

Kumhof, Michael

**Conference Paper**

## The Chicago Plan Revisited - Debt-free Money, Growth, and Stability

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2025: Revival of Industrial Policy

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Kumhof, Michael (2025) : The Chicago Plan Revisited - Debt-free Money, Growth, and Stability, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2025: Revival of Industrial Policy, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/325358>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# DISCUSSION PAPER SERIES

DP19603

## **THE CHICAGO PLAN REVISITED - DEBT-FREE MONEY, GROWTH, AND STABILITY**

Michael Kumhof

**MONETARY ECONOMICS AND  
FLUCTUATIONS, MACROECONOMICS  
AND GROWTH AND BANKING AND  
CORPORATE FINANCE**

**CEPR**

# THE CHICAGO PLAN REVISITED - DEBT-FREE MONEY, GROWTH, AND STABILITY

*Michael Kumhof*

Discussion Paper DP19603  
Published 20 October 2024  
Submitted 08 October 2024

Centre for Economic Policy Research  
33 Great Sutton Street, London EC1V 0DX, UK  
Tel: +44 (0)20 7183 8801  
[www.cepr.org](http://www.cepr.org)

This Discussion Paper is issued under the auspices of the Centre's research programmes:

- Monetary Economics and Fluctuations
- Macroeconomics and Growth
- Banking and Corporate Finance

Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as an educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Copyright: Michael Kumhof

# THE CHICAGO PLAN REVISITED - DEBT-FREE MONEY, GROWTH, AND STABILITY

## Abstract

The Chicago Plan, proposed by leading economists during the Great Depression, envisaged the separation of banks into money banks with 100% reserve backing for deposits and credit banks financed through non-monetary liabilities. Fisher (1936) claimed four advantages: (1) Reduction of public debt through a debt-to-equity swap. (2) Reduction of private debts as money creation no longer requires debt creation. (3) Elimination of runs on the payment system. (4) Better control of credit-driven business cycles. Using a DSGE model of the US economy, we find strong support for all four claims. Furthermore, steady state output gains approach 17 percent and monetary policy is much more effective in response to every shock. Monetary policy improves welfare by combining a conventional Taylor rule with a countercyclical rule for the interest rate on treasury loans to credit banks.

JEL Classification: E44, E52, G21

Keywords: 100% reserve banking

Michael Kumhof - michael.kumhof@outlook.com  
*Bank of England and CEPR*

## Acknowledgements

The views expressed in this paper are those of the authors and should not be attributed to the institutions with which the authors are affiliated. The authors are grateful for helpful comments and suggestions from George Akerlof, Olivier Blanchard, Michael Burda, Michael Clark, Timothy Congdon, Ulf Dahlsten, Herman Daly, Heiner Flassbeck, Erhard Glötzl, Charles Goodhart, Carol Hopson, Joseph Huber, Michael Hudson, Jesús Huerta de Soto, Zoltan Jakab, Steve Keen, Uli Kortsch, Larry Kotlikoff, Douglas Laxton, Stefan Lewellen, Bernard Lietaer, Falk Mazelis, Kris Mitchener, Thorvald Grung Moe, Dirk Muir, Antonio Pancorbo, Johannes Priesemann, Romain Rancière, Liliya Repa, Adair Turner, Kenichi Ueda, Richard Werner and Steven Zarlenga, and from seminar participants at AFM Netherlands, Bank of England, Bank of Korea, BIS, Boston University, CEPR, Czech National Bank, Demos Finance, De Nederlandsche Bank, European Central Bank, European Economic Association, Federal Reserve Board, Global Utmaning, Goethe University, Humboldt University, IIMR, IMF, LSE, Maurice Allais Workshops, New Economics Foundation, Norges Bank, Philadelphia Fed, Swiss National Bank, UNCTAD, University of Delft, University of Sankt Gallen, Verein fuer Socialpolitik, Virginia Tech, Warwick University, and World Bank.

