Broad Banking, Financial Markets and the Return of the Narrow Banking Idea*

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Abstract

Currently, many monetary and fiscal policy measures are aimed at recovering from the financial market meltdown that started in the US subprime sector and ended up in the international banking system. Yet, the meltdown was not only ending up in banking system, it was also, to some extent, amplified by the banking system. The meltdown has then spread worldwide and developed into a great recession (including the loss of credibility of whole countries in the Eurozone and elsewhere). Although some slow recovery appears to be on the horizon, it is worthwhile exploring the fragility and potentially destabilizing feedbacks of the banking system in the context of a Keynesian macro model. We use a simple dynamic multiplier approach on the market for goods and also a simple rate of return driven adjustment rule for stock prices to study the role of commercial banks and credit when embedded into such an environment. We first consider the implications of a broad banking system where commercial banks are allowed to trade in assets (here equities) as a substitute for lending. We show 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 consider narrow banking which is defined by a Fisherian 100 percent reserve ratio for checkable deposits and the exclusion of trade in stocks and other assets for commercial banks. It is shown that in such a scenario stability is guaranteed by some weak assumptions on the behavior of economic agents. Moreover, a sufficient loan supply is guaranteed in such a framework, and disastrous bank runs are avoided, in contrast to what is likely to happen under traditional broad banking. Though the narrow banking is an extreme case of banking it highlights the stability and efficiency properties of such a banking system.

Keywords: Financial Markets, Credit, Portfolio Choice, Instability of Broad Banking, Narrow Banking, Stability, Efficiency

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

Contents

1 Introduction

The role and extent of commercial banking and the issue whether it adds to macroeconomic instability is currently in the focus of a large body of literature.[1] There are also a lot of historical studies that demonstrate that many of the historical financial crises may have originated in adverse shocks to firms, households, foreign exchange, stock market or sovereign debt. Yet, as has been shown[2] the banking sector could seldom escape the crises. In fact most of crises ended up as a meltdown of the banking sector and the banking sector has usually exacerbated and amplified the crisis whatever origin it had. This is the more so the more the traditional banks have been turned into investment banks. As Gorton (2010) shows in earlier times loan losses and bank runs where usually the way of how the crises where triggered, but in recent times banking crises seem to be strongly related to adverse shocks in asset prices. This is occurring when banks have significantly invested in capital assets. One might want to show of how such asset accumulation of banks can lead to a channel through which some exacerbating or even destabilizing effects on the macroeconomy can be generated.

The issue is do we have proper models to explain this? Do we have models that help to understand this central aspect of the instability of the banking system? There are the earlier non-conventional studies by Kindleberger and Aliber (2005) and Minsky (1986, 1982) that view the role of credit as significantly amplifying forces. In Kindleberger it is the instability of credit and in Minsky it is the way financing becomes de-linked from collaterals that contributes to a downward spiral once large real or financial shocks occur. This is surely an important tradition that captured many of the aspects of the boom-bust scenarios that we have seen historically.

On the other hand, recent vintages of the DSGE model, for example of the Bernanke et al. (1999) type, do have considered financial markets as accelerating force and in principle such models can explain amplifications of the macroeconomy through the financial side, the financial accelerator, but those models are locally stable. The amplification through shocks is there, but the financial and real sides are mean reverting: After an amplified shock the variables revert back to their mean level. This is shown through local linearizations where the locally approximated linear system shows the mean reverting tendencies spite of some amplifications of shocks.[3] Moreover in those DSGE model with a built in financial accelerator the banking system is often not specifically modeled.

Here we pursue a rather traditional root and model the banking system as commercial banks that can accumulate capital assets in particular equity. In this paper we use a minimal structure of assets to reconsider the issue of broad versus narrow banking. Broad banking means that the bank can accumulate capital assets, but in our set up there is only one risky asset (equities E) and no further tradable financial asset, but only two types of deposits (checkable and time (saving) deposits D_1, D_2 besides high powered money H supplied by the central bank. The central bank can therefore only perform open market policies by trading in equities and it can enforce reserve requirements in our model. We assume in this respect that these requirements are only made for checkable deposits (commercial banks' money creation).

Policy actions are therefore narrowly defined, but open market policies do reach the financial markets here in a direct way (and not indirectly via the federal funds rate). Financial markets are modeled as portfolio choice of households between E and $M2$ (money and deposit holdings of households), who thereafter adjust the structure of their M2 money holdings as described by the textbook money multiplier (concerning high powered money and checkable deposits). Time deposits are treated in a fairly standard way and are used to balance certain operations of the commercial banks in this paper. The goods market is modeled via a textbook multiplier approach and the labor market is assumed to be simply appended to what happens on the market for goods.

We show that there are two sources of instability in the financial markets (a Tobinian investment accelerator and accelerating capital gains or losses and expectations about them). Moreover there is a destabilizing credit channel effect which comes into operation if commercial banks are strongly stock market oriented in their decision on new loan supplies.[4] These feedback channels make the considered

[1]See Adrian et al. (2010), Brunnermeier and Sannikov (2010), and Gorton (2009, 2010)

[2]See Reinhard and Rogoff (2009) and Gorton (2009, 2010)

[3]For a details of such an evaluation, see Brunnermeier and Sannikov (2010).

[4]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 might observe a comovement of credit expansion and rising asset or equity prices. We will come back to this issue at the end of the paper.

situation of broad banking, a fairly unstable one if the parameter that characterizes their stock market orientation becomes large enough. Central banks can influence this situation through wealth effects in the financial markets and through the goods market dynamics if changes in high powered money have an influence on economy activity.
Taken together it is however questionable if broad commercial banking can be influenced to such a degree that instability, the occurrence of banking crises and bank runs can be safely excluded from the working of the financial part of the economy. We therefore propose – based on Fisher's (1935) 100 % money proposal – that money creation (in the form of checkable deposits) should be excluded — or excluded to a great extent– from the operations performed by commercial banks. This would mean the the banks have to significantly reduce proprietary trading, which as become a major corner stone of the Obama financial market reform.
We explore what it means 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 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 case is to be preferred to the situation 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.
We consider the model first from the perspective of stock-flow consistency and study thereafter through the introduction of laws of motions for the real and the financial markets the stock-flow interactions generated by the model under the assumption of a 'broad banking' scenario. Due to the analytical difficulties that pile up when the model is too rapidly extended we are limiting our analysis to a set of special cases here, before we contrast the obtained results with a 'narrow banking' scenario at the end of the paper. Longer proofs are collected in an appendix to the paper.

2 The basic accounting framework for investment, credit, and consumption behavior

In this section we introduce the model by way of balance sheets and flow accounts for the four sectors: firms, commercial banks, households and the central bank. We first model the economy with a completely passive central bank and commercial banks that can create deposits (ink stroke money) by purchasing equities on the stock market from the household sector. We denote in the following by $\dot{x}$ the time derivative of a variable x, and by $\hat{x}$ the growth rate of x, and by f' derivative of f.

