Money and finance: Services for production or appropriation?*

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Abstract

This paper considers an economy in which the financial system provides intermediary services for founded and unfounded assets. Founded assets have real investments as underlying, the unfounded assets have not. Money is used for real and financial transactions. In particular, the money supplied to the financial system may be used to honor the payoff promises of unfounded assets rather than being transmitted to real investment activity. Two economic policy conclusions are suggested: First, money policy should not be confined to the supply of money but has also to care for its distribution. Second, the creative potential of the economy should be redirected from financial innovation to the development of real investment opportunities.

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1 Introduction

This paper is a personal exercise which I am happy to share at the reader's risk, who may find it amateurish. The exercise is motivated by two observations: First, we see a lot of money creation but not much real stimulus. Second, we see a large and complex financial system which can hardly be reconciled with the view that it serves the traditional purpose to transform – in a risky world – current saving into future production capacity. Rather, it provides services for financial investments the real basis of which is not easy to identify or may not exist at all. Therefore, the money transmitted through the financial system, too, may be used for serving unfounded investment activity.

The paper does not apply refined present day tools – too many things are unclear to me or rest on assumptions I don't share. What the paper tries, is to portray a new finance economy through the lens of my economic training as a young men. In other words, I do macroeconomic accounting with money, finance and goods. Money is considered a means of payment for all kind of transactions – exchange of goods, property rights and claims on future pay-offs as well as for satisfying promised pay-offs. The financial sector is viewed as system that provides financial instruments for trading money, goods and property rights across time. There is no specific banking function of risk transformation, nor any distinction between liquidity or solvency risks of financial agents. As a consequence, there is no risk of instability in form of bank runs. A financial crisis is in my view a much broader malfunctioning of the financial system: The loss of trust and a feeling of people to be fooled by a financial and monetary system in which services related to the creation of real aggregate wealth are confounded with services for becoming rich at

the cost of others. Banks themselves are part of the commingling. Besides taking deposits and giving loans, they do all kind of other financial business some of which may support redistribution of wealth rather than add value to the economy. To my knowledge, this aspect is missing in the literature on money, banking and finance. Also in alternative approaches like the financing through money creation view promoted by Jakob and Kumhof (2015), for instance, the deposits created by banks are in the end invested in real capital. The purpose of my exercise is to show, in a consistent macroeconomic framework, how creation and distribution of money in interaction with a financial system that offers founded and unfounded investment vehicles leads to a mix of production, redistribution and deceptions.

1.1 From distortions in general equilibrium to macroeconomics with imperfect financial markets

In a perfect market economy, the competitive equilibrium maps the distribution of endowments into the outcome space in an efficient way. This is no longer true under distortions. Not only allocational efficiency is disturbed, distributional justice is also affected. In a rigorous sense, the efficiency costs and its redistributive consequences can only be assessed by evaluating the correctness or incorrectness of all relative prices of input and output goods, including intertemporal and state-specific terms of trade. In an economy with money, an additional problem arises from the fact that instantaneous trades, intertemporal contracts and valuation of endowments are in nominal terms. They depend not only on the degree of perfection or imperfection in the goods market, but also on money supply, distortions in the financial markets and, if financial conflicts have to be resolved, also on access to funds

to honor nominal promises.

Given its complexity, a complete analysis of the imperfect reality seems so hopeless that economics tends to seek comfort in the perfect world – market- or plan-based, or focuses on partial analysis. This paper takes a bold step and looks at the macro-economic system with goods, money and finance from the following perspective: Transactions are made in money value – not only in the spot market but also intertemporal trades. An individual's possibilities depend on the money he or she gets for the endowments and on the degree to which promises made today are honored in the future. Hence, I outline all macroeconomic relationships in money flows and look how the allocation of money – determined by the supply of money and its distribution through the financial system (the "banks") – affects the allocation of goods. In particular, how biases in the distribution of money on different agent groups and uses impact on the distribution of real opportunities. The biases may come from distortions in the finance sector or be a result of directed money flows by the central bank (in addition to the control of the aggregate level of money supply).

The main source of potential distortions on which the paper focuses comes from the fact that in a money economy with financial markets not all assets traded in the financial market are linked one to one to real transactions. Actually, with the complex set of financial instruments used in contemporary finance, the relationship between financial assets and real underlyings seems pretty decoupled. I deal with this problem in a very simple way by distinguishing between founded assets (with real endowments or production capacities as underlying) and unfounded assets, which have no real underlying at all but are based on the belief that banks keep their pay-off promises.

Banks will do so if they can attract or appropriate for this purpose enough money in the future. This money can come from additional money supply or from future savings in unfounded assets, or is diverted from investments in founded assets.

The central policy questions addressed by this set up are: How does monetary policy – in interaction with the unfounded assets offered in the financial market – affect price level, unemployment and real capital accumulation? Which monetary controls are required to avoid unemployment and deflation (emerging from funds invested in unfounded assets) and to improve real capital accumulation? We will see that drastic interventions in the distribution of money are required. Moreover, it is important to (re)direct the allocation of talents towards innovation in the real rather than the financial sphere.

1.2 From macroeconomics with goods and money to macroeconomics with goods, money and finance

Expansionary monetary policy transmits into higher asset prices and lower interest rates; thereby financing costs are decreased, which finally stimulates investment and consumption. This is in short what we teach or learn in introductory textbooks as the standard case. In reality, however, we have recently seen huge increases in money supply without much stimulation of investment and aggregate demand. In traditional Keynesian words, we are stuck in a "liquidity trap". While there seems to be some consensus on this diagnosis, there is less agreement about what is the cause of the trap. Is it really the households who hoard money under their mattresses? Many people think it is not. They think the created liquidity is absorbed through a big

hole in the financial market and somehow used for profitable business that does not transmit into real investment activity. The purpose of this paper is to explore the possibility of such a hole in a standard general equilibrium framework with uncertainty and financial markets.

For this purpose I use the investment model of Falkinger (2014), which is closely related to Acemoglu and Zilibotti (1997), as a starting point. In addition to bonds and state-contingent securities, money and a synthetic financial asset are introduced into the model. Unlike the saving in a bond or in a security used for financing real investment, savings invested in the synthetic asset have no underlying in form of productive investments. Nonetheless, like bonds and securities the synthetic asset assign claims to future production. In other words, the financial market provides "productive" assets and "appropriative" assets. All assets endow their holder with property rights which can be exchanged to purchasing power in the future. The productive assets generate at the same time financial means for creating future production capacities by real investment, the productive assets do not.

Money matters in this model since it affects the price at which financial products are exchanged with "real goods" (that is, the units that generate output and utility). Both the current and the future money supply matter. Consider first the role of future prices. For the asset holding agent, an asset is the promise of a future income stream. The extent to which the promise transmits into real income depends on the details of future monetary policy – not only on the level of money supply but also on how the money is transmitted to the different agents in the economy. If the central bank gives additional money to the banks and the banks use the provided liquidity to honour the promises of the synthetic financial products, it is the holder of the

synthetic asset who profits. If the additional money goes to the firms so that the promises of the productive assets can be honoured it is the holder of the productive assets who benefits. But current money supply matters too. Additional liquidity may raise the price of productive assets and thereby lower the cost of real investment. This is the stimulation effect of expansionary monetary policy in the standard economic toolbox. In the model presented here, however, the supply of money to the financial sector also facilitates the provision of synthetic financial assets so that saving portfolios will be distorted away from productive to appropriative investments.[1]

The analysis is carried out in a basic overlapping generations (OLG) model, in which each generation lives two periods. Agents receive some resource endowment in the first period which can be consumed or saved. In the second period of their life, they live on their savings. Section 2 outlines the basic framework. Section 3 describes the supply and use of money for founded and unfounded investment. Section 4 analyzes aggregate production and consumption and Secion 5 considers the macroeconomics relationships that equilibria have to fulfill. Moreover, the macroeconomic implications of monetary policy in an economy with unfounded assets are shown by comparative-static analysis. A short summary of the most important policy lessons to be drawn is presented in the concluding section.

[1]Thus, monetary policy faces a moral hazard effect. As shown, for instance, by Cao and Illing (2015), moral hazard also plays a role in more established models of banking and finance. In their analysis, the anticipation of monetary expansion induces banks to take too much illiquidity risk. Here they may be induced to offer too much unfounded investment opportunities.

2 Basic model

In each period t an event $\omega \in \Omega$ is realized. While ω is observed ex post, it is not known ex ante. As Diamond (1967) pointed out, the basic limit to investment under uncertainty is "an inability to distinguish finely among the states of nature in the economy's trading" (p. 769). In Falkinger (2014) this limit was modeled in a formal way by assuming the following uncertainty structure. The total state space Ω is split into Θ and $\bar{\Theta}$ of measure μ and $1-\mu$. Subset Θ consists of distinguishable states $\omega \in \Theta$ each of which has measure π_ω, $\sum_{\omega\in\Theta} \pi_\omega = 1$. Within $\bar{\Theta}$ no events can be distinguished ex ante and no measure can be assigned to them by economic agents.

