in the parameter space under consideration).

As discussed in Flaschel et al. (2011), by introducing a Tobin-like capital gains tax τ_e (not as these authors have proposed it: a transaction tax) with respect to the stock market, such instability features can be however be suppressed. This modifies the second law of motion, for capital gains expectations, to

$$\dot{\pi}_e^e = \beta_{\pi_e^e}(\hat{p}_e - \pi_e^e) = \beta_{\pi_e^e}\left[(1-\tau_e)\beta_e \alpha_e f_e\left(\frac{r(Y)}{p_e} + \pi_e^e\right) - \pi_e^e\right]$$

and leads to

$$\beta_{\pi_e^e}^H = \frac{\beta_e \alpha_e f_e^{'}(\cdot)\frac{r(\cdot)}{p_e}}{(1-\tau_e)\beta_e \alpha_e f_e^{'}(\cdot) - 1} > 0$$

showing that the destabilizing financial market accelerator can therefore always be tamed through the introduction of an appropriate level of a capital gains tax.

3 Feedback Mechanisms and Stability Properties under Broad Banking

The assumed major determinants of consumption and investment imply for the aggregate demand function the expression

$$Y^d = a_y Y + a_e(p_e - p_{eo})E - a_l(L - L_o) + \bar{A} \quad (a_y < 1), \tag{12}$$

with $a_y = c_y + \nu_y$, $a_e = c_e + \nu_e$, $\bar{A} = \bar{C} + \bar{I} + \delta K$. The aggregate demand function is thus based on income effects (concerning both household consumption[9] and firm investment), state of confidence effects on firm and household goods demand , and self-discipline or enforced discipline of firms with respect to their level of debt. Further, we assume a gradual adjustment of the output level of the form

$$\begin{aligned} \dot{Y} &= \beta_y(Y^d - Y) \\ &= \beta_y(a_y Y + a_e(p_e - p_{eo})E - a_l(L - L_o) + \bar{A} - Y). \end{aligned}$$

For the dynamics of the loan rate, after inserting the expressions for i_l and r_e^e into equation (4) for new loans, we obtain

$$\begin{aligned} \dot{L}(Y, i_l(Y, p_e)) &= l_y\,(Y - Y_o) - l_i\,(i_{lo} + i_y\,(Y - Y_o) + \gamma_e(r_e^e - r_{eo}^e) - i_{lo}) \\ &= (l_y - l_i i_y)\,(Y - Y_o) - l_i\gamma_e\left(\frac{r(Y)}{p_e} + \pi_e^e - \frac{r(Y_o)}{p_{eo}} - \pi_{eo}^e\right) \end{aligned}$$

In the following we will consider the interaction of share prices with the credit channel of the economy by keeping capital gains expectations at their steady state value π_{eo}^e to keep our analysis as straightforward as possible.[10] Under this assumption the system of differential equations describing the development of the economy is

$$\begin{aligned} \dot{Y} &= \beta_y((a_y - 1)Y + a_e(p_e - p_{eo}) - a_l(L - L_o) + \bar{A}), \\ \dot{L} &= (l_y - l_i i_y)\,(Y - Y_o) - l_i\gamma_e\left(\frac{r(Y)}{p_e} - \frac{r(Y_o)}{p_{eo}}\right), \\ \dot{p}_e &= \beta_e\alpha_e\left[f_e\left(\frac{r(Y)}{p_e} + \pi_{eo}^e\right) - p_e\right], \end{aligned}$$

with $Y_o(= \bar{A}/(1 - a_y))$, L_o and $p_{eo}(= r(Y_o)/i_{lo})$ as the steady state levels of the dynamic variables of the system.

[9] Here output is used as a proxy for household income.

[10] This assumption can be justified by means of a Tobin tax on capital gains that is chosen sufficiently high, such that the stability of the 3D dynamics considered here is preserved (see the preceding section).