2.1 Production and Investment

Firms (f, external loan and equity financing):

Balance Sheet:	
Assets	***Liabilities***
Capital Stock pK $[p = 1]$	Loans L
Inventories V	Equities $p_e E$
	Net Worth

The balance sheet of firms is a simple one. Firms have issued equities E and have used credit L as external sources to finance their past investment into the capital stock K. We do not consider goods price inflation and normalize the corresponding price level by 1. The only variable price of the model is the share price p_e. We ignore the accumulation of assets $\dot{E}$ and $\dot{K} = I$ in this paper. We will use

Flow Account:	
Uses	***Resources***
Wages $wN(Y), N'(Y) > 0$	
Interest Payments $i_l(Y)(1-\delta)L,\ i_l^{'}(Y) > 0$	
Dividends $r(Y)(1-\delta)E, \quad r'(Y) > 0$	
Retained Profits or Losses Π_f	
Unintended Inventory Changes $\dot{V} = \mathcal{I}$	Output and Demand $Y = Y^d + \mathcal{I}$
Investment Function $I = i_1 Y + i_2 p_e E + a_l(L_o - L) + \bar{I}$	Investment Funds $\dot{L} + \delta L + \Pi_f + p_e \dot{E}^s_f, \quad \dot{E}^s_f - \delta E = \dot{E}$

a dynamic multiplier process later on for the description of output dynamics which means (since the Metzlerian inventory adjustment process is still absent) that inventories V are adjusted passively by just the difference between aggregate demand and aggregate supply $Y^d - Y = -\dot{V}$.
We next consider the flow account of firms concerning production and and their investment behavior. We assume that the level of economic activity determines the loan rate i_l and also the dividend rate r in a positive way. The only thing in the production account that needs further explanation is given by the relationship $\delta K = \delta L \frac{K}{L} = \delta E \frac{K}{E}$ and $i_l(Y)(1-\delta)L$, which we by and large assume to work in the background of the model. We assume that capital depreciation occurs due to bankruptcy which makes this part of the capital stock just disappear and which also reduces the interest payments of firms and their loans by a corresponding amount.
As for the investment function, we assume that it depends positively on capacity utilization and thus the activity level and also positively on the state of confidence in the economy which we measure by the deviation of the share prices from their steady state value. There is in addition a negative leverage effect in the investment function. The investment function will be suitably extended later on. Investment is financed through retained earnings Π_f (to be determined residually), through new credit $\dot{L}$ and residually through the issue of new equities (depending on the amount of retained earnings that firms can realize). Concerning the income of firms we get the expression $Y_f = S_f = \Pi_f + \mathcal{I}$ which assumes that unintended inventory changes and output (not sales) are used in the income calculations made in this paper. There is moreover the following transfer of income from firms to the household sector $Y_{hf} = wN(Y) + r(Y)(1-\delta)E_h$ based on the portion of dividends that go into this sector.
We stress again that the amount of investment that is financed by loans depends on what is supplied by commercial banks (so that there credit rationing occurring) and that the new equity issue is determined on this basis in a residual way in order to get investment demand realized.

2.2 Banking and Credit

The balance sheet of commercial banks is also a simple one: Banks can provide loans L out of checkable and time deposits D_1, D_2, but they can also invest these deposits or the contract based returned principal on loans into stock holdings $p_e E_b$. The interest rate on time deposits is i_d and considered as a given magnitude in this paper, while the loan rate i_l was already assumed to depend positively on economic activity Y. There is no interest on checkable deposits which represent money endogenously generated by the commercial banking system.
We assume the simple textbook multiplier relationship between $M = H_h + D_1$, where H denotes the high powered money issued by the central bank. This multiplier formula is given as follows:

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

based on the relationships $H_h = \rho_h D_1$, and $R = \rho_b D_1$ which represent the cash demand of households and

Broad Commercial Banking (b, private ownership):

Balance Sheet:	
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

Flow Account:	
Uses	***Resources***
Interest Payments $i_d D_2$	Interest Payments $i_l(Y)(1-\delta)L$
Reserve Adjustment $\dot{R} = 0$	Change in C-Deposits $\dot{D}_1 = 0,\ \rho_{b1} > 0$
Defaults δL (retained profits)	Dividends $r(Y)(1-\delta)E_b$
Distributed Profit Π_{bh} $= i_l(Y)(1-\delta)L + r(Y)(1-\delta)E_b - i_d D_2 - \delta L$	
Net Loans $\dot{L} = [b_l(i_l(Y) - i_l(Y_o)) - b_e(r_e^e - r_{eo}^e)]L$	
Change in Equity Holdings $\dot{L} = -p_e \dot{E}_b^s,\ \dot{E}_b = \dot{E}_b^s - \delta E_b$	Change in T-Deposits $\dot{D}_2 = 0,\ \rho_{b2} = 0$

the reserve requirements of commercial banks, respectively. This money multiplier is however assumed as inactive in the flow account of banks. We also ignore changes in time deposits in this account.

The first part of the flow account is then largely self-explanatory. We stress however that it contains credit default (at rate δ) and the corresponding loss of interest on these loans. Moreover the amount of central bank money is considered a given magnitude here. We assume finally that there is a positive reserve requirement ratio $\rho_{b1} > 0$ on C-Deposits, but none with respect to T-Deposits.

If commercial banks intend to provide additional loans $\dot{L}$ (or intend to reduce the number of outstanding debt) the following sequence of events is assumed to happen. They sell (purchase) equities of amount $-p_e\dot{E}_b = \dot{L}$. The means for the intended supply of loans therefore lead to a reduction in the asset holdings of banks. The opposite of course occurs when they find equities more interesting than loans from the perspective of profit maximization (under uncertainty).[5] We assume also as given a loan supply function $\dot{L}$ which depends on a comparison between the loan rate (in its deviation from the steady state) and the rate of return of equities (again in its deviation from the steady state). This later rate will be introduced when the dynamics of stock markets are considered in the next section. We assume finally that the profits (assumed to stay positive in this paper) made by the banking systems are transferred to their owners, the sector of households.

In the flow account of banks we could allow in addition to the profit-oriented reallocation between their new loan supply (which can also be negative if they do not turn returned principals back into the credit market) and their equity holdings for the loan generation sequence where commercial banks create new loans $\dot{L}$ which give rise to new deposits $\dot{D}_1$ or $\dot{D}_2$ through the circuit of money.

We summarize the above structure by pointing to its crucial elements again. The amount of credit is assumed to be determined by commercial banks by their comparing of the return on loans with the expected rate of return on their equities. Additional loans are here generated solely through the sale of some of the equities of firms owned by banks, i.e., there is not yet a supply of credit through the creation of commercial bank deposits, since the income circuit and money per se does not increase the stock of money. We here only discuss the possibility that there may be credit rationing by commercial banks, in the extreme simply because they find it more profitable from to invest in additional equities the principal

[5]The role of equities to act as collateral or bank capital is neglected in this paper.

they receive from those firms that have to repay their contracted debt.