2.1 Technologies

There is one type of goods which can be used for consumption as well as for real investment. Investment goods can be invested in two types of technologies: A robust low-productivity technology working in all circumstances, and highly productive technologies specialized to specific conditions. Both types of technologies are linear in capital input. If $K_{0,t}$ units of capital are employed in a robust technology the generated output is

$$X_{0,t} = a_t K_{0,t} \text{ for all } \omega \in \Omega. \tag{1}$$

In contrast, if K_t^ω units of capital are employed into the high-productivity technology specialized to state $\omega \in \Theta$, the output is given by

$$X_t(\omega) = \begin{cases} A_t(\omega) K_t^\omega & \text{if } \omega \text{ is realized} \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

Productivity $A_t(\omega)$ rises with the specificity of the investment. Moreover, the expected productivity of specialized risky technologies is higher than the productivity of the robust technology. For all $\omega \in \Theta$,

$$A_t(\omega) = \frac{A_t}{\pi_\omega}, \quad \mu A_t > a_t. \tag{3}$$

Obviously, specialized investments can only be targeted to distinguishable states. No such targeted investment opportunities exist for $\omega \in \bar{\Theta}$.

After production, capital fully depreciates so that the stock of capital employed in a technology coincides with the flow of real investment.

2.2 Financial markets

In the baseline model two types of assets are traded: bonds and state-contingent securities. Each unit of money invested in period t into a bond generates in return r_{t+1} units of money in period $t+1$. State-contingent assets only exist for distinguishable states $\omega \in \Theta$. They are modeled as Arrow securities. For all $\omega \in \Theta$, one unit of money invested into an ω-security gives in return

$$R_{t+1}(\omega) = \begin{cases} R_{\omega,t+1} & \text{if } \omega \text{ is realized} \\ 0 & \text{otherwise.} \end{cases}$$

The asset returns are generated by underlying real investments into robust and specialized technologies. If firms want to run a technology, they have to raise money in the financial market in order to finance their capital investment. For a unit of real investment in the robust technology, p_t units of a bond have to be issued, where p_t denotes the price of goods (including

investment goods) in period t; and for financing a unit of real investment into a technology specialized to $\omega \in \Theta$, p_t units of an ω-security are required. To the buyers of the assets issuers can promise for the future the returns:

$$r_{t+1} = p^e_{t+1} a_{t+1}/p_t$$

$$\text{and} \tag{4}$$

$$R_{\omega,t+1} = p^e_{t+1} A_{t+1}(\omega)/p_t$$

respectively. p^e_{t+1} denotes the expected goods price in period $t+1$. In view of (3), we have

$$\pi_\omega R_{\omega,t+1} = \frac{p^e_{t+1} A_{t+1}}{p_t} \equiv R_{t+1}, \quad \mu R_{t+1} > r_{t+1}. \tag{5}$$

We extend this baseline model by adding assets without real underlyings. In addition to bond, b, and state-contingent securities, z_ω, the financial sector offers a financial product, f, that promises for all future states a nominal pay off φ_{t+1} per unit spent on f. Moreover, liquidity l can be deposited at zero cost.

Holding positive amounts of l or f, along side with bonds, is consistent with optimal portfolio choice if the following assumption is imposed on the payoffs:

$$r_{t+1} = r^{\max}_{t+1} \equiv \max\{1, \varphi_{t+1}\}, \tag{6}$$

where $r_{t+1} = \frac{p^e_{t+1} a_{t+1}}{p_t}$. If $r_{t+1} = 1$ then an investor is indifferent between money holding and purchasing bonds; if $r_{t+1} = \varphi_{t+1}$ the investor is indifferent between the f-asset and the bond. (See Section 3.2 for further discussion.)

2.3 Endowment and preferences

At the beginning of each period a mass N_t of agents is born. Each agent i is endowed with the capacity to produce $\bar{x}_t^{0,i}$ units of goods. The nominal income generated by $\bar{x}_t^{0,i}$ depends on macroeconomic conditions. If capacity output can be sold at $p_t = p_t^e$, the nominal income is $p_t^e \bar{x}_t^{0,i}$. Actually, however, the nominal income depends on the supply and distribution of money in the economy (see section 3.1). Let $m_t^1 p_t^e$ be the amount of money earned by generation t per unit of endowment. Then, the nominal income is:

$$y_t^i = m_t^1 p_t^e \bar{x}_t^i. \tag{7}$$

The income can be spent on current consumption or be saved for financing future consumption. For an agent i, born at the beginning of period t, who consumes $c_t^{1,i}$ units in the first period of life and saves s_t^i units of money for the second period, the intertemporal possibilities are given by the following budget constraints:

$$\begin{aligned}
c_t^{1,i} &= \frac{y_t^i - s_t^i}{p_t} \\
s_t^i &= s_{\Theta,t}^i + s_{\bar{\Theta},t}^i, \quad s_{\Theta,t}^i \equiv \sum_{\omega \in \Theta} z_{\omega,t}^i, \quad s_{\bar{\Theta},t}^i = b_t^i + l_t^i + f_t^i \\
c_{\omega,t}^{2,i} &= \begin{cases} \frac{R_{\omega,t+1} z_{\omega,t}^i}{p_{t+1}} + c_{\bar{\Theta},t}^{2,i} & \text{if } \omega \in \Theta \text{ in } t+1 \\ \frac{r_{t+1} b_t^i + l_t^i + \varphi_{t+1} f_t^i}{p_{t+1}} \equiv c_{\bar{\Theta}}^{2,i} & \text{otherwise.} \end{cases}
\end{aligned} \tag{8}$$

$c_{\omega,t}^{2,i}$ denotes consumption in the agent's second life cycle.

Agents are assumed to have additive logarithmic preferences so that optimal saving and consumption plans are given by the following program:

$$\max_{\substack{c_t^i, \left(z_{\omega,t}^i\right)_{\omega \in \Theta}, b_t^i \\ b_t^i, l_t^i, f_t^i}} EU = ln\left(c_t^{1,i}\right) + \delta \left[\mu \sum_{\omega \in \Theta} \pi_\omega ln\left(c_{\omega,t}^{2,i}\right) + (1-\mu)\, ln\left(c_{\bar{\Theta},t}^{2,i}\right) \right]$$

subject to (8). Actually, consumer plans are made before the market clearing price p_t is established. Thus, the consumer's decisions are based on $c_t^{1,i} = \frac{y_t^i - s_t^i}{p_t^e}$ rather than $c_t^{1,i} = \frac{y_t^i - s_t^i}{p_t}$. However, under logarithmic preferences the price level plays no role for the optimal solution in nominal terms.

Then, as shown in the Appendix, the optimal portfolio has the following properties.

$$\begin{aligned} s_t^i &= \frac{\delta}{1+\delta} y_t^i \\ s_{\Theta,t}^i &= \frac{\mu - \rho_{t+1}}{1-\rho_{t+1}} s_t^i, \quad z_{\omega,t}^i = \pi_\omega s_{\Theta,t}^i \\ s_{\bar{\Theta},t}^i &= \frac{1-\mu}{1-\rho_{t+1}} s_t^i, \end{aligned} \tag{9}$$

where $\rho_{t+1} \equiv \frac{r_{t+1}^{\max}}{R_{t+1}} = \frac{a_{t+1}}{A_{t+1}}$ was used.

Under this portfolio choice, the consumption levels planned by an agent born at the beginning of period t are in the first period of life:

$$c_t^{1,i} = \frac{1}{1+\delta} \frac{y_t^i}{p_t^e} \tag{10}$$

and in the second period of life:[2]

$$\begin{aligned} c_{\Theta,t}^{2,i} &= \frac{\mu R_{t+1}}{p_{t+1}^e} s_t^i \text{ if } \omega \in \Theta \text{ in } t+1 \\ c_{\bar{\Theta},t}^{2,i} &= \frac{r_{t+1}^{\max}}{p_{t+1}^e} s_{\bar{\Theta},t}^i \text{ if } \omega \in \bar{\Theta} \text{ in } t+1, \end{aligned} \tag{11}$$

respectively.

It is important noticing that portfolio choice and consumption levels planned for the second period of life are based on promised nominal payoffs $R_{t+1} =$

[2] For calculating $c_{\Theta,t}^{2,i}$, use $\pi_\omega R_{\omega,t+1} = R_{t+1}$ from (5) to get $R_{\omega,t+1} z_{\omega,t}^i = R_{t+1} s_{\Theta,t}^i$. Adding this to $r_{t+1} s_{\bar{\Theta},t}^i$, we have $c_{\omega,t}^{2,i} = \frac{R_{t+1} s_{\Theta,t}^i + r_{t+1} s_{\bar{\Theta},t}^i}{p_{t+1}^e} = \frac{R_{t+1}(\mu - \rho_{t+1}) + r_{t+1}^{\max}(1-\mu)}{(1+\rho_{t+1})} \frac{s_t^i}{p_{t+1}^e} = \frac{\mu\left(R_{t+1} - r_{t+1}^{\max}\right)}{1+\rho_{t+1}} \frac{s_t^i}{p_{t+1}^e} = \mu R_{t+1} \frac{s_t^i}{p_{t+1}^e} \equiv c_{\Theta,t}^{2,i}$.