Let us however focus first on the dynamic interaction of the real side of the economy by considering the subsystem given by the two law of motions for Y and L keeping p_e at its steady state level p_{eo}. Thus we consider

$$\begin{aligned}\dot{Y} &= \beta_y((a_y-1)Y + a_e(p_e - p_{eo})E - a_l(L-L_o) + \bar{A}),\\ \dot{L} &= (l_y - l_i i_y)(Y - Y_o) - l_i\gamma_e\left(\frac{r(Y)}{p_e} - \frac{r(Y_o)}{p_{eo}}\right).\end{aligned}$$

The matrix of partial derivatives of the Jacobian of this system at the steady state is given by

$$\begin{aligned}J &= \begin{pmatrix} \beta_y(a_y-1) & -\beta_y a_l \\ \left(l_y - l_i i_y - l_i\gamma_e\frac{r'(Y_o)}{p_{eo}}\right) & 0 \end{pmatrix}\\ &= \begin{pmatrix} - & - \\ \pm & 0 \end{pmatrix}\end{aligned}$$

The matrix of partial derivatives shows that the credit channel describing the interaction of firm debt with economic activity determines whether the steady state of the system is stable or of an unstable saddle-point type depending on whether

$$\gamma_e < \frac{p_{eo}}{l_i r'(Y_o)}(l_y - l_i i_y) \qquad \text{or} \qquad \gamma_e > \frac{p_{eo}}{l_i r'(Y_o)}(l_y - l_i i_y).$$

The economic rationale of this result is straightforward: because an increase in output leads on the one hand to a higher demand for loans, but on the other hand to an increase in the loan interest rate and in the dividends (due to $r'(Y) > 0$), and thus to an increase in r_e^e, the expected rate of return on equities, the final effect on the level of new loans $\dot{L}$ can be either positive or negative. If the effect is positive ($\partial\dot{L}/\partial Y > 0$), then the determinant of the Jacobian matrix will be positive and the steady state of the above subsystem will be locally stable. A higher output level will lead to new loans, and thus to a larger debt of the entrepreneurial sector which in turn will negatively affect the output dynamics, acting thus in a stabilizing manner. On the contrary, if $\partial\dot{L}/\partial Y < 0$, then an increase in output will lead to a lower level of new loans, which in turn will influence the output dynamics in a positive and thus destabilizing manner.

It should be clear that the net effect of Y on $\dot{L}$ depends very much not only on $r'(Y)$, but also on γ_e, the parameter representing the stock market orientation of the commercial banking sector. The larger γ_e the more negative will be the influence of Y on $\dot{L}$.

Let us now consider the original model with the dynamic law of motion for the equity prices p_e, thus we consider

$$\begin{aligned}
\dot{Y} &= \beta_y((a_y-1)Y + a_e(p_e - p_{eo}) - a_l(L-L_o) + \bar{A}), \\
\dot{L} &= (l_y - l_i i_y)(Y - Y_o) - l_i\gamma_e\left(\frac{r(Y)}{p_e} - \frac{r(Y_o)}{p_{eo}}\right), \\
\dot{p}_e &= \beta_e\alpha_e\left[f_e\left(\frac{r(Y)}{p_e} + \pi^e_{eo}\right) - p_e\right].
\end{aligned}$$

The corresponding Jacobian of this 3D subsystem evaluated at the steady state of the system is

$$J = \begin{bmatrix} J_{11} & J_{12} & J_{13} \\ J_{21} & J_{22} & J_{23} \\ J_{31} & J_{32} & J_{33} \end{bmatrix} = \begin{bmatrix} \partial\dot{Y}/\partial Y & \partial\dot{Y}/\partial L & \partial\dot{Y}/\partial p_e \\ \partial\dot{L}/\partial Y & \partial\dot{L}/\partial L & \partial\dot{L}/\partial p_e \\ \partial\dot{p}_e/\partial Y & \partial\dot{p}_e/\partial L & \partial\dot{p}_e/\partial p_e \end{bmatrix},$$

and it is a simple matter to calculate that

$$\begin{array}{lll}
J_{11} = \beta_y(a_y - 1), & J_{12} = -\beta_y a_l, & J_{13} = \beta_y a_e, \\
J_{21} = l_y - l_i i_y - l_i\gamma_e\frac{r'(Y_o)}{p_{eo}}, & J_{22} = 0, & J_{23} = l_i\gamma_e\frac{r(Y_o)}{p^2_{eo}}, \\
J_{31} = \beta_e\alpha_e f'_e(\,\cdot\,)\frac{r'(Y_o)}{p_{eo}}, & J_{32} = 0, & J_{33} = -\beta_e\alpha_e\left(f'_e(\,\cdot\,)\frac{r(Y_o)}{p^2_{eo}} - 1\right).
\end{array}$$

As can be clearly observed, this Jacobian matrix has the following sign structure

$$J = \begin{bmatrix} - & - & + \\ \pm & 0 & + \\ + & 0 & - \end{bmatrix},$$

under the assumption that $f'_e(\,\cdot\,)r(Y_o) > p^2_{eo}$.