2.3 Households and Consumption

The flow account mirrors what was already discussed in the previous flow account. It however adds now a consumption function to the investment function already provided which uses as main determinants the income of households and thus the activity level of the economy and the measure of the state of confidence we are using. The account moreover shows again how loans are financed through the creation of time deposits via the purchase of equities by commercial banks. Due to these operations we assume that the savings of households goes into new equity demand at first, subject to reallocations when financial markets are considered in the next section. The income of households consists of wage income, dividend income and loan rate income (which comprise time-deposit income, but is of reduced by the defaulting loans).
The balance sheet of households is on the basis of what has already been said and is self-explanatory.

Households (h, bank owners and firm stock owners):

Balance Sheet:	
Assets	***Liabilities***
Cash H_h	
C-Deposits D_1	
T-Deposits D_2	
Equities $p_e E_h$	

Flow Account:	
Uses	***Resources***
Consumption Function $C = c_1 Y + c_2 p_e E + \bar{C}$	Wages $wN(Y)$
	Interest on T-Deposits $i_d D_2$
Reallocation of Equity Holdings $p_e \dot{E}_h^d = p_e \dot{E}_b^s$	Dividends $r(Y)(1-\delta)E_h$
Change in Cash Holdings $\dot{H}_h = 0$	
Change in C-Deposits $\dot{D}_1 = 0$	extra dividend payments $r(Y)(1-\delta)E_c$
Change in T-Deposits $\dot{D}_2 = -p_e \dot{E}_h^d$ $\dot{E}_h = \dot{E}_h^d - \delta E_h$	Distributed Profit $\Pi_{bh} = i_l(Y)(1-\delta)L + r(Y)(1-\delta)E_b - i_d D_2 - \delta L$
Households' Savings S_h	
income Y_h	$wN(Y)+r(Y)(1-\delta)E+i_l(Y)(1-\delta)L-\delta L$

Note that we simplify dividend distribution by assuming that all dividends are channeled back (one way or the other) into the household sector. Note also that the savings of households is directed towards the demand of new equities solely and that his portfolio is also modified by the loan – equity exchange of commercial banks. Note finally that dividends are paid per equity unit and not per value unit of the stocks and are thus independent of the occurrence of stock marked rallies.

2.4 The Monetary Authority

It is currently assumed that the monetary authority is completely inactive, but has accumulated equities in the past, through its open market operations, which in this model can only concern the equity market. All dividends that could accrue to the central bank are assumed to be paid to or transferred into the household sector (for reasons of simplicity), see their flow account.[6]

The Central Bank (c):

Balance Sheet:	
Assets	***Liabilities***
	High Powered Money $H = H_h + R$
Equities of Firms $p_e E_c$	CB: Net Worth

Monetary Policy (Flows):	
Uses	***Resources***
	Open Market Policies 0
Equity Demand 0 CB Surplus: $r(Y)(1-\delta)E_c \to HH$	Dividends $r(Y)(1-\delta)E_c \to HH$

The accumulation effects $\dot{E}_f^s, \dot{E}_h$ on the stocks of equities held and the reallocation of the existing stock will be ignored as accumulation equations in this first version of the model, just as the capacity effects on the capital stock through investment I and the capacity effect on inventories through unintended inventory investment $\mathcal{I}$.
The assumed major determinants of consumption and investment imply as aggregate demand function the expression:

$$Y^d = a_y Y + a_e p_e E - a_l(l - l_o)E + \bar{A}, \quad L = lE, a_y < 1$$

with $a_y = c_1 + i_1, a_e = c_2 + i_2, \bar{A} = \bar{C} + \bar{I}$. The aggregate demand function is thus based on income and activity level effects (on households' consumption and firms' investment), state of confidence effects on firms and households, and self-discipline or enforced discipline of firms with respect to debt levels.
The laws of motions that flow from this section thus are:

$$\begin{aligned} \dot{Y} &= \beta_y(Y^d - Y) = \beta_y((a_y - 1)Y + a_e p_e E - a_l(L - L_o) + \bar{A}) \\ \dot{L} &= [b_l(i_l(Y) - i_l(Y_o)) - b_e(r_e^e - r_{eo}^e)]L \end{aligned}$$

with $r_e^e = r(Y)/p_e + \pi_e^e$, $r'(Y) > 0$ the expected rate of return on equities – to be considered in the next section – and $Y_o = [\bar{A} + a_e p_{eo} E_o]/(1 - a_y), L_o$ as the steady state levels of economic activity and debt. The matrix of partial derivatives of the Jacobian of this system at the steady state is given by:

$$\begin{aligned} J_o &= \begin{pmatrix} \beta_y(a_y - 1) & -\beta_y a_l \\ (b_l i_l' - b_e \frac{r'}{p_e})L_o & 0 \end{pmatrix} \\ &= \begin{pmatrix} - & - \\ \pm & 0 \end{pmatrix} \end{aligned}$$

We consider this subsystem of the full model as describing the credit channel of it. The matrix of partial derivatives in this respect shows that the credit channel (the interaction of firm's debt with economic

[6]Total savings are $S_h + S_f + S_b \equiv (Y_h - C) + (\Pi_f + \mathcal{I}) + \delta L$ This gives after some restructuring of such expressions the consistency result that total savings equal total investment if and only if there is flow consistency on the equity market.

activity) can be stable ($b_l i_l^{'} > b_e \frac{r'}{p_e}$) or of unstable saddlepoint type ($b_l i_l^{'} < b_e \frac{r'}{p_e}$). Increasing sensitivity of loan supply to rates of return on the financial markets thus destabilizes the credit channel on the real side of the economy. This may for example occur in the form of a Minsky (1982,1986) moment during periods of tranquil progress which may induce bank management to bear more speculative risk than is acceptable from a pure bankers point of view.

> *As we approach the last decade of the twentieth century, our economic world is in apparent disarray. After two secure decades of tranquil progress following World War II, in the late 1960s the order of the day became turbulence - both domestic and international. Bursts of accelerating inflation, higher chronic and higher cyclical unemployment, bankruptcies, crunching interest rates, and crises in energy, transportation, food supply, welfare, the cities, and banking were mixed with periods of troubled expansions. The economic and social policy synthesis that served us so well after World War II broke down in the mid-1960s. What is needed now is a new approach, a policy synthesis fundamentally different from the mix that results when today's accepted theory is applied to today's economic system.* Minsky (1982, p.3)