$\frac{p^e_{t+1}A_{t+1}}{p_t}$, $r_{t+1} = \frac{p^e_{t+1}a_{t+1}}{p_t}$ and $r^{\max}_{t+1} = \max\{1, \varphi_{t+1}\}$. Actually, the plans may be deceived if nominal payoff promises are not fully honored.

Because of assumption (6), agents are indifferent with respect to the allocation of $s_{\bar{\Theta}}$ on bonds on the one side and unfounded financial investment $d = l + f$ on the other side. (Whether they use l or f for the investment in d depends on φ_{t+1}. If $\varphi_{t+1} > 1$, then $l = 0$; if $\varphi_{t+1} < 1$, then $f = 0$; otherwise they are indifferent between l and f.) Let χ denote the share of $s_{\bar{\Theta}}$ invested in d. That is,

$$d^i_t = \chi^i_t s^i_{\bar{\Theta},t}. \tag{12}$$

For the aggregation we assume that $D_t = \sum_i d^i_t$ can be aggregated to

$$D_t = \chi_t S_{\bar{\Theta},t}, \quad S_{\bar{\Theta},t} = \sum_i s^i_{\bar{\Theta},t}. \tag{13}$$

3 The supply and use of money for founded and unfounded uses

3.1 Aggregate money supply and its distribution to the real economy

At the beginning of period t, when state $\omega \in \Theta \cup \bar{\Theta}$ is realized, the real wealth of the economy consists of a total stock of resources

$$\bar{X}^0_t + \bar{X}_{\vartheta,t}, \quad \vartheta \in \{\Theta, \bar{\Theta}\}$$

where $\bar{X}^0_t$ is the new endowment of the young generation and $\bar{X}_{\vartheta,t}$ is the production capacity owned by the old generation. Capital letters denote

the aggregate values of the respective individual variables (denoted by small letters).

Agents need money to exchange goods. But it is also used for investment in unfounded assets.

Money is issued by the central bank in exchange for property rights. The banking sector distributes the money to the various agents in the economy. Let

$$M_t^e = p_t^e \left(\bar{X}_t^0 + \bar{X}_{\vartheta,t} \right)$$

be the aggregate volume of money supporting price expectation p_t^e. That is, M_t^e is the money supply consistent with a monetary policy rule committed to a given inflation target p_t^e / p_{t-1}. I allow for deviations from this rule by assuming that actual money supply in period t is given by

$$M_t = m_t p_t^e \left(\bar{X}_t^0 + \bar{X}_{\vartheta,t} \right), \tag{14}$$

where $m_t > 0$ may be equal to one but also take values below and above one. This accounts for discrete monetary policy measures, which may be expansionary ($m_t > 1$) or restrictive ($m_t < 1$) compared to the baseline ($m_t = 1$).

The money supplied by the central bank is distributed by the banks. Let M_t^{young} and M_t^{old} denote the volume of money distributed to young and old households, respectively. Moreover, there is money kept in the banking sector, in particular for covering transaction costs T but possibly also for liquidity reasons.

A fair distribution of money to young and old households would exactly match their shares in the real resources. To account for distortions in the

transmission of money, I assume that the distribution of money may be biased. Young households give to banks the property right in their endowment $\bar{X}_t^0$ and get in return

$$M_t^{\text{young}} = m_t^{\text{young}} p_t^e \bar{X}_t^0, \tag{15}$$

units of money.[3] Fair distribution would require $m_t^{\text{young}} = m_t$. Deviation from this benchmark means that the transmission of money is biased in favor of the young ($m_t^{\text{young}} > m_t$) or to their disadvantage ($m_t^{\text{young}} < m_t$). Young households spend their money income partly on consumption, partly they leave it in the banks as savings – in exchange for pay-off promises in the future. With nomal income $Y_t = M_t^{\text{young}}$ we have for aggregate savings

$$S_t = \frac{\delta}{1+\delta} M_t^{\text{young}}, \; S_{\Theta,t} = \frac{\mu - \rho_{t+1}}{1-\rho_{t+1}} S_t, \; S_{\bar{\Theta},t} = \frac{1-\mu}{1-\rho_{t+1}} S_t, \tag{16}$$

where $S_{\Theta,t}$ is aggregate savings in contingent securities and $S_{\bar{\Theta},t}$ is savings in bonds or unfounded financial assets.

In an analogous way, old households receive in exchange for their assets

$$M_t^{\text{old}} = m_t^K p_t^e \bar{X}_{\vartheta,t} + m_t^\chi r_t^{\max} D_{t-1}. \tag{17}$$

M_t^{old} is the total volume of money available to honor the pay-off promises to past savings. It may be selectively targeted according to the type of investment. The saving invested into founded assets (securities and bonds) has the property rights in production capacity $\bar{X}_{\vartheta,t}$ as underlying. The other part of saving, $D_{t-1} = \chi_{t-1} S_{\bar{\Theta},t-1}$, was invested in unfounded financial papers promising pay-off $r_t^{\max}$ per unit invested. For $m_t^K = 1$, the return promises $R_t = \frac{p_t^e A_t}{p_{t-1}}$ and $r_t = \frac{p_t^e a_t}{p_{t-1}}$ of securities and bonds, respectively, are

[3] See Figure 2 in the Appendix for a detailed flow diagram of money and property rights.

fully honored.[4] If $m_t^K \neq 1$, then pay-off promises are deceived ($m_t^K < 1$) or over-fulfilled ($m_t^K > 1$). In an analogous way, the honoring of unfounded promises depends on m_t^χ.

Although the saving in unfounded financial assets has no counterpart in real investment, it may have resource effects on the cost side. To account for this, I assume that the banks have transaction costs for managing $D_t = \chi_t S_{\bar{\Theta},t}$ and retain

$$M_t^T = \tau D_t, \ \tau \geq 0 \tag{18}$$

for covering the costs.[5]

In sum, the volume of money left in the banks (after accounting for transaction costs) is given by

$$\begin{aligned} M_t^B &= M_t - M_t^{\text{young}} + S_t - M_t^{\text{old}} - M_t^T \\ &= M_t - \frac{M_t^{\text{young}}}{1+\delta} - M_t^{\text{old}} - \tau D_t \end{aligned}$$

In principle, all this money can be lent to firms, who need money for purchasing investment goods. In return, the banks receive property rights in the production capacity built by these investment goods. Actually, however, the banks may retain some liquidity puffer

$$L_t^B = \lambda D_t, \quad \lambda \in [0,1] \tag{19}$$

[4] Securities saving $S_{\Theta,t-1}$is transformed by rate A_t/p_{t-1} into production capacity and bond saving is transformed at rate a_t/p_{t-1}.

[5] No transaction costs are assumed for the management of S_Θ and B. Apart from simplicity, the focus on transaction costs of managing purely financial assets expresses the view that those assets require more complex "efforts" to be placed in the market. After all, their pay-off promises are not founded by productive investment.

in proportion to the unfounded financial papers they issued to households. Also the firms may leave some funds L_t^F liquid in the bank, in particular if they are pessimistic about future demand.

In sum, the aggregate level of spending on investment goods is

$$M_t^I = M_t - \frac{M_t^{\text{young}}}{1+\delta} - M_t^{\text{old}} - \tau D_t - L_t, \tag{20}$$

where $L_t = L_t^B + L_t^F \geq 0$ represents potential distortion from liquidity holdings of banks or firms. If total money supply is distributed in an unbiased way ($m_t^{\text{young}} = m_t^K = m_t^\chi = m_t$) and no liquidity distortion occurs ($L_t = 0$), then

$$\begin{aligned} M_t^I &= S_t - [m_t r_t^{\max} D_{t-1} + \tau D_t] \\ &= S_{\Theta,t} + (1-\chi_t) S_{\bar{\Theta},t} + \left[(1-\tau)\chi_t S_{\bar{\Theta},t} - m_t r_t^{\max} \chi_{t-1} S_{\bar{\Theta},t-1}\right], \end{aligned} \tag{21}$$

where $r_t^{\max} = r_t = \frac{p_t^e a_t}{p_{t-1}}$.

Hence, the funds available for real investments are equal to aggregate saving in founded assets if and only if the saving (net of transaction cost) in unfounded assets matches the pay-off promises to unfounded investments made in the past (so that the square-bracketed term vanishes). This also shows why unfounded saving can be supported by the bank even without retaining liquidity buffers ($\lambda = 0$): The unfounded savings of the young are used to honor the return promises on unfounded savings in the past. If additional money is needed banks can still divert it from the saving in founded assets. In the latter case, however, firms get less money for real investment so that eventually capital formation breaks down.