According to the Routh-Hurwitz stability conditions for a 3D dynamical system, the steady state is asymptotic locally stable if

$$a_i > 0 \quad (i = 1, 2, 3) \quad \text{and} \quad a_1a_2 - a_3 > 0,$$

where $a_1 = -\text{trace}(J)$, $a_2 = \sum_{k=1}^{3} J_k$ with

$$J_1 = \begin{vmatrix} J_{22} & J_{23} \\ J_{32} & J_{33} \end{vmatrix}, J_2 = \begin{vmatrix} J_{11} & J_{13} \\ J_{31} & J_{33} \end{vmatrix}, J_3 = \begin{vmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{vmatrix}.$$

and $a_3 = -\det(J)$.

For the Jacobian matrix the trace is given by

$$\text{trace } J = \beta_y(a_y - 1) - \beta_e\alpha_e\left(f_e^{'}(\,\cdot\,)\frac{r(Y_o)}{p_{eo}^2} - 1\right) = -a_1$$

and the determinant is given by

$$\begin{aligned}
|J| &= -\beta_y a_l l_i \gamma_e \frac{r(Y_o)}{p_{eo}^2}\beta_e\alpha_e f_e^{'}(\,\cdot\,)\frac{r'(Y_o)}{p_{eo}} \\
&\quad -\beta_y a_l \beta_e\alpha_e\left(f_e^{'}(\,\cdot\,)\frac{r(Y_o)}{p_{eo}^2} - 1\right)\left(l_y - l_i i_y - l_i\gamma_e\frac{r'(Y_o)}{p_{eo}}\right) \\
&= -\beta_y a_l \beta_e\alpha_e\left[\left(f_e^{'}(\,\cdot\,)\frac{r(Y_o)}{p_{eo}^2} - 1\right)(l_y - l_i i_y) - l_i\gamma_e\frac{r'(Y_o)}{p_{eo}}\right] = -a_3.
\end{aligned}$$

In order that $|J| = 0$ we have the parameter relationship

$$\left(\gamma_e^{a_3}\frac{l_i r'(Y_o)}{p_{eo}}\right) = \left(f_e^{'}(\,\cdot\,)\frac{r(Y_o)}{p_{eo}^2} - 1\right)(l_y - l_i i_y)$$

that is

$$\gamma_e^{a_3} = \left(\frac{f_e^{'}(\,\cdot\,)i_{lo} - r(Y_o)/i_{lo}}{l_i r'(Y_o)}\right)(l_y - l_i i_y)$$

For the sum of the three principal minors of order two $a_2 = J_1 + J_2 + J_3$ of the Jacobian matrix J we get

$$a_2 = \beta_y(1-a_y)\beta_e\alpha_e\left(f_e^{'}(\,\cdot\,)\frac{r(Y_o)}{p_{eo}^2} - 1\right) - \beta_y a_e\beta_e\alpha_e f_e^{'}(\,\cdot\,)\frac{r'(Y_o)}{p_{eo}} + \beta_y a_l\left(l_y - l_i i_y - l_i\gamma_e\frac{r'(Y_o)}{p_{eo}}\right).$$

As with the previous stability condition, we calculate the threshold value for $a_2 = 0$ as

$$\gamma_e^{a_2} = \frac{(1-a_y)\beta_e\alpha_e(f_e'(\,\cdot\,)i_{lo} - r(Y_o)/i_{lo})}{a_l l_i r'(Y_o)} + \frac{r(Y_o)(l_y - l_i i_y)}{i_{lo} l_i r'(Y_o)} - \frac{a_e\beta_e\alpha_e f_e'(\,\cdot\,)}{a_l l_i}.$$

It is obvious that the critical stability condition

$$a_1 a_2 - a_3 > 0$$

will be fulfilled and thus stability will be guaranteed for all $\gamma_e < \min\{\gamma_e^{a_2}, \gamma_e^{a_3}\}$ while there will be instability in the opposite case.