3 Portfolio choice and the dynamics of financial markets

We consider next the financial markets of the economy which in this paper is simply described by the portfolio choice (desired portfolio readjustment) of households between money plus T-Deposits $M + D_2$ and equities E_h. We use a dynamic approach here in place of a Tobinian equilibrium determination of share prices,[7] by assuming that stock imbalances in households' gross portfolio:[8]

$$p_eE^d - p_eE = f_e(r_e^e)W_h^n - p_eE = -(M^d - M), \quad W_h^n = M + p_eE, r_e^e = \frac{r(Y)}{p_e} + \pi_e^e$$

lead to a fractional flow demand for assets of amount $\alpha_e(E^d - E)$, $\alpha_e \in (0,1)$, which in turn leads to share price inflation or deflation of amount $\hat{p}_e = \beta_e\alpha_e\frac{p_eE^d - p_eE}{p_eE}$, β_e the adjustment speed of share prices whereby equilibrium in the stock market is reestablished ($E_h^d = E_h$).[9] Excess demand $\alpha_e(E^d - E)$ depends on the rate of return on equities r_e^e which is composed of the dividend rate of return $\frac{r(Y)}{p_e}$ and expected capital gains π_e^e. We assume that there holds $f_e(r_e^e) \in (0,1), f_e^{'} > 0, f_e(r_{eo}^e) = p_eE$, around the steady state value of the rate of return on equities.
Expected capital gains are based here on chartist behavior solely which is modeled on the theoretical level by a simple adaptive expectations formation mechanism. One could use nested adaptive expectations (humped shaped explorations of the past) or other backward looking mechanism as well, but this would increase the dimension of the considered dynamics, without leading really to an increase in insight. Adding fundamentalists' behavior on the other hand could be used to add stabilizing elements to the considered expectations formation, but again not to a real change in what we shall show below.
The laws of motion shown below thus represent our modeling of the dynamics of financial markets, primarily driven by the interaction between actual capital gains and expected ones.[10]

$$\dot{p}_e = \beta_e\alpha_e\frac{p_eE_h^d - p_eE}{E}$$

[7]Significantly more elaborate versions of the dynamics of the financial sector (and also of the real sector) are provided in Asada et al. (2010a,b,c), 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.

[8]Since households are ultimately receiving – by assumption – all dividend payments, we use only an aggregate excess demand function as driving the price of stock and reserve a detailed treatment of the distribution of stocks and its implications for a later extensions of the model.

[9]Note here that banks (including the central bank) are assumed in this paper of only adjusting their equity stock by way of time derivatives, that is not instantaneously.

[10]An alternative formulation of the law of motion for stock prices is the following one (which would simplify the financial dynamics to a certain degree):

$$\hat{p}_e = \beta_e\alpha_e\frac{E_h^d - E}{E} = \beta_e\alpha_e f_e(\frac{r(Y)}{p_e} + \pi_e^e)$$

.

$$
\begin{aligned}
&= \beta_e\alpha_e[f_e(\frac{r(Y)}{p_e}+\pi_e^e)(M+p_eE)-p_eE]/E \\
\dot{\pi}_e^e &= \beta_{\pi_e^e}(\hat{p}_e-\pi_e^e) \\
&= \beta_{\pi_e^e}(\beta_e\alpha_e[f_e(\frac{r(Y)}{p_e}+\pi_e^e)(M+p_eE)-p_eE]/E-\pi_e^e)
\end{aligned}
$$

The Jacobian of these dynamics is given (at the steady state $p_{eo}(Y_o, H_h+D_1+D_2), \pi_{eo}^e=0$) by:

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

Stability analysis is simple in this case since the determinant of the matrix J is always positive and the trace of J gives rise to the critical stability condition

$$
\beta_{\pi_e^e}^H = \frac{\beta_e\alpha_e[f_e'(\cdot)\frac{r(\cdot)W_h^n}{p_e^2}+(1-f_e(\cdot))E]}{[\beta_e\alpha_e f_e'(\cdot)W_h^n-1]E} > 0
$$

if the entry J_{22} is positive and thus representing a danger for asymptotic stability. This asymptotic stability gets lost at the Hopf-bifurcation point $\beta_{\pi_e^e}^H$, where the system looses 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 considered parameter space).
The considered Hopf-bifurcation represents in general however only a local phenomenon, around the considered bifurcation parameter. We expect therefore that the systems tends to become globally unstable when the adjustment speed of capital gain expectations $\beta_{\pi_e^e}^H$ becomes larger and larger.
This instability can be suppressed by introducing a Tobin type capital gain tax τ_e (not as he has proposed it: a transaction tax) with respect to the stock market. This modifies the second law of motion, for capital gain expectations, as follows:

$$
\dot{\pi}_e^e = \beta_{\pi_e^e}((1-\tau_e)\beta_e\alpha_e[f_e(\frac{r(Y)}{p_e}+\pi_e^e)(M+p_eE)-p_eE]/E-\pi_e^e)
$$

and leads to

$$
\beta_{\pi_e^e}^H = \frac{\beta_e\alpha_e[f_e'(\cdot)\frac{r(\cdot)W_h^n}{p_e^2}+(1-f_e(\cdot))E]}{[(1-\tau_e)\beta_e\alpha_e f_e'(\cdot)W_h^n-1]E} > 0
$$

or

$$
\begin{aligned}
\tau_e^H &= 1-\frac{\beta_e\alpha_e[f_e'(\cdot)\frac{r(\cdot)W_h^n}{p_e^2}+(1-f_e(\cdot))E]/E+\beta_{\pi_e^e}}{\beta_{\pi_e^e}\beta_e\alpha_e f_e'(\cdot)W_h^n} \\
&= 1-\frac{[f_e'(\cdot)\frac{r(\cdot)W_h^n}{p_e^2}+(1-f_e(\cdot))E]/(E\beta_{\pi_e^e})+1/(\beta_e\alpha_e)}{f_e'(\cdot)W_h^n} < 1
\end{aligned}
$$

The destabilizing financial market accelerator can therefore always be tamed through the introduction of an appropriate level of a Tobin capital gain tax. We assume now in fact that this tax is operated as a stock tax, meaning that existing equities (on the secondary markets) are taxed in this way (but not the issue of new equities by firms on the primary markets). The change in taxation at time t is therefore given by $T=\tau_e\dot{p}_eE$ which in the case of capital losses represents a subsidy to equity holders. On this

basis one can assume that the parameter c_2 is affected (lowered) by such a tax, but not the qualitative form of the consumption function.
Note here however that such a tax introduces a new type of income into the economy, administered by an independent fiscal authority, which is assumed to raise or deliver funds T according to the rule

$$T = \tau_e p_e E.$$

We assume that this fiscal authority has an initial endowment that is large enough such that this endowment remains positive during the business fluctuations that are implied by the model.[11]

4 The core real-financial market feedback interactions

We consider first the interaction of share prices with the credit channel of the economy by keeping capital gains expectation at their steady state value. The resulting feedback chains are mathematically determined through the products of the partial derivatives of the laws of motion that appear in the calculation of the principal minors of the 3D Jacobian of the dynamics at the steady state of the model. The 3 principal minors of order 2 represent in this way the credit channel (if the third law of motion is excluded), the financial accelerator (if the second is excluded) and a Tobin-type real-financial market interaction in the last case.

$$\begin{aligned}
\dot{Y} &= \beta_y((a_y-1)Y + a_e p_e E - a_l(L-L_o) + \bar{A}) \\
\dot{L} &= [b_l(i_l(Y) - i_{lo}) - b_e(\frac{r(Y)}{p_e} - r^e_{eo})]L \\
\dot{p}_e &= \beta_e\alpha_e([f_e(\frac{r(Y)}{p_e})(M + p_e E)]/E - p_e)
\end{aligned}$$