3.2 Arbitrage between founded and unfounded investments

By issuing unfounded financial papers with return promises $r_{t+1}^{\max}$, the financial sector competes with the real sector for funds. If $r_{t+1} < r_{t+1}^{\max}$ then firms get nothing for building up robust production capacity. For attracting resources, the productivity level of robust investment must satisfy the condition: $r_{t+1} \geq r_{t+1}^{\max}$, which is equivalent to

$$\frac{p_{t+1}^{e} a_{t+1}}{p_t} \geq \max\left\{1, \varphi_{t+1}\right\}.$$

The right-hand side of the inequality shows that we have to distinguish two cases. First, $\varphi_{t+1} \leq 1$; then the only financial asset without real underlying that can be used by the savers is money. In this case, if $\frac{p_{t+1}^{e} a_{t+1}}{p_t} \leq 1$, money hoarding is an optimal portfolio choice. The second case is $\varphi_{t+1} > 1$. In this case the financial sector offers financial assets which promise higher future pay-offs than money. In the following I address such assets by "F-assets" as a short name. If $\frac{p_{t+1}^{e} a_{t+1}}{p_t} \leq \varphi_{t+1}$, holding such assets is an optimal choice. In sum, we have the following two scenarios with unfounded assets: First, the scenario with rational money hoarding if

$$\varphi_{t+1} \leq 1 \text{ and } \frac{p_{t+1}^{e} a_{t+1}}{p_t} \leq 1.$$

Second, a scenario with rational "F-assets" holding if

$$\varphi_{t+1} > 1 \text{ and } \frac{p_{t+1}^{e} a_{t+1}}{p_t} \leq \varphi_{t+1}.$$

This poses the question: What determines φ_{t+1}, and in particular φ_{t+1} relative to $\frac{p_{t+1}^{e} a_{t+1}}{p_t}$?

The baseline approach of the paper is to do comparative static analysis under the assumption that a_{t+1} and $r_{t+1}^{\max} = \max\{1, \varphi_{t+1}\}$ are exogenously given and satisfy

$$\frac{p_{t+1}^{e}}{p_t} = \frac{r_{t+1}^{\max}}{a_{t+1}}. \tag{22}$$

(See assumption (6).) In this case, the share of $S_{\bar{\Theta},t}$ put into L or F is undetermined and we have multiple equilibria. This allows us to show the macroeconomic implications of χ-shifts which, though unexplained, are consistent with rational portfolio choices.

An alternative approach, pursued as an extension, is to explain both a_{t+1} and φ_{t+1} endogenously along the following reasoning.

Suppose that there is a stock of knowledge Ψ for generating blueprints for real investment projects, whereas Φ is the stock of knowledge for designing F-assets. Blueprint quality affects the productivity of all real investments – robust investments as well as the risky ones – in a uniform way. That is, for all t,

$$A_{t+1} = \rho_{t+1} a_{t+1},$$

where ρ_{t+1} is exogenous. Thus the structure of real investments is invariant with respect to the level of blueprint quality that is feasible under Ψ. For a given Ψ, the level of blueprint quality is inversely related to the investment funds seeking investments in the real sector. Let $B_t = (1 - \chi_t) S_{\bar{\Theta},t}$ be the nominal volume of funds available in period t for robust investment. Then the productivity level (per physical unit of investment), feasible under Ψ, is assumed to be given by the following relationship:

$$a_{t+1} = \tilde{a}(\Psi, B_t), \quad \frac{\partial \tilde{a}}{\partial \Psi} > 0, \frac{\partial \tilde{a}}{\partial B} < 0. \tag{23}$$

A larger stock of knowledge allows to transform a given volume of funds in a more productive way into future production capacity. If a larger volume of funds competes for a given stock of knowledge the transformation becomes more difficult.

In an analogous way, we assume that the credible pay-off promises φ_{t+1} of F-assets are higher, if the stock of knowledge, Φ, for designing such assets is high, and lower if more funds are seeking F-investments. Furthermore, the credible pay-off promises for the future are positively related to the degree to which past promises are honored today. Since the latter depends on m_t^χ (relative to m_t^K), φ_{t+1} is increasing in m_t^χ/m_t^K. More specifically, the following relationship is assumed for the feasible performance promises:

$$\begin{aligned} &\varphi_{t+1} = p_{t+1}^e \tilde{\varphi}\left(\Phi, F_t, \frac{m_t^\chi}{m_t^K}; M_t\right) \\ &\text{with} \\ &\frac{\partial\tilde{\varphi}}{\partial\Phi} > 0, \frac{\partial\tilde{\varphi}}{\partial(m_t^\chi/m_t^K)} > 0, \frac{\partial\tilde{\varphi}}{\partial F} < 0, \frac{\partial\tilde{\varphi}}{\partial M} \geq 0. \end{aligned} \tag{24}$$

Accounting for a possible effect through aggregate money supply M_t is motivated by the belief that the total volume of money distributed through the financial sector is a possible source of speculating with unfounded assets.

Substituting $B_t = (1-\chi_t)S_{\bar{\Theta},t}$ and $F_t = \chi_t S_{\bar{\Theta},t}$ into (23) and (24), we conclude: $\frac{p_{t+1}^e a_{t+1}}{p_t} = \varphi_{t+1}$ if and only if

$$\tilde{a}\left(\Psi, (1-\chi_t)S_{\bar{\Theta},t}\right) = p_t\tilde{\varphi}\left(\Phi, \chi_t S_{\bar{\Theta},t}, \frac{m_t^\chi}{m_t^K}, M_t\right).$$

Hence,

$$\chi_t = \tilde{\chi}\left(\underset{-}{\Psi}, \underset{+}{\Phi}, \underset{+}{\frac{m_t^\chi}{m_t^K}}, \underset{+}{m_t}\right), \tag{25}$$

where the sign below a variable is the sign of its impact (as determined by implicit differentiation of $\tilde{a}(\cdot) = \tilde{\varphi}(\cdot)$). The impact of $S_{\bar{\Theta},t}$ cannot be signed without further assumption. If not otherwise mentioned, invariance of χ with respect to the level of saving will be assumed. The positive impact of m_t on χ_t captures the effect of money supply through the price level p_t (which makes real investments expensive and therefore tends to make them less attractive) as well as a possible direct effect through M_t.

4 Aggregate production and consumption

4.1 Aggregate production

For discussing the implications of biased money distribution and unfounded financial investments, we assume that in period $t-1$ money distribution was unbiased and unfounded savings of generation $t-1$ (net of transaction costs) exactly matched the pay-off promises to unfounded assets held by generation $t-2$. Then, according to (16) and (21), the funds available to firms for purchasing investment goods in period $t-1$ were:

$$S_{\Theta,t-1} = \frac{\mu - \rho_t}{1 - \rho_t} S_{t-1}, \quad S_{t-1} = \frac{\delta}{1+\delta} m_{t-1} p^e_{t-1} \bar{X}^0_{t-1} \tag{26}$$

for investments in risky technologies, and

$$(1 - \chi_{t-1})\, S_{\bar{\Theta},t-1} = (1 - \chi_{t-1})\, \frac{1-\mu}{1-\rho_t} S_{t-1} \tag{27}$$

for investment in the robust technology, respectively.

In period t, the capital stock generated by the resources saved in $t-1$ in form of contingent securities is $K^\omega_t = \frac{S_{\Theta,t-1}}{p_{t-1}}$, $\omega \in \Omega$. The capital stock

generated by bond saving is $K_t^0 = (1-\chi_{t-1})\frac{S_{\bar{\Theta},t_1}}{p_{t-1}}$. (By assumption, the other part $D_{t-1} = \chi_{t-1}S_{\bar{\Theta},t-1}$ has been absorbed by transaction costs or used for honoring the unfounded promises to holders of assets without underlyings issued in period $t-2$.)

Applying the relevant capital productivities, we obtain for aggregate capacity output in period t:

$$\bar{X}_{\bar{\Theta},t} = a_t\frac{S_{\bar{\Theta},t-1}}{p_{t-1}} - a_t\chi_{t-1}\frac{S_{\bar{\Theta},t-1}}{p_{t-1}} \tag{28}$$

if $\omega \in \bar{\Theta}$, and

$$\bar{X}_{\Theta,t} = \mu A_t\frac{S_{t-1}}{p_{t-1}} - a_t\chi_{t-1}\frac{S_{\bar{\Theta},t-1}}{p_{t-1}} \tag{29}$$

if $\omega \in \Theta$. (For the latter recall $A_t(\omega)\pi_\omega\frac{S_{\Theta,t-1}}{p_{t-1}}+a_t\frac{S_{\bar{\Theta},t-1}}{p_{t-1}} = \left(A_t\frac{\mu-\rho_t}{1-\rho_t} + a_t\frac{1-\mu}{1-\rho_t}\right)\frac{S_{t-1}}{p_{t-1}} = \mu A_t\frac{S_{t-1}}{p_{t-1}}$.)