These stability conditions for the original system basically corroborate the results of the reduced two-dimensional system discussed above with respect to the financial market orientation parameter γ_e. It is however interesting to note that this three-dimensional system allows us for example to incorporate into our model additional effects or stylized facts such as the positive correlation between stock market booms (higher equity prices) and increases in new credit, represented by the entry J_{23} in the above Jacobian matrix.[11]

In the next section we reconsider the implications Fisher's (1935) 100%-money proposal as a modification of our modeling framework of a commercial banking system that acts on the credit market and the financial markets without any institutional barrier.

4 Dynamics and Macroeconomic Stability under Narrow Banking

The return to the narrow banking idea, related to what Fisher (1935) proposed after the Great Depression in his book 100% Money, has recently been discussed again for example by De Grauwe (2008). In the mainstream textbook literature, however, see for example Freixas and Rochet (2008), this idea lives at best a shadowy existence, though of course the topic of bank runs is definitely of importance in the mainstream literature, see for example Rochet (2008) and Sinn (2009).

According to the narrow banking view, commercial banks should not be allowed to endogenously create money out of the central bank money in their balance sheet (where they are simply offering services as depositary institutions) and nor should they be allowed to purchase equities through ink stroke money (which would return to them in the form of checkable deposits through the circuit of money). If equities cannot be purchased by money creation of type M1, commercial banks will not so easily engage in speculative behavior. Because in such a system banks would thus no longer hold equities as bank capital, the rate of return on equities would no longer be of importance for the conduct of the banks' business and would thus be removed from the loan rate setting policy of these thereby narrowly defined banks. Furthermore, if the process of M1 money supply remains fully

[11] Within a similar framework the possibilities for the central bank to steer the economy in the context of broad banking were discussed in Flaschel et al. (2011). Since the rate of interest on $t-$deposits does not influence economic activity nor the financial markets in the context of the model there remains only the possibility to conduct open market operations through the purchase or sale of equities on the market for stocks (through trade with the household sector). However, as already shown in Flaschel et al. (2011), the open market operations of the central bank do not really improve the stability properties of the dynamical system.

in the hands of the central bank, the main rationale for bank runs on checkable deposits would disappear, as the public would know that all checkable deposits in the hands of the commercial banks will be supported by high-powered money from the central bank. The primary role of the commercial banks – besides being depositary institutions – would again be confined to the active creation of $t-$deposits through their loan supply decisions via the circuit of money, possibly supported in addition by a money supply or withdrawal rule of the central bank (to be considered later on).

On the basis of what we have modeled and investigated in the case of broad banking, let us therefore begin with the discussion of narrow banking by means of the following modifications of the broad banking system previously discussed. We first of all assume that commercial banks are not allowed to trade in financial assets anymore, beyond the limits that are set by the rules regulating banking capital (which are here assumed to be zero). Moreover, we now assume – to limit such a behavior from the ideal perspective of Fisher (1935) – that checkable deposits D_1 have to be backed up by a reserve requirement of 100% ($\rho_b = 1$) and are thus no longer at the disposal of commercial banks for the provision of loans, so reducing commercial banks to purely depository institutions. We assume instead (as a first example) that an inflow of checkable deposits is reallocated by households in equal portions into such deposit holdings and $t-$deposits. If commercial banks intend to provide loans of amount $\dot{L}$, this assumption implies the change in the flow account of the commercial banks indicated in Table 9.

Table 9: Narrow Commercial Banking

Uses	***Resources***
$i_d D_2$	$i_l(Y)L$
$\Pi_{bh} = i_l(Y)L - i_d D_2$	
Loan Supply $\dot{L} = l_b(Y - Y_o)$	New $t-$Deposits $\dot{D}_2 = \dot{L}$
Changes in Reserves $\dot{R} = \dot{D}_1$	New $c-$Deposits $\dot{D}_1 = \dot{L}, \quad \rho_b = 1$