Note that this steady state is uniquely determined and given by

$$Y_o = \frac{\bar{A} + p_{eo}E}{1-a_y}, \quad L_o, \quad p_{eo} : f_e(r(Y_o)/p_{eo})(M + p_{eo}E) = p_{eo}E$$

with $E, M + D_2$ given magnitudes. Note also that we have to assume for the functions i_l, r that there holds

$$i_l(Y_o) = r(Y_o)/p_{eo}$$

in the steady state.
The <u>determinant of the Jacobian</u> $= -a_3$ of this dynamical system is zero iff there holds:

$$b_l^{a_3} = \frac{r'}{i_l' p_e}[1 - \frac{f_e' W_h^n \frac{r}{p_e^2}}{[f_e' W_h^n \frac{r}{p_e^2} + 1 - f_e]}]b_e < \frac{r'}{i_l' p_e}$$

For values of b_l below this value we have a positive determinant and thus the instability of the steady state of the dynamics.

The <u>Routh-Hurwitz coefficient</u> $a_1a_2 - a_3$ on the other hand is zero iff:

$$b_l^b = \frac{r'}{i_l' p_e} b_e + \frac{(J_{11} + J_{33})J_2 + \beta_y a_l L_o \beta_e \alpha_e b_e \frac{r}{p_e^2} \frac{r'}{p_e} f_e' W_h^n}{i_l' \beta_y (1-a_y)\beta_y a_l} > \frac{r'}{i_l' p_e}$$

if β_e sufficiently large. The opposite holds true if this parameter is chosen sufficiently small. For values of b_l below this critical value we have a negative $a_1a_2 - a_3$ expression and thus the instability of the steady state of the dynamics.

[11] We remark that capital gains are only realized when equities are moving between the three sectors of the economy.

It is obvious that the conditions

$$a_3 > 0, a_1 a_2 - a_3 > 0 \text{ imply } a_2 > 0,$$

since $a_1 = -$ trace > 0 holds true, so that stability will be given for all

$$b_l > \max\{b_l^{a_3}, b_l^b\}$$

while there is instability below this maximum, which there represents the critical stability condition for these dynamics. The details of the proofs are provided in appendix I.[12]

There may be a Minsky (1982,1986) moment present in this type of an economy whereby the parameter b_e is increasing relative to b_l over time, since equity markets become more and more the focus of interest of banks in relatively prosperous and tranquil phases of economic evolution. The economy may therefore become more and more fragile and volatile over time. Minsky type moments can be introduced into the dynamics of this section by the systematic change in some parameters of the model towards more volatile parameter constellations.

5 Open market policy

We now consider the possibilities for the central bank to steer the economy in the context of broad banking. Since the rate of interest on T-Deposits does not influence economic activity as well as financial markets there remains in the context of the model only the possibility to conduct open market operations through the purchase or selling of equities on the market for stocks (through trade with the household sector). This policy is assumed to react to the state of confidence in a negative way and is therefore characterized as being countercyclical in nature, and shown in the flow account of the central bank below.

The Central Bank (c):

Monetary Policy (Flows):	
Uses	***Resources***
	Open Market Policies $\dot{H} = c_m(p_{eo} - p_e)E$
Equity Demand $p_e\dot{E}_c^d = \dot{H}, \quad \dot{E}_c = \dot{E}_c^d - \delta E_c$	
CB Surplus: $r(Y)(1-\delta)E_c \rightarrow HH$	Dividends $r(Y)(1-\delta)E_c \rightarrow HH$

Additional credit supply is now generated through the shown open market operations of the central bank, leading to the following sequence of events with respect to money and credit:

$$\begin{aligned} \dot{M} &= \dot{H}_h + \dot{D}_1 = \alpha_m \dot{H}, \quad \dot{R} = \dot{H}_b = \rho_b \dot{D}_1 \quad \rightarrow \\ \dot{D}_1 &= \alpha_m \dot{H}/(1+\rho_h), \quad \dot{H} = \dot{H}_b + \dot{H}_h \end{aligned}$$

since the changes in the reserves of commercial banks and the high powered money holdings of households are automatically adjusted by means of the money multiplier, creating deposits of amount $\dot{D}_1$ which can be totally transformed into loans by the commercial banks (but not into T-Deposits), since the reserves of the banks have already been adjusted.
In the flow account of commercial banks we have now the presence of a money multiplier process. Note however that this is not yet a situation with truly endogenously generated credit, since the initiative for money creation comes from the central bank. The result is therefore of a conventional textbook multiplier type.
The changes implied in the household sector are shown in their flow account as follows:

[12] $a_2 = J_1 + J_2 + J_3$ the sum of the three principal minors of order 2 of the matrix J. The index in these minors shows the index of the excluded rows and columns.

Broad Commercial Banking (b, private ownership):

Flow Account:	
Uses	***Resources***
$i_d D_2$	$i_l(Y)(1-\delta)L$
$\dot{R} = \dot{H}_b = \rho_b \dot{D}_1$	$\dot{D}_1 = \alpha_m \dot{H}/(1+\rho_h)$
δL	$r(Y)(1-\delta)E_b$
Π_{bh}	
$\dot{L} = [b_l(i_l(Y) - i_l(Y_o)) - b_e(r_e^e - r_{eo}^e)]L$	
$\dot{L} = p_e \dot{E}_b^s + (\dot{D}_1 - \dot{R})$	$\dot{D}_2 = 0, \ \rho_{b2} = 0$

Households (h, bank owners and firm stock owners):

Flow Account:	
Uses	***Resources***
$C = c_1 Y + c_2 p_e E + \bar{C}$	$wN(Y)$
$p_e \dot{E}_h^s = p_e(\dot{E}_b^d + \dot{E}_c^d)$	$r(Y)(1-\delta)E_h$
$\dot{D}_1 = \alpha_m \dot{H}/(1+\rho_h)$	$r(Y)(1-\delta)E_b$
$\dot{H}_h = \rho_h \dot{D}_1$	$r(Y)(1-\delta)E_b$
$\dot{D}_2 = p_e \dot{E}_h^s - \dot{H}_h - \dot{D}_1$	$i_d D_2$
S_h	Π_{bh}
Y_h	$wN(Y) + r(Y)(1-\delta)E + i_l(Y)(1-\delta)L - \delta L$

Taken together the structure of the model is only modified in the equity demand function of commercial banks (which is based on their intended loan supply function). This does not change the laws of motion of the model and thus implies that monetary policy is completely ineffective in this case.
This however is not completely true since we have neglected here the effect of changes in H on the definition of private wealth W_h^n which is given by canceling balancing terms by: $W_h^n = (\alpha_m - 1)H + p_e E$. This implies that the monetary policy is feeding back into this term and thus into stock price dynamics such that the original 3D Jacobian is augmented as follows:

$$J_o = \begin{pmatrix} J_{11} & J_{12} & J_{13} & 0 \\ J_{21} & J_{22} & J_{23} & 0 \\ J_{31} & J_{32} & J_{33} & + \\ 0 & 0 & - & 0 \end{pmatrix}$$