4.2 Aggregate consumption

Aggregate consumption in period t comes from the young generation, born at the beginning of t, plus the old generation, born at the beginning of $t-1$. Plans are based on the expectation that the actual price, p_t, coincides with the expected one, p_t^e. This is supported by the expectation that M_t^e units of money are supplied in an unbiased way. Thus, $Y_t^{1,\text{plan}} = p_t^e\bar{X}_t^0$ and according to (10), aggregate planned consumption of the young generation is

$$C_t^{1,\text{plan}} = \frac{1}{1+\delta}\frac{Y_t^{1,\text{plan}}}{p_t^e} = \frac{\bar{X}_t^0}{1+\delta}.$$

Moreover, using $R_t = \frac{p_t^e A_t}{p_{t-1}}$ and $r_t^{\max} = \frac{p_t^e a_{t-1}}{p_{t-1}}$ in (11), we have for the aggregate planned consumption of the old generation:

$$C_{\Theta,t-1}^{2,\text{plan}} = \frac{\mu R_t}{p_t^e}S_{t-1} = \frac{\mu A_t}{p_{t-1}}S_{t-1},\ C_{\bar{\Theta},t-1}^{2,\text{plan}} = \frac{r_t^{\max}}{p_t^e}S_{\bar{\Theta},t-1} = \frac{a_{t-1}}{p_{t-1}}S_{\bar{\Theta},t-1}. \tag{30}$$

for $\omega \in \Theta$ and $\omega \in \bar{\Theta}$, respectively.

Consumption plans are made on the basis of expected prices and pay off promises. Actual consumption levels, however, are determined by actual prices and funds available to consumers in period t. According to (15) and (17), the sum of money income channeled to the young is $m_t^{\text{young}} p_t^e \bar{X}_t^0$, whereas the old receive in the aggregate the amounts $m_t^K p_t^e \bar{X}_{\vartheta,t}$ and $m_t^\chi r_t^{\max} D_{t-1}$ in return for their savings in founded and non-founded assets, respectively. Using $r_t^{\max} = \frac{p_t^e a_t}{p_{t-1}}$, we obtain for the implied real consumption levels (addressed by superscript "eff" like effective):

$$C_t^{1,\text{eff}} = \frac{m_t^{\text{young}} p_t^e}{p_t} \frac{\bar{X}_t^0}{1+\delta}$$

and (31)

$$C_{\vartheta,t-1}^{2,\text{eff}} = \frac{p_t^e}{p_t} \left(m_t^K \bar{X}_{\vartheta,t} + m_t^\chi a_t \chi_{t-1} \frac{S_{\bar{\Theta},t-1}}{p_{t-1}} \right),$$

respectively, where p_t deviates from p_t^e if expectations are deceived.

Substituting (28) for $\bar{X}_{\vartheta,t}$ in (31), we can rewrite $C_{\vartheta,t-1}^{2,\text{eff}}$, $\vartheta \in \{\Theta, \bar{\Theta}\}$, in the form:

$$\begin{aligned} C_{\Theta,t-1}^{2,\text{eff}} &= \frac{p_t^e}{p_t} \left[m_t^K \frac{\mu A_t S_{t-1}}{p_{t-1}} + \left(m_t^\chi - m_t^K \right) a_t \chi_{t-1} \frac{S_{\bar{\Theta},t-1}}{p_{t-1}} \right], \\ C_{\bar{\Theta},t-1}^{2,\text{eff}} &= \frac{p_t^e}{p_t} \left[m_t^K \frac{a_t S_{\bar{\Theta},t-1}}{p_{t-1}} + \left(m_t^\chi - m_t^K \right) a_t \chi_{t-1} \frac{S_{\bar{\Theta},t-1}}{p_{t-1}} \right], \end{aligned} \tag{32}$$

respectively.

Comparing the effective old-age consumption levels with planned consumption (described in (30)), we see that there are two possible sources of deception: One is an unexpected rise in the price level ($p_t > p_t^e$); the other one are non honored nominal pay-offs. They come from partial default of promises

from real investment ($m^K < 1$) or emerge if the financial sector does not succeed in acquiring enough money for honoring the promises of unfounded financial papers ($m^\chi < 1$).

For the young households, who own an aggregate amount $\bar{X}_t^0$ of real resources, analogous distortions are possible. On the one side, if money policy doesn't succeed in implementing the expected price level ($p_t = p_t^e$), then their effective consumption in period t deviates from the optimal share $\frac{1}{1+\delta}$ of their real endowment. On the other side, even if $p_t = p_t^e$ is achieved by monetary policy, any bias ($m_t^{\text{young}} \neq 1$) in the channeling of money to young households distorts effective consumption possibilities away from the distribution implied by the ownership in real resources.

In sum, optimal intertemporal consumption plans may be deceived by unanticipated inflation ($p_t > p_t^e$) or because of biased money supply ($m_t^j \neq 1,\ j \in \{\text{young}, K, \chi\}$). The first source hits all agents uniformly; the second one is selective and implies redistribution.

5 Macroeconomic equilibrium

5.1 Equilibrium locus of price level and degree of utilization

Aggregate demand is equal to the sum of consumption, investment in firms and resources absorbed by the financial industry. The effective nominal levels of these components are determined by the funds available to households (young ones and old ones), to banks and to firms. Young households spend a

share $\frac{1}{1+\delta}$ of their funds on consumption, old households spend all the funds. Collecting the respective terms from Section 3.1, we have for the level of effective demand (in real terms):

$$\begin{aligned} X_t^D &= \frac{1}{p_t}\left\{\frac{1}{1+\delta}M_t^{\text{young}} + M_t^{\text{old}} + M_t^T + M_t^I\right\} \\ &= \frac{1}{p_t}\left[m_t p_t^e\left(\bar{X}_t^0 + \bar{X}_{\vartheta,t}\right) - L_t\right], \end{aligned}$$

where (14), (18) and (20) have been used for the last equation.

This is brought in line with the constraint imposed by the capacity output

$$\bar{X}^{\text{tot}} \equiv \bar{X}_t^0 + \bar{X}_{\vartheta,t},$$

if actual price level, p_t, and degree of capacity utilization, u_t are such that $X_t^{\text{tot}}(1-u_t) = X_t^D$ which reduces to

$$\frac{m_t p_t^e}{p_t} + u_t = 1 + \frac{L_t}{p_t \bar{X}_t^{\text{tot}}}, \quad L_t = \lambda_t D_t + L_t^F. \tag{33}$$

Without liquidity holding, the long-run policy rule ($m_t = 1$) supports full employment ($u_t = 0$) and a price level that fullfills expectation ($p_t = p_t^e$). This corresponds to what was called classical regime in traditional macroeconomics. The so-called Keynesian regime would mean that $L_t^F > 0$ in (33), due to pessimistic investment behavior of firms. In this case, $m_t = 1$ and $p_t = p_t^e$ are no longer consistent with full employment ($u_t = 0$). Either unemployment rises or the price level falls or both unemployment and deflation are triggered if firms hold liquidity and the central bank sticks to its monetary rule.

For seeing the equilibrium (p, u)-locus under discretionary adjustment of money supply we rewrite (33) as

$$p_t(1-u_t) = m_t p_t^e - \frac{L_t^F}{\bar{X}_t^{\text{tot}}}. \tag{34}$$

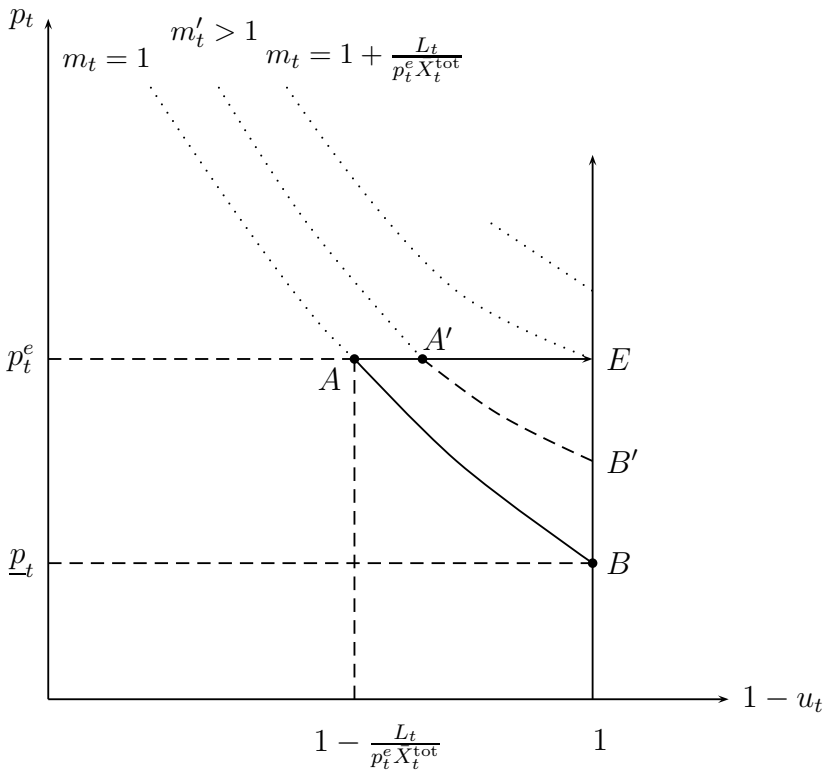

Figure 1: Non-anticipated monetary expansion under liquidity hoarding.