In contrast, we assume no reserve requirements on time-deposits D_2, which are safeguarded by other means (including contract length and withdrawal penalties) against bank runs. Time deposits earn an interest rate that is interrelated with the loan rate on the credit given by firms and manipulated appropriately to ensure that the assumed ratio of 0.5 characterizes households reallocation of received checkable deposits. Though new loans all first reappear as checkable deposits in the money holdings of the household sector, 50% reappear as $t-$deposits. If this process is iterated in virtual time (where loans are not yet

fully backed up by $t-$deposits) it will in fact generate through the circuit of money an amount of $t-$deposits which in the limit allows the provision of loans intended by commercial banks (the use of the retained profits of banks as credit supply lead in the same way to an additional credit volume that is twice the size of these funds). During this process an equally sized amount of $c-$deposits is of course generated. We assume that the described circuit of money works infinitely fast in order to avoid its formal description in dynamic terms. Thus, we now allow for the endogenous creation of commercial bank money (in the form of time deposits), in addition to what we discussed when the textbook money multiplier was considered (which is now one). This money creation, however, concerns only the difference $M2 - M1$, while the creation of $M1$, the narrow measure of money supply is completely under the control of the central bank. This does therefore not allow commercial banks to get interest income out of those money deposits for which they in fact pay no interest.[12]

To show the viability of narrow banking, we start with a case where the credit demand of firms is rationed by the supply decision ($\dot{L}$) of banks, in order to move on from this credit rationing situation towards one where the banking system is efficiently supplying the credit that is demanded by firms – and does so in a stable environment where bank runs are excluded by the rules of narrow banking.

4.1 Credit Rationing by Banks

In this scenario, including the assumed single determinant (economic activity) of the loan supply[13] $\dot{L}$ gives rise to interaction of the real with the financial markets and the loan supply of commercial banks that can be written as[14]

$$\begin{aligned}
\dot{Y} &= \beta_y((a_y - 1)Y + a_e p_e E - a_l(L - L_o) + \dot{L} + \bar{A}), \\
\dot{L} &= l_b(Y - Y_o), \\
\hat{p}_e &= \beta_e \alpha_e \left(f_e(\frac{r(Y)}{p_e}) - 1 \right).
\end{aligned}$$

[12]These money holdings are thus always checkable against central bank money and can therefore not be subject to bank runs, since they are purely passive in the balance sheet of the commercial banks and not at their disposal should they become insolvent.

[13]This is assumed for expositional simplicity and could be replaced by more advanced supply functions or no credit rationing at all in future extensions of the model.

[14]Note that we again assume that the capital gains dynamics is controlled, for example, by a Tobin tax to a sufficient degree so that we need not treat it explicitly here.

The steady state of this dynamical system is of course the same as before and its Jacobian (if we assume that $a_y + l_b < 1$ holds true) has the sign structure

$$J_o = \begin{pmatrix} - & - & + \\ + & 0 & 0 \\ + & 0 & - \end{pmatrix}.$$

The sign structure implies stability of the steady state if the parameter a_e is such that $a_2 > 0$ holds true (since a_1 and a_3 are obviously positive) since in this case the positive interaction between the state of confidence in the goods market dynamics and the output effect on dividends in the stock market dynamics is the only effect that can be destabilizing. The term $a_1 a_2 - a_3$ must then be positive, since the $-a_3$ term is matched by a component in the terms contained in $a_1 a_2$.

We now add to the above first scenario of narrow banking a role for monetary policy and describe the flow account of the Central Bank as shown in Table 10. The central bank

Table 10: Central Bank (Flows Account)

Uses	***Resources***
	Open Market Policies $\dot{H} = m_e(p_{eo} - p_e)E$
Equity Demand $p_e \dot{E}_c^d = \dot{H} = -p_e \dot{E}_c^s$	
CB Surplus: $r(Y)E_c \rightarrow$ H-sector	Dividends $r(Y)E_c$

is thus assumed to know the structure of the model and to pursue a countercyclical money supply rule for the stabilization of the real-financial market interaction. The central bank therefore expands money supply in a stock market boom by selling equities (the only asset in which it can trade in this model) and by purchasing equities in the bust. Note that the circuit of money induced by the money supply rule of the central bank "moves" in the opposite direction of the circuit of money so far considered, since it changes the checkable deposit holdings of asset holders first (by the assumed trade in equities) and – when now a portion t_m of these $c-$deposits is transferred into time deposits by households – provides new opportunities for commercial banks to increase their loan supply.