The determinant of this matrix is given by

$$|J_o| = \begin{vmatrix} J_{11} & J_{12} & 0 & 0 \\ J_{21} & J_{22} & 0 & 0 \\ 0 & 0 & 0 & + \\ 0 & 0 & - & 0 \end{vmatrix}$$

which is positive if and only if the shown 2D subsystem has a positive determinant. This shows that monetary policy and the implied endogenous money creation is adding stability to the considered 3D dynamics, at least for small values of c_m, since negative real parts of the three eigenvalues of the 3D system must then be augmented by a fourth eigenvalue which is negative.
If we allow in this extended setup that the expansionary monetary policy has a positive effect on economic activity as shown below:

$$\begin{aligned} \dot{Y} &= \beta_y[(a_y - 1)Y + a_e p_e E - a_l(L - L_o) + \dot{L} + a_h \dot{H} + \bar{A}] \\ &= \beta_y((a_y - 1)Y + a_e p_e E - a_l(L - L_o) + \dot{L} + a_h c_m(p_{eo} - p_e)E + \bar{A}) \end{aligned}$$

we in addition get that the J_2 Tobin channel will be made weaker which improves the stability of the considered dynamics.

6 Credit demand and extended goods market dynamics

We are here reconsidering the supply schedule of bank loans by explicitly adding a demand side expression to it now: $\dot{l}_f^d(i_l)L, \dot{l}_f^{d'}(i_l) < 0$. This gives as equilibrium condition for the credit market the relationship:

$$0 = [b_l(i_l - i_{lo}) - b_e(r_e^e - r_{eo}^e)] + f_l(i_l - i_{lo})$$

if we specify loan demand by assuming $\dot{l}_f^d(i_l)L = -f_l(i_l - i_{lo})L$. Note that we no longer postulate a relationship between economic activity and the loan rate, since this relationship is to be derived now. The equilibrium condition for the credit market implies:

$$i_l = i_{lo} + \frac{b_e(r_e^e - r_{eo}^e)}{b_l + f_l}$$

The new law of motion for loans therefore now is

$$\dot{L} = -\frac{f_l}{b_l + f_l} b_e(r_e^e - r_{eo}^e)L$$

The Jacobian is in this case characterized by

$$\begin{aligned} J_o &= \begin{pmatrix} \beta_y(a_y-1) & -\beta_y a_l & \beta_y a_e E \\ -\frac{f_l}{b_l+f_l} b_e \frac{r'}{p_e} & 0 & \frac{f_l}{b_l+f_l} b_e \frac{r}{p_e^2} \\ \beta_e \alpha_e f_e' \frac{W_h^n r'}{p_e} & 0 & -\beta_e \alpha_e [f_e' \frac{W_h^n r}{p_e^2} + 1 - f_e] \end{pmatrix} \\ &= \begin{pmatrix} - & - & + \\ - & 0 & + \\ + & 0 & - \end{pmatrix} \end{aligned}$$

It is again possible to derive the type of maximum condition we have considered beforehand. Since $a_1 > 0$ holds true again, stability will be given for all $b_l > \max\{b_l^{a_3}, b_l^b\}$ while there is instability below this maximum. Yet, in the present situation, we observe that the system becomes unstable if the parameter b_e is chosen sufficiently large, since the parameter b_l is no longer available to compensate for this and since the credit channel is now always an instable one. This holds, since the coefficient a_2 from the Routh Hurwitz condition can now easily be made positive by increasing the parameter b_e, since there is no more much stability resistance present in the terms that make up the coefficient a_2 (while the determinant is still composed by opposing effects of the parameter b_e).
Assuming a Minsky bankers' carelessness increasing moment at work in the sizing of the parameter b_e may therefore lead to instability when the always destabilizing credit channel becomes sufficiently dominant. Instead of going into the details of a stability analysis of the present case we extend it further by recognizing that the aggregate demand function Y^d did not allow for an explicit role of credit. However since part of the investment is credit financed it should be explicitly augmented by the credit volume currently provided, implying that the dynamic multiplier should – on this basis – in fact be formulated as follows:

$$\begin{aligned} \dot{Y} &= \beta_y[Y^d - Y) = \beta_y((a_y-1)Y + a_e p_e E - a_l(L-L_o) + \dot{L} + \bar{A}] \\ \dot{L} &= -\frac{f_l}{b_l+f_l} b_e (r_e^e - r_{eo}^e) \end{aligned}$$

It is obvious that the determinant of the Jacobian of these subdynamics is unchanged through this extension. This implies that the arguments of the preceding case remain intact, in particular the one concerning the Minsky moments in the credit channel.

7 Narrow banking and efficient credit supply

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 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 this mainstream literature, see for example Rochet (2008) and Sinn (2009).

The Central Bank (c):

Monetary Policy (Flows):	
Uses	***Resources***
	Open Market Policies $\dot{H} = -c_{m1}(Y - Y_o) - c_{m2}(p_{eo} - p_e)E$
Equity Demand $p_e \dot{E}_c^d = \dot{H}$	
CB Surplus: $r(Y)(1-\delta)E_c \rightarrow HH$	Dividends $r(Y)(1-\delta)E_c \rightarrow HH$

Narrow Commercial Banking (b, private ownership):

Flow Account:	
Uses	***Resources***
$i_d D_2$	$i_l(Y)(1-\delta)L$
Reserve Adjustment $\dot{R} = \dot{D}_1$	New C-Deposits $\dot{D}_1 = (1-\rho_h)\dot{H}$
δL	
$\Pi_{bh} = i_l(Y)(1-\delta)L - i_d D_2 - \delta L$	
Net Loan Supply $\dot{L} = c_b(Y - Y_o)$	New T-Deposits $\dot{D}_2 = \dot{L}$

We reconsider in this section Fisher's (1935) 100%-money proposal as modification of our modeling framework of a commercial banking system that acts on the credit market and the financial markets without any institutional barrier. We therefore now assume – to limit such a behavior from an ideal perspective of Fisher (1935) – that checkable deposits are backed up by a reserve requirement of 100 % ($\rho_b = 1$), so that commercial banks are reduced to purely depository institutions in this respect, while there are no reserve requirements on T-Deposits D_2, which are safeguarded by other means (including contract lengths, withdrawal penalties) against bank runs. Time deposits earn an interest rate that is interrelated with the loan rate received by firms and manipulated in order to initiate that granted loans are backed up by time deposits through the circuit of money when these loans reappear at first as checkable deposits in the money holdings of the household sector. We are thus now allowing (which can also be added to what we discussed beforehand) for the endogenous creation of commercial bank money, so to speak out of the blue, in addition to what we discussed when the textbook money multiplies was considered. By contrast there are now no equity holdings of commercial banks anymore (which can be introduced from the viewpoint of required bank capital or collateral later on).