Figure 1 illustrates the effect of non-anticipated monetary expansion on capacity utilization for a given ratio $L_t^F / \bar{X}_t^{\text{tot}}$ of liquidity hoarding.

Segment AB shows the unemployment-deflation locus consistent with a monetary policy rule ($m_t = 1$) that intends to support p_t^e and ignores liquidity hoarding. Under full downward flexibility of prices, full employment could still be achieved (point B) as long as $\underline{p}_t = p_t^e - \frac{L_t^F}{X_t^{\text{tot}}} > 0$. If liquidity hoarding is extreme, for instance for $p_t^e = 1$ and $L_t^F > \bar{X}_t^{\text{tot}}$, then full employment is not feasible with $m_t = 1$.[6] Unanticipated monetary expansion shrinks the

[6] In principle, the points along the dotted line starting from A left upward are also consistent with $m_t = 1$. Yet, this would mean inflation and unemployment rise pari passu. Such inflationary scenarios are not the focus of this paper, I do not consider these branches

segment AB to $A'B'$ until it collapses in a single point E, at which prices are again in line with their expected level and full utilization of capacity. Further monetary expansion would increase the price level one to one as implied by the classical quantity relationship.

Let us now assume that the liquidity holding does not come from pessimistic firms but is held in banks as puffer (L_t^B) for the promises made in relation to investments without real underlying. Then equation (33) reads:

$$p_t(1-u_t) = m_t p_t^e - \lambda \chi_t \frac{S_{\bar{\Theta},t}}{\bar{X}_t^{\text{tot}}}. \tag{35}$$

For any given level $L_t^B = \lambda_t \chi_t S_{\bar{\Theta},t}$, the same logic applies as outlined before. Yet, the economic reasons behind the liquidity holding are quite different and the "demand" for liquidity therefore changes endogenously. Note first that

$$S_{\bar{\Theta},t} = \frac{1-\mu}{1-\rho_{t+1}} \frac{\delta}{1+\delta} M_t^{\text{young}}, \;\; M_t^{\text{young}} = m_t^{\text{young}} p_t^e \bar{X}_t^0.$$

Hence, under non-biased money supply ($m_t^{\text{young}} = m_t$), any increase in money supply leads at the same time to an increase in unfounded saving and a corresponding increase in liquidity holding. Thus, for a comparable level of liquidity holding $L_t^B = L_t^F$ to begin with, fighting deflation and unemployment requires a comparable more aggressive monetary expansion under L^B than under L^F. Since the liquidity holding in banks is related to unfounded investment, a biased distribution of money away from the savings invested in papers without underlyings would be more effective than expanding money supply. In our OLG-framework this would mean to reduce m_t^{young}, since the saving is done by the young generation. Yet, such a biased distribution of money not only implies redistribution of resources away from the income

in the further discussion.

earners who save. More importantly, it has severe implications for future production opportunities, too, because accumulation of physical capital is dampened pari passu with unfounded investment as long as χ is not affected through other channels. (The next section looks at accumulation effects more closely.) This points to a closer examination of possible determinants of χ.

As discussed in Section 3.2, reasonable economic arguments suggest to consider the share of saving invested in unfounded assets as function

$$\chi = \tilde{\chi}\left(\underset{-}{\Psi}, \underset{+}{\Phi}, \underset{+}{\frac{m_t^{\chi}}{m_t^{K}}}, \underset{+}{m_t}\right) \tag{36}$$

of the supply and distribution of money as well as of the stock of knowledge spent on search for pay-off promising real projects (Ψ) and financial products (Φ), respectively. Equation (36) in combination with (35) underlines the limits of expansionary monetary measures if financial markets offer F-assets the pay-off promises of which are not founded in the productivity of real projects. Not only that unfounded saving increases pari passu with the funds available for effective demand, supplying more liquidity may also shift the portfolio structure away from assets with real underlyings and thus crowd out the financial means remaining to firms for capital investment.

In sum, with liquidity holdings related to F-assets, monetary policy is in a fundamental trap between unemployment and deflation. Unlike hoarding by pessimistic firms, the liquidity held for F-assets constrains the financing of real investment even if firms are optimistic. If expansionary monetary policy wants to levy this constraint, portfolios may even shift further towards F-assets. There are only two ways out of the dilemma – both of them drastic. First, one can destroy the credibility in the pay-off promises of unfounded financial products by a selective reduction of m_t^{χ} below one (while keeping

m_t^K at one), so that past promises on F-assets are only partially honored. This hurts the old generation but deters the young generation from putting their saving in unfounded investments. At the same time, $m_t^K = 1$ guarantees that promises on founded assets can be fulfilled. The second way would be to channel money directly to firms rather than distributing it through the described channels of the banking system.

Finally, apart from controlling the money flow to the different uses, the allocation of talent matters, too. Substituting (36) for χ in (35), we see that shifting the economy's stock of knowledge from know-how (Ψ) related to real production opportunities toward financial business know-how (Φ), unrelated to real investment, aggravates the unemployment-deflation problem.

5.2 Equilibrium accumulation of real capital

How do supply and distribution of money affect the aggregate volume of funds for real investment?

Using (13) - (19) in (20), we obtain:

$$M_t^I = m_t p_t^e \bar{X}_t^0 \left\{ 1 - \frac{m_t^{\text{young}}}{m_t} \frac{\left[1 + (\tau + \lambda)\delta \chi_t \frac{1-\mu}{1-\rho_{t+1}}\right]}{1+\delta} \right\}$$
$$+ m_t p_t^e \bar{X}_{\vartheta,t} \left(1 - \frac{m_t^K}{m_t} \right) - m_t^\chi p_t^e a_t \frac{\chi_{t-1} S_{\bar{\Theta},t-1}}{p_{t-1}} - L_t^F .$$

Substituting (28) and (29) for $\bar{X}_{\vartheta,t}$, we can rewrite this equation as:

$$M_t^I = m_t p_t^e \bar{X}_t^0 \left\{ z_t^{\text{young}} - z_t^{\text{old}} \right\} - L_t^F \tag{37}$$

where

$$z_t^{\text{young}} \equiv 1 - \frac{m_t^{\text{young}}}{m_t} \frac{1 + (\tau + \lambda)\delta\chi_t \frac{1-\mu}{1-\rho_{t+1}}}{1+\delta},$$

$$z_t^{\text{old}} \equiv \frac{S_{\bar{\Theta},t-1}}{\bar{X}_t^0 p_{t-1}} \left\{ \frac{m_t^{\chi}}{m_t} \chi_{t-1} a_t - \left(1 - \frac{m_t^K}{m_t}\right) \left(\left[\mu A_t \frac{1-\rho_t}{\underset{a_t}{1-\mu}} \right] - a_t \chi_{t-1} \right) \right\}.$$

Equation (37) describes nominal capital accumulation as a function of saving behavior in interaction with money supply (m_t) and its distribution $\left(\frac{m_t^{\text{young}}}{m_t}, \frac{m_t^K}{m_t}, \frac{m_t^{\chi}}{m_t}\right)$. Combining this with a price consistent with the equilibrium (p_t, u_t)-locus determined in Section 5.1, we have the real capital accumulation.

The term z_t^{young} represents the rate of founded savings (of the young). For $m_t^{\text{young}} = m_t$ it collapses to

$$z_t^{\text{young}} = \frac{\delta \left[1 - (\tau + \lambda)\chi_t \frac{1-\mu}{1-\rho_{t+1}}\right]}{1+\delta}. \tag{38}$$

The resources absorbed in accumulating F-assets crowds out real investment possibilities. For $\chi_t = 0$, we have the undistorted saving rate $\frac{\delta}{1+\delta}$.

Term z_t^{old} is the rate of dissaving (out of $\bar{X}_t^0$) due to pay-off promises on unfounded saving in the past – not covered by the production capacity $\bar{X}_{\vartheta,t}$ built up through the saving founded on real underlyings. If nominal return promises on real assets are fully honored ($m_t^K = m_t$), then this rate of dissaving collapses to

$$z_t^{\text{old}} = \frac{m_t^{\chi}}{m_t} \chi_{t-1} a_t \frac{S_{\bar{\Theta},t-1}}{\bar{X}_t^0 p_{t-1}}, \tag{39}$$

where $\frac{S_{\bar{\Theta},t-1}}{\bar{X}_t^0 p_{t-1}} = \frac{m_{t-1}^{\text{young}} p_{t-1}^e}{p_{t-1}} \frac{\delta}{1+\delta} \frac{1-\mu}{1-\rho_t} \frac{\bar{X}_{t-1}^0}{\bar{X}_t^0}$, according to (15) and (16).