Note however that, in the case $t_m = 1$, commercial banks have all loans returned as time-deposits, which they could use then to provide extra loans, leading to an infinite

circuit of money. We therefore consider it more realistic (as already done in the special case $t_m = 0.5$ discussed above) to assume that only a portion t_m of the initial result of the new money supply $\dot{H}$ is transformed into time deposits so that $1 - t_m$ remains tied up in the reserves of banks balancing the new demand for checkable deposits $(1 - t_m)\dot{H}$ of the household sector. The circuit of loans and money therefore creates $t_m t_m \dot{H} = t_m^2 \dot{H}$ time deposits in its next round, leading in the ideal again to the creation of $\alpha_m \dot{H}$ ($\alpha_m = \frac{t_m}{1-t_m}$) new loans and balancing time deposits. The changes implied in the household sector are summarized in the flow account shown by Table 11.

Table 11: Flow Account:Households (h, bank and firm owners)

Uses	***Resources***
$C = c_y Y + c_e p_e E + \bar{C}$	wN
	$i_d D_2$
$p_e \dot{E}_h = p_e \dot{E}_c^s$	$rE_h + rE_c$
$c-$deposit change $\dot{D}_1$	
$t-$deposit change $\dot{D}_2$	$\Pi_{bh} = i_l L - i_d D_2$
Y_h	$wN + rE + i_l L$

Table 12 adjusts the flow account of the commercial banks to what has now been assumed as action of the central bank. Note that we assume here that the supply of actual loans $\dot{L}$ (and not the loans $\dot{L}^i = l_b(Y - Y_o)$ intended by the firms) is given by the full use of time deposits that are created by the virtual (infinitely fast) circuit of money that is set into motion by the intended loans $\dot{L}^i$ of firms.

Table 12: Flow Account:Narrow Commercial Banking (b, private ownership)

Uses	***Resources***
$i_d D_2$	$i_l L$
Loans $\alpha_m(\dot{L}^i + \dot{H})$	$\dot{D}_2 = \alpha_m(\dot{L}^i + \dot{H})$
Reserve Change $\dot{R} = \dot{D}_1$	$\dot{D}_1 = \alpha_m^{-1}(\dot{L}^i + \dot{H})$
	$\Pi_{bh} = i_l L - i_d D_2$

Taken together the dynamics of the model we have considered so far is thereby modified

to[15]

$$
\begin{aligned}
\dot{Y} &= \beta_y((a_y-1)Y + a_e p_e E - a_l(L-L_o) + \alpha_m(\dot{L}^i + \dot{H}) + \bar{A}) \\
&= \beta_y\left[(a_y + \alpha_m l_b - 1)Y + (a_e - \alpha_m m_e)p_e E - a_l(L-L_o) + \bar{A} - c_b Y_o + \alpha_m m_e p_{eo} E\right], \\
\dot{L} &= \alpha_m(l_b(Y_o - Y) + m_e(1-p_e)E), \\
\hat{p}_e &= \beta_e \alpha_e \left[f_e\left(\frac{r(Y)}{p_e}\right) - 1\right].
\end{aligned}
$$

This gives for the Jacobian of this system at the steady state under the side conditions of the preceding case, $a_y + \alpha_m l_b - 1 < 0$, the sign distribution

$$
J_o = \begin{pmatrix} - & - & \pm \\ + & 0 & - \\ + & 0 & - \end{pmatrix}.
$$

Again, the sign structure in the above Jacobian implies again stability of the steady state solution, since a_1, a_2 are obviously positive if a_e is chosen as in the previous case and since $a_1 a_2 - a_3$ must be positive then, since the positive term in a_3 is matched by a products in the term $a_1 a_2$ and the negative one is made positive when a_3 is subtracted from $a_1 a_2$.

It should be further pointed out that the condition $J_{11} < 0$ can be more easily met if a Keynesian countercyclical fiscal policy that reduces the propensity to spend a_y to a sufficient degree is also assumed. Note also that the positive feedback channel created by $a_e p_e$ and $r(Y)$ between the first and the last law of motion need only be weakened, but not really overthrown, in order to get its possibly destabilizing nature fixed. The task of the central bank here is to reduce through its policy parameter l_e the impact of the state of confidence on aggregate demand, as measured by the parameter a_e, by so much that the sum of principal minors of order 2, a_2, becomes positive. As the very least any monetary policy of the assumed type will make the economy less accelerative in nature.