But this money creation concerns the difference $M2 - M1$ of the conventional measures of money supply and thus does not allow banks to get interest income out of the money deposits for which they pay no interest. These money holdings are thus always checkable central bank money and can therefore not be subject to bank runs, since they are purely passive in the balance sheet of the banks and not at their disposal should they become insolvent.

Households (h, bank owners and firm stock owners):

Flow Account:	
Uses	***Resources***
$C = c_1 Y + c_2 p_e E + \bar{C}$	$wN(Y)$
	$i_d D_2$
Change in Equity Holdings $p_e \dot{E}_h^s = p_e \dot{E}_c^d = \dot{H}$	$r(Y)(1-\delta)E_h$
Change in Cash Holdings $\dot{H}_h = \rho_h \dot{H}$	$r(Y)(1-\delta)E_c$
C-Deposits Change $\dot{D}_1 = (1-\rho_h)\dot{H}$	
T-deposit Change $\dot{D}_2 = \dot{L}$	$\Pi_{bh} = i_l(Y)(1-\delta)L - i_d D_2 - \delta L$
Y_h	$wN(Y) + r(Y)(1-\delta)E + i_l(Y)(1-\delta)L - \delta L$

The view thus is that commercial banks should not be allowed to endogenously create money out of the central bank money in their balance sheet and also not by purchasing equities through ink stroke money (which would return as in the form of T-Deposits to them through the circuit of money. The full

control of the M1 money supply process – in our view – should remain in the hands of the central bank which not only eliminates bank runs on checkable deposits. This also removes speculative behavior of the commercial banks from the model if equities cannot be pursued by money creation of type M1. The primary role of the commercial banking system then becomes to channel not only the interest bearing savings of households into the investment projects of firms – besides the creation of T-Deposits through their autonomous lending decisions through the circuit of money, supported in addition by the money supply or withdrawal rule of the central bank. Note that we now assume that the central bank knows the structure of the model and is realizing that it must use a procyclical money supply rule for the stabilization of the real- financial market interaction (see the results below).
The changes implied in the household sector are shown in their flow account and are as follows. Taken together the dynamics of the model we considered so far is then modified in the loan supply function $\dot{L}$ (plus the correction of the aggregate demand function discussed in the previous section) and in the aggregate expression for private wealth. This gives rise to

$$\begin{aligned}
\dot{Y} &= \beta_y((a_y-1)Y + a_e p_e E - a_l(L-L_o) + \dot{L} + a_h\dot{H} + \bar{A}) \\
\dot{L} &= c_b(Y-Y_o) \\
\dot{p}_e &= \beta_e\alpha_e([f_e(\frac{r(Y)}{p_e})(L+p_eE) - p_eE]/E
\end{aligned}$$

This gives as Jacobian (if we assume that $a_y + c_b < 1$ holds true):

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

Assuming again that the Tobinian real-financial market interaction is a stable one: $J_2 > 0$, in particular if monetary policy is made sufficiently active in this respect, then implies stability for the remaining feedback interactions, if the parameter a_h is chosen sufficiently large, since a_1, a_2, a_3 are then positive and since $a_1a_2 - a_3$ can be made positive thereby too.
The assumed type of narrow banking therefore not only eliminates the discontinuities created by the occurrence of bank runs, but also makes the economy a stable one if the real financial market interaction (the product of the coefficients J_{13}, J_{31}) is not allowed to work in a too pronounced way by a proper choice of monetary policy). This shows that Narrow Banking is dynamically seen much more reliable and robust than the model of broad banking we have used beforehand.
But is it also as efficient in the supply of credit as the broad banking system (which as we know can be plagued by credit rationing if banks are too much focused on financial markets instead). This will indeed be the case – ignoring the financial market focus of broad banking already – if the interest rate on T-Deposits can be managed by commercial banks effectively such that their loans (supplied in view of the credit demand of creditworthy firms) are channeled into time deposits in place of checkable deposits. It is then a matter of the variables i_l, i_d to achieve such a result with however rationing occurring if there are limits to the interaction of these two interest rates. Note that we have here the change in time deposits generated by the households sector from his savings that are not created through loans and the circuit of money they imply.
In our view the considered institutional change outperforms possible efficiency gains of non-credit based risk taking broad banking. Loan supply does not depend negatively on the rate of return on the stock markets, but now positively on the level of economic activity. Moreover, a countercyclical monetary policy with respect to the state of confidence (and the level of economic activity) of the economy further improves the stability of the dynamics.

8 Conclusions

We discussed in this paper, monetary and fiscal policy measures aimed at preventing the financial market meltdown that started in the US subprime sector. This meltdown has spread worldwide and developed

into a great recession. Although some slow recovery appears to be on the horizon, it is worthwhile exploring the fragility and potentially destabilizing feedbacks of the banking sector and the macroeconomy in the context of Keynesian macro models.
We have used a simple dynamic multiplier approach on the market for goods and also a simple rate of return driven adjustment rule for stock prices to study the role of commercial banks and credit when embedded into such an environment. We first considered the implications of a broad banking system where commercial banks are allowed to trade in capital assets (here equities) as a substitute for lending. We showed 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. Though in our simplified model of broad banking asset purchases and credit expansion are substitutes, as we have indicated, the model can be extended to accommodate more the empirical fact of comovements of asset purchases and credit expansion.
We then considered a situation of narrow banking which is defined by a Fisherian 100 % reserve ratio for checkable deposits and the exclusion of a trade in stocks for commercial banks. This would imply a significant reduction of proprietary trading of the banking sector. It was shown that: a) in such a scenario stability is guaranteed by some weak assumptions on the behavior of economic agents, b) a sufficient loan supply to the entrepreneurs is guaranteed in such a framework, and c) disastrous bank runs are no longer possible, in contrast to what is possible under broad and also traditional banking.
Narrow banking thus not only provides systemic stability in place of systemic crises, but also dynamic stability as well as sufficient efficiency of the credit creation process. Though narrow banking appears a too extreme case to be implemented realistically, but it shows the improved stability properties when broad banking is constrained.
In this paper we have concentrated the consideration of broad commercial banking on the case where the supply of credit versus investment in financial assets are at the focus of interest of commercial banks. This is however only a partial view on their activities which moreover can include in particular the channeling of households savings in time or checkable deposits into credit for firms. Moreover, there also exists a channel – working in the opposite direction – that leads from firms' credit demand to the generation of household deposits that back up this demand. This mechanism of endogenous money creation has been introduced, contrasted with broad banking and investigated in the section on narrow banking, but can of course also be active under broad banking. In the interaction of savings and investment we therefore have from the viewpoint of the circuit of money causalities that run from saving to investment, but also a circuit that is working the other way round. In addition there is the interaction of credit supply with investment in financial markets under broad banking. Such an extension of the models of this papers is needed if one wants to discuss the stylized fact of the comovement of credit and stock markets, an observation that must however be left here for future research.