The further analysis focuses on distortions related to unfounded saving and

assumes $m_t^{\text{young}} = m_t^K = m_t$. Moreover, it is assumed that in the past expectations were fulfilled, that is $m_{t-1}^{\text{young}} = m_{t-1} = 1$ and $p_{t-1}^e = p_{t-1}$. Then, (37)-(39) give us for the total saving rate $z_t = z_t^{\text{young}} - z_t^{\text{old}}$ the expression:

$$z_t = \frac{\delta}{1+\delta}\left\{1 - \left[(\tau+\lambda)\chi_t + \frac{m_t^\chi}{m_t}\chi_{t-1}a_t\xi\right]\frac{1-\mu}{1-\rho_{t+1}}\right\} \tag{40}$$

with $\xi \equiv \frac{1-\rho_{t+1}}{1-\rho_t}\frac{\bar{X}_{t-1}^0}{\bar{X}_t^0}$. And the available funds for real investment are:

$$M_t^I = S_t - \left[(\tau+\lambda)\chi_t S_{\bar{\Theta},t} + \frac{m_t^\chi}{m_t}\chi_{t-1}a_t\xi S_{\bar{\Theta},t}\right] - L_t^F, \tag{41}$$

which coincides with (21) if $m_t^\chi = m_t$ and $\lambda_t = L_t^F = 0$.[7]

The second term in the squared brackets shows the burden of unfounded old promises. This burden is mitigated if the endowment of the young grows so that $\xi < 1$. Apart from that it can only be reduced by lowering m_t^χ which means that banks do not get enough money to honor the unfounded promises. Clearly, this requires strict control over the distribution channels of money. Otherwise banks could use money meant to be provided for the transactions of the young generation or in return to past founded savings.

The first term in the squared brackets describes the resources lost in transacting the new investments in unfounded assets. This loss can only be reduced by reducing the savings of the young generation or the propensity χ_t to save in F-assets. The first measure is clearly counterproductive, since this would not only reduce $(\tau+\lambda)\chi_t S_{\bar{\Theta},t}$ but also S_t and thus have a negative net effect on aggregate capital accumulation. For the same reason, it would be counterproductive to use untargeted restrictive money supply ($m_t = 1$) to dampen propensity χ_t. The targeted restriction of m_t^χ, however, would clearly help, since deception of old promises makes new promises less credible.

[7] Note that $\xi S_{\bar{\Theta},t} = S_{\bar{\Theta},t-1}\frac{m_t p_t^e}{m_{t-1}p_{t-1}^e} = S_{\bar{\Theta},t-1}\frac{m_t p_t^e}{p_{t-1}}$ for $m_{t-1} = 1$ and $p_{t-1}^e = p_{t-1}$. Moreover, $\frac{p_t^e a_t}{p_{t-1}} = r_t^{\max}$.

For aggregate accumulation in real terms, $I_t = \frac{M_t^I}{p_t}$, we focus first on the case of liquidity holding by firms by assuming $\chi_t = \chi_{t-1} = 0$ so that $z_t = \frac{\delta}{1+\delta}$. Solving (34) for p_t and dividing (41) by p_t (40), we obtain

$$I_t = \frac{\frac{\delta}{1+\delta} p_t^e \bar{X}_t^0 - \frac{L_t^F}{m_t}}{p_t^e - \frac{L_t^F}{m_t \bar{X}_t^{\text{tot}}}} (1 - u_t). \tag{42}$$

This confirms that, given u_t, expansionary monetary policy has a positive effect on capital accumulation.[8] The reason is that rising prices reduce liquidity hoarding in real terms.

What are, by contrast to liquidity hoarding in firms, the effects on real capital formation of liquidity diverted to unfounded financial business? Let $L_t^F = 0$. Then, (35) and (41) imply for $I_t = \frac{M_t^I}{p_t}$:

$$I_t = \frac{S_t - \left[(\tau + \lambda)\chi_t + \frac{m_t^\chi}{m_t} \chi_{t-1} a_t \xi\right] S_{\bar{\Theta},t}}{m_t p_t^e - \lambda \chi_t \frac{S_{\bar{\Theta},t}}{\bar{X}_t^{\text{tot}}}} (1 - u_t). \tag{43}$$

For given values of χ_t and $\frac{m_t^\chi}{m_t}$, I_t is invariant with respect to m_t, since S_t and $S_{\bar{\Theta},t}$ are proportional to m_t (for $m_t^{\text{young}} = m_t$). More importantly, although prices are declining in χ_t and thus investment goods become less expensive, as shown by (35), a rise in χ_t has a deteriorating effect on real capital formation.[9] The crowding out effect of unfounded investment on the funds for real investment dominates the cost reduction effect. Clearly, non-honoring of promises for F-assets by setting $m_t^\chi < m_t$ has a positive effect on capital formation. If this induces investors to reduce the share allocated to F-assets, all the better for real capital formation.

[8] I_t is decreasing in L_t^F / m_t, since $\frac{\delta}{1+\delta} \bar{X}_t^0 < \bar{X}_t^{\text{tot}}$.

[9] $\partial I_t / \partial \chi_t < 0$ because of $S_t < m_t p_t^e \bar{X}^{\text{tot}}$.

Finally, equation (43) shows that past saving in unfounded papers (χ_{t-1}) throws its negative shadow even if new investment in F-assets stops ($\chi_t = 0$). As long as the pay-off promises are honored at least to some extent, they imply a redistribution of resources from real investment to consumption of the old generation.

6 Conclusion

Under liquidity hoarding, monetary policy faces an unemployment-deflation trade-off. If the liquidity holding comes from pessimistic households or firms, the creation of money may help to reduce the unemployment deflation dilemma. But, expansionary monetary policy aggravates the dilemma, if the liquidity holding serves the financial system as puffer for honoring pay-off promises on unfounded assets. In this case, more drastic policy measures are required. Not only the supply has to be controlled, also its distribution has to be taken care of. Either the financial system is prevented from using money for honoring unfounded promises or the money is channeled directly to firms. The first measure clearly hurts the financial investors, including pension funds among others, but redirects the allocation of savings toward real investment. The second measure stimulates real investment directly.

Apart from the supply and distribution of money, the use of the economy's creative resources matters, too. In this respect, the analysis presented in this paper points to a redirection of the creative energy away from financial innovation toward the development of ideas for useful production opportunities. Finally, even if the investment in unfounded assets is stopped, the unfounded investments from the past tarnishes current real investment.

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A Appendix "Portfolio Choice"

Let

$$\mathcal{L} = ln(c^1) + \delta \left[\mu \sum_{\omega \in \Theta} \pi_\omega ln\left(c^2_\omega\right) + (1-\mu) ln\left(c^2_{\bar{\Theta}}\right) \right] + \lambda(y - p_t c^1 - s) + \sum_{\omega \in \Theta} \nu_\omega z_\omega + \sum_{j \in \{b,l,f\}} \nu_j j$$

be the Lagrange function for $\max\limits_{c^1,(z_\omega)_{\omega\in\Theta},b,l,f} EU$ subject to

$$\begin{aligned} & s = s_\Theta + s_{\bar{\Theta}},\ s_\Theta \equiv \sum_{\omega \in \Theta} z_\omega,\ s_{\bar{\Theta}} = b + l + f \\ & c^2_\omega = \frac{R_\omega z_\omega}{p^e_{t+1}} + c^2_{\bar{\Theta}},\ c^2_{\bar{\Theta}} = \frac{rb + l + \varphi f}{p^e_{t+1}} \end{aligned} \tag{A.1}$$

and

$$p_t c^1 + s \leq y,\ z_\omega \geq 0, b \geq 0, l \geq 0, f \geq 0,$$

where $\lambda, \nu_\omega, \nu_b, \nu_l, \nu_f$ denote the Lagrange multipliers for the relevant inequality constraints.

Then the first-order conditions are:

$$\begin{aligned} (c^1) \quad & c^1 = \frac{1}{\lambda p_t} \\ (z_\omega) \quad & \frac{\delta \mu \pi_\omega R_\omega}{c^2_\omega p^e_{t+1}} = \lambda - \nu_\omega \end{aligned} \tag{A.2}$$

and for $j \in \{b, l, f\}$

$$(j) \quad \left[\sum_{\omega \in \Theta} \frac{\mu \pi_\omega}{c^2_\omega p^e_{t+1}} + \frac{1-\mu}{c^2_{\bar{\Theta}} p^e_{t+1}} \right] \delta r_j = \lambda - \nu_j \tag{A.3}$$

with $r_b = r, r_l = 1, r_f = \varphi$.

From (A.3) we conclude that $\nu_j > 0$ and $j = 0$ if $r_j < r^{\max} \equiv \max\{r, 1, \varphi\}$. (For saving notation j is used as index of as well as the value of the respective component of $s_{\bar{\Theta}}$.) Moreover, if $r_j = r_{j'} = r^{\max}$ for $j \neq j'$, then $\nu_j = \nu'_j \equiv \nu_{\min}$

and the investor is indifferent between j and j'. In this case, (A.3) reduces to

$$\left[\sum_{\omega\in\Theta}\frac{\delta\mu\pi_\omega}{c^2_\omega p^e_{t+1}}+\frac{\delta(1-\mu)}{c^2_{\bar{\Theta}}p^e_{t+1}}\right]r^{\max}=\lambda. \tag{A.4}$$

(Note that $\nu_{\min}>0$ would imply $b=l=f=0$ and thus $c^2_{\bar{\Theta}}=0$ so that the left side of equation (j) in (A.3) would be infinite.)