4.2 Demand-Determined Credit

It should be pointed out that in the just discussed scenario, the firm's loan demand is still assumed to be rationed, since the loans created by the banks determine the outcome on the credit market. However, a narrow banking system does not need to imply that credit

[15] Here $\tilde{A}$ is the new constant in the enlarged multiplier dynamics.

is more rationed than in the case of broad banking. Indeed, a narrow banking system can also handle the case where credit is demand determined and for example functionally determined as in the preceding case of a supply rationed outcome. In such a situation the flow account of the commercial banks is modified as shown in Table 13.[16]

Table 13: Flow Account: Narrow Commercial Banking (b, private ownership)

Uses	***Resources***
$i_d D_2$	$i_l L$
Loans $\dot{L} = l_f(Y - Y_o)$	$\dot{D}_2 = \alpha_m \dot{L}$
Reserve Change $\dot{R} = \dot{D}_1$	$\dot{D}_1 = \alpha_m^{-1} \dot{L}$
	$\Pi_{bh} = i_l L - i_d D_2$

The task of the banking system is then to manipulate the loan and the time-deposit interest rate such that $t_m \geq 0.5$ is achieved (which in the $>$ case would imply idle time-deposit reserves). An example for this manipulation is the following one. We assume that the parameter t_m which determines $\dot{D}_2$ is a positive function of the interest rate i_d on time-deposits. The task would then be to choose a deposit rate i_d such that $\frac{t_m(i_d)}{1-t_m(i_d)} > 1$ holds true.

So far we have considered the credit to deposit multipliers as working in virtual time with infinite speed. From the practical point of view this assumption is however not really necessary, since there is a continuous flow of loan-output/deposit-input type in such an economy. In the steady state this flow would balance loans and the creation of deposits in the assumed way in actual time, while for fluctuating loans some further flexibility of the banking system may be needed in order to achieve the result that time-deposits are always created to such a degree that they balance the loan creation of banks.

Such flexibility concerns the practical situation that the reserve ratio on checkable deposits does not need to be 1 as has been assumed so far, but can be adjusted in a downward direction to a certain degree if this were needed in view of the current loan demand. Again the interest rate on time-deposits and the one on loans may be adjusted in such a way as to balance loan demand with loan supply out of time-deposits. Finally, there may exist voluntary time-deposit reserves held by the banking system. A proper management of the banking system may therefore be needed in addition to the ideal constructions we have considered in this section.

[16] We again neglect policy actions here.

It may be easy to maintain a time-deposit ratio $t_m > 0.5$ in times of a normal operation of the economy and its banking system. But in times of financial stress, where liquidity preference is increasing, the ratio t_m may fall below 1/2. This first of all rations credit demand which to a certain degree may be a good thing, if there are firms that are not really viable in such a situation and which only consume financial resources without much change in their default position. Secondly, since this is most likely in a situation with low and falling stock market prices, the central bank may implement a monetary policy as we have considered it above, in order to increase the loan supply and to improve the situation on the stock market simultaneously. Finally, there may also be a quantitative easing policy of the central bank, that is a supply of central bank money to the banking system at a low rate of interest from which new credits can be generated.

5 Conclusions

In this paper we have considered the implications for macroeconomic stability of a broad banking system where commercial banks are allowed to trade in capital assets (here equities) as a substitute for traditional lending activities. Using a simple dynamic multiplier approach on the market for goods and a simple rate of return driven adjustment rule for stock prices we have shown that such a scenario is likely to be an unstable one, even if an appropriate monetary policy of the central bank is added to the considered dynamics. We then considered a narrow banking system defined by a Fisherian 100% reserve ratio for checkable deposits and the exclusion of stock trade for commercial banks. This would imply a significant reduction of proprietary trading of the banking sector. We showed in a narrow banking system that; a) the rationale for bank runs no longer exists as all checkable deposits are backed by high-powered central bank money; b) speculative behavior by banks is likely to be significantly lower; while c) a sufficient loan supply to entrepreneurs can be guaranteed in such a framework.

Low and falling stock market prices, increasing liquidity preference and credit rationing are a big problem for any banking system, but in the narrow banking considered here at the very least the exclusion of bank runs (100% reserves) may lead to a more stable real-financial market interaction and presumably also a more efficient credit supply than in the case where the traditional function of commercial banks as credit institutions becomes mixed up with investment banking and the like. Narrow banking thus can not only provide a greater systemic stability, but also at least as much efficiency in the credit creation process as the present banking system. Furthermore while narrow banking appears a too extreme

case to be implemented in reality, its features show the improvements in macrofinancial stability which can be attained if broad banking were to be constrained.

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