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Appendix: Proofs of propositions (section 4)

We consider first the interaction of share prices with the credit channel of the economy by keeping capital gains expectation at their steady state value.

$$\begin{aligned}
\dot{Y} &= \beta_y((a_y-1)Y + a_e p_e E - a_l(L-L_o) + \bar{A}) \\
\dot{L} &= [b_l(i_l(Y)-i_{lo}) - b_e(\frac{r(Y)}{p_e} - r^e_{eo})]L \\
\dot{p}_e &= \beta_e\alpha_e([f_e(\frac{r(Y)}{p_e})(M+D_2+p_eE) + p_eE_b + p_eE_c]/E - p_e)
\end{aligned}$$

The Jacobian is in this case characterized by

$$\begin{aligned}
J_o &= \begin{pmatrix} \beta_y(a_y-1) & -\beta_y a_l & \beta_y a_e E \\ (b_l i_l^{'} - b_e\frac{r'}{p_e})L_o & 0 & b_e\frac{r}{p_e^2}L_o \\ \beta_e\alpha_e f_e^{'}\frac{W_h^n r'}{p_e} & 0 & -\beta_e\alpha_e[f_e^{'}\frac{W_h^n r}{p_e^2} + 1 - f_e] \end{pmatrix} \\
&= \begin{pmatrix} - & - & + \\ \pm & 0 & + \\ + & 0 & - \end{pmatrix}
\end{aligned}$$

This gives for the determinant of J_o

$$\begin{aligned}
|J_o| &= \begin{vmatrix} \beta_y(a_y-1) & -\beta_y a_l & \beta_y a_e E \\ (b_l i_l^{'} - b_e\frac{r'}{p_e})L_o & 0 & b_e\frac{r}{p_e^2}L_o \\ \beta_e\alpha_e f_e^{'}\frac{W_h^n r'}{p_e} & 0 & -\beta_e\alpha_e[f_e^{'}\frac{W_h^n r}{p_e^2} + 1 - f_e] \end{vmatrix} \\
&= \beta_y\beta_e\alpha_e L_o \begin{vmatrix} a_y-1 & -a_l & a_e E \\ b_l i_l^{'} - b_e\frac{r'}{p_e} & 0 & b_e\frac{r}{p_e^2} \\ \frac{r'}{p_e}f_e^{'}W_h^n & 0 & -\frac{r}{p_e^2}f_e^{'}W_h^n - 1 - f_e \end{vmatrix} \\
&= \beta_y\beta_e\alpha_e L_o a_l \begin{vmatrix} 0 & -1 & 0 \\ b_l i_l^{'} - b_e\frac{r'}{p_e} & 0 & b_e\frac{r}{p_e^2} \\ \frac{r'}{p_e}f_e^{'}W_h^n & 0 & -\frac{r}{p_e^2}f_e^{'}W_h^n - (1 - f_e) \end{vmatrix} \\
&= -\beta_y\beta_e\alpha_e L_o a_l[[\frac{r}{p_e^2}f_e^{'}W_h^n + 1 - f_e][b_l i_l^{'} - b_e\frac{r'}{p_e}] + \frac{r'}{p_e}f_e^{'}W_h^n b_e\frac{r}{p_e^2}]
\end{aligned}$$

which gives for $|J_o| = 0$ the parameter relationship:

$$b_l^{a_3} = \frac{r'}{i_l^{'}p_e}[1 - \frac{f_e^{'}W_h^n\frac{r}{p_e^2}}{[f_e^{'}W_h^n\frac{r}{p_e^2} + 1 - f_e]}]b_e < \frac{r'}{i_l^{'}p_e}$$

For values of b_l below this value we have a positive determinant and thus the instability of the steady state of the dynamics. Note that this steady state is uniquely determined and given by

$$Y_o = \frac{\bar{A} + p_{eo}E}{1-a_y}, \quad L_o, \quad f_e(r(Y_o)/p_{eo})(M + D_2 + p_{eo}E) = p_{eo}E$$

Note also that we have assumed for the functions i_l, r that there holds

$$i_l(Y_o) = r(Y_o)/p_{eo}$$

in the steady state.
The determinant of J_o is given by

$$|J_o| = -\beta_y \beta_e \alpha_e L_o a_l [[\frac{r}{p_e^2} f_e^{'} W_h^n + 1 - f_e][b_l i_l^{'} - b_e \frac{r'}{p_e}] + \frac{r'}{p_e} f_e^{'} W_h^n b_e \frac{r}{p_e^2}] = -a_3$$

and the trace by

$$\text{trace } J_o = \beta_y(a_y - 1) - \beta_e \alpha_e [f_e^{'} \frac{W_h^n r}{p_e^2} + 1 - f_e] = -a_1$$

For the sum of the minors of order two we get:

$$a_2 = \beta_y(1 - a_y)\beta_e \alpha_e [f_e^{'} \frac{W_h^n r}{p_e^2} + 1 - f_e] + \beta_y a_l L_o [b_l i_l^{'} - b_e \frac{r'}{p_e}] - \beta_y a_e E \beta_e \alpha_e f_e^{'} \frac{W_h^n r'}{p_e}$$

$$b = a_1 a_2 - a_3 \quad = \quad \beta_y(1 - a_y)\beta_y a_l [b_l i_l^{'} - b_e \frac{r'}{p_e}] - (J_{11} + J_{33}) J_2 - \beta_y a_l L_o \beta_e \alpha_e b_e \frac{r}{p_e^2} \frac{r'}{p_e} f'_e W_h^n$$

This gives, when solved under the critical stability condition $b = a_1 a_2 - a_3 = 0$, the expression:

$$b_l^b \quad = \quad \frac{r'}{i_l^{'} p_e} b_e + \frac{(J_{11} + J_{33}) J_2 + \beta_y a_l L_o \beta_e \alpha_e b_e \frac{r}{p_e^2} \frac{r'}{p_e} f_e^{'} W_h^n}{i_l^{'} \beta_y (1 - a_y) \beta_y a_l} > \frac{r'}{i_l^{'} p_e}$$

if β_e sufficiently large. The opposite holds true if this parameter is chosen sufficiently small. Compare to

$$b_l^{a_3} = \frac{r'}{i_l^{'} p_e} [1 - \frac{f_e^{'} W_h^n \frac{r}{p_e^2}}{[f_e^{'} W_h^n \frac{r}{p_e^2} + 1 - f_e]}] b_e$$

For values of b_l below this critical value we have a negative $a_1 a_2 - a_3$ expression and thus the instability of the steady state of the dynamics.
It is obvious that the conditions

$$a_3 > 0, a_1 a_2 - a_3 > 0 \text{ imply } a_2 > 0,$$

since $a_1 > 0$ holds true, so that stability will be given for all $b_l > \max\{b_l^{a_3}, b_l^b\}$ while there is instability below this maximum.
There may be a Minsky moment present in this type of an economy whereby the parameter b_e is increasing relative to b_l over time, since equity markets become more and more the focus of interest of banks in relatively prosperous and tranquil phases of economic evolution. The economy may therefore become more and more fragile and volatile over time.