A further simplification results from the fact that $\pi_\omega R_\omega = R$ and $\sum_{\omega\in\Theta}\frac{1}{R_\omega}=\frac{1}{R}$, according to (5). Using this in (z_ω), we obtain $\frac{\delta\mu R}{c^2_\omega p^e_{t+1}}=\lambda-\nu_\omega$. This implies that either $z_\omega>0$ for all $\omega\in\Theta$ or for none. (Suppose that $z_\omega=0$, whereas $z_{\omega'}>0$ and thus $\nu_{\omega'}=0$. Then $c^2_{\omega'}>c^2_\omega=c^2_{\bar{\Theta}}$ and $\lambda-\nu_{\omega'}=\frac{\delta\mu R}{c^2_{\omega'}p^e_{t+1}}<\frac{\delta\mu R}{c^2_{\bar{\Theta}}p^e_{t+1}}=\lambda-\nu_\omega$ which contradicts $\nu_{\omega'}=0$.) Now suppose that $z_\omega=0$ for all $\omega\in\Theta$. Then, according to (A.2), $\frac{\delta\mu R}{c^2_{\bar{\Theta}}p^e_{t+1}}\leq\lambda$ whereas (A.4) reduces to $\frac{\delta r^{\max}}{c^2_{\bar{\Theta}}p^e_{t+1}}=\lambda$. The two conditions are only consistent if $r^{\max}\geq\mu R$. Hence, $\mu R>r^{\max}$ is sufficient for $z_\omega>0,\nu_\omega=0,\omega\in\Theta$. Under this condition, the system given by (A.2) and (A.3) reduces to

$$\begin{aligned}
&\text{(i)} && c^1=\frac{1}{\lambda p_t}\\
&\text{(ii)} && \frac{\delta\mu R}{c^2_\omega p^e_{t+1}}=\lambda\\
&\text{(iii)} && \left[\frac{\lambda}{R}+\frac{\delta(1-\mu)}{c^2_{\bar{\Theta}}p^e_{t+1}}\right]r^{\max}=\lambda,
\end{aligned} \tag{A.5}$$

where for (iii), condition (z_ω) of (A.2) has been substituted into (A.4) and $\sum_{\omega\in\Theta}\frac{1}{R_\omega}=\frac{1}{R}$ has been used.

Equation (iii) of (A.5) implies

$$c^2_{\bar{\Theta}}p^e_{t+1}=\frac{\delta}{\lambda}\frac{(1-\mu)r^{\max}R}{R-r^{\max}} \tag{A.6}$$

and equation (ii) implies

$$c^2_\omega p^e_{t+1}=\frac{\delta}{\lambda}\mu R. \tag{A.7}$$

Combining these two equations with $c^2_\omega p^e_{t+1} = R_\omega z_\omega + p^e_{t+1} c^2_{\bar{\Theta}}$ from (A.1), we obtain $R_\omega z_\omega = \frac{\delta}{\lambda} R \frac{\mu R - r^{\max}}{R - r^{\max}}$, which with $R_\omega = \frac{R}{\pi_\omega}$ reduces to

$$z_\omega = \pi_\omega \frac{\delta}{\lambda} \frac{\mu R - r^{\max}}{R - r^{\max}} \tag{A.8}$$

and gives us

$$s_\Theta = \frac{\delta}{\lambda} \frac{\mu R - r^{\max}}{R - r^{\max}}. \tag{A.9}$$

Using (A.9) and (A.6) in $s = s_\Theta + s_{\bar{\Theta}}$ and $s_{\bar{\Theta}} = \frac{c^2_{\bar{\Theta}} p^e_{t+1}}{r^{\max}}$, we have $s = \frac{\delta}{\lambda}$ and thus, according to (A.6) - (A.9):

$$\begin{aligned} s_\Theta &= \frac{\mu R - r^{\max}}{R - r^{\max}} s, \quad z_\omega = \pi_\omega s_\Theta \\ s_{\bar{\Theta}} &= \frac{(1-\mu) R}{R - r^{\max}} s \\ c^2_\omega &= \frac{\mu R}{p^e_{t+1}} s \equiv c_\Theta, \quad c_{\bar{\Theta}} = \frac{r_{\max} s_{\bar{\Theta}}}{p^e_{t+1}}. \end{aligned} \tag{A.10}$$

Moreover, combining the equation $s = \frac{\delta}{\lambda}$ with budget constraint $s = y - p_t c^1$ and condition (i) from (A.5), we obtain $\frac{1}{\lambda} = \frac{y}{1+\delta}$ and thus finally:

$$c^1 = \frac{1}{1+\delta} \frac{y}{p_t} \text{ and } s = \frac{\delta}{1+\delta} y. \tag{A.11}$$

B Appendix: Flow of money, property rights and goods

The following diagram shows the flows of money in exchange for property rights, payoff promises and goods.

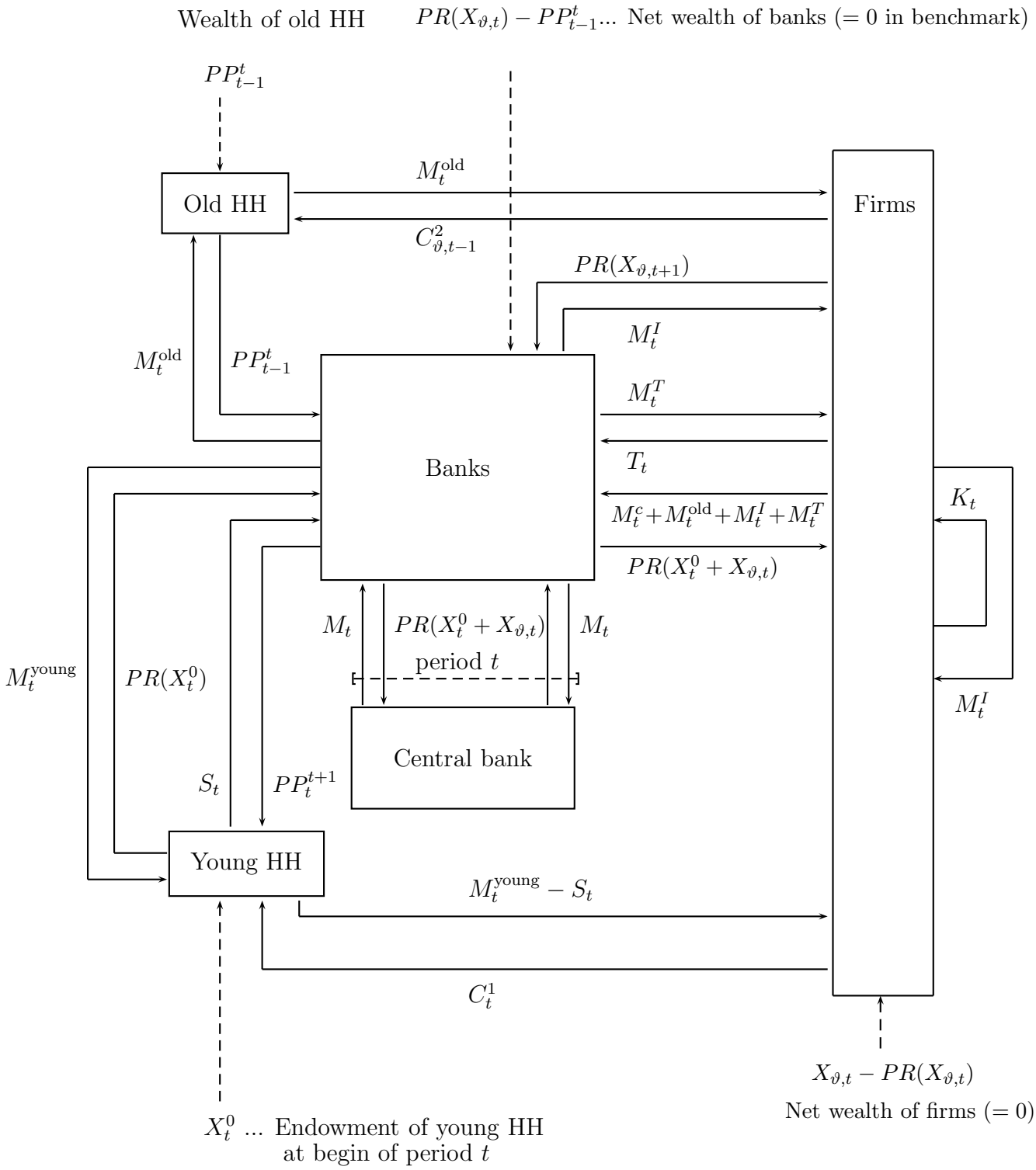

Figure 2: The distribution of money in exchange for property rights and the exchange of goods for money. PP^t_{t-1} denotes payoff promise for period t made in period $t-1$. $PR(X)$ means property right in X and M are money flaws. Dotted lines indicate positions "inherited" from past.