# 1. Introduction

In the wake of the Great Depression, economists tried to understand the failures that had led to the crisis. This extended to many domains, but the most important was in monetary economics, given the key roles of private bank behavior and of central bank policies in triggering and prolonging the crisis. During this time a large number of leading US macroeconomists supported a proposal for monetary reform that later became known as the Chicago Plan,<sup>1</sup> named after its strongest proponent, professor Henry Simons of the University of Chicago. It was also supported, and brilliantly summarized, by Fisher (1936). Its key feature is a call for the separation of the monetary and credit functions of banking, by separating commercial banks into money banks that are required to maintain full backing of deposits by public (government-issued) money and credit banks that can only finance new credit through the borrowing of public money from non-banks or from the government, but not through the ex nihilo creation of new private deposit money.

Fisher (1936) claimed four major advantages for the Chicago Plan: (1) *Large reduction of public debts* and therefore of public interest expenses.<sup>2</sup> (2) *Large reduction of private debts* and therefore of private interest expenses.<sup>3,4</sup> (3) *Elimination of runs on the payment system*. (4) *Much better control of credit-driven business cycles*.<sup>5</sup>

We study Fisher’s four claims by embedding a carefully calibrated model of the current US financial system in a state-of-the-art monetary DSGE model, and then simulating a transition from the current economy to one that has adopted the Chicago Plan. We find strong support for all four claims. In addition, steady state output gains approach 17 percent relative to trend, and monetary policy acquires new tools that make it much more effective in response all shocks, not only shocks to credit. Monetary policy accomplishes this by combining a conventional Taylor rule for the interest rate on reserves with a countercyclical rule for the spread of the interest rate on treasury loans to credit banks and an acyclical rule for the spread of the interest rate on public money.

A full analysis of the balance sheet dynamics of the Chicago Plan will be presented when we discuss the model. But it is important to discuss the principles early to fix ideas. We do this using Figure 1, which shows the changes in the balance sheets of commercial banks and the government that occur in the single transition period of our model simulation, after the adoption of the Chicago Plan but before its longer-term real effects are realized. Numbers are in percent of initial GDP, and numbers for the initial steady state are consistent with the US data averages used in our calibration.

---

<sup>1</sup>Other commonly used names are 100% reserve banking, full reserve banking, and narrow banking.

<sup>2</sup>Laubach (2009) (see also Engen and Hubbard (2004), Gale and Orszag (2004)) reports that each percentage point increase in the US debt-to-GDP ratio increases the real interest rate by between 1 and 6 basis points. Based on this, the IMF (2021, 2022) applies a value of 4 basis points in its new Debt Sustainability Framework.

<sup>3</sup>Arcand et al. (2015) and Cecchetti and Kharroubi (2012) have shown that at high private debt levels, exceeding around 100% of GDP, further increases in debt can have sizeable negative effects on growth.

<sup>4</sup>Schularick and Taylor (2012) show empirically, and Kumhof et al. (2015) show theoretically, that high debt levels are a very important predictor of major crises.

<sup>5</sup>Reinhart and Rogoff (2009) document the high costs of boom-bust credit cycles and bank runs throughout history.

As shown in the yellow shaded area of the top left panel, the assets of the financial system prior to the Chicago Plan equal 165% of GDP, with loans and government bonds accounting for 150% and 15% of GDP. Loans in turn consist of short-term loans (consumer loans, working capital loans) and mortgage loans at 100% of GDP and investment loans at 50% of GDP. Liabilities consist of deposits, which includes retail and wholesale deposits, and equity equal to 148% and 17% of GDP. The implementation of the plan takes place in two steps.

The first step, as claimed by Fisher (1936), leads to a *reduction of public debts* and public interest expenses. As shown in the bottom part of the top left panel, the Chicago Plan obliges banks to obtain credit from the treasury to finance the reserves necessary to back their existing deposits. Treasury credit represents a very large seigniorage gain to the government, with the result that public debt (75% of GDP both before and after this step) net of treasury credit (148% of GDP) is now negative.<sup>6</sup> In this context it is critical that the newly created reserves are not debt. As discussed in Kumhof et al. (2020), based on legal theory, public money should be classified as a hybrid category of “social equity” that reflects its proximity to corporate equity in several legal dimensions, including being non-defaultable and irredeemable – holders of public money cannot claim repayment in something other than public money.<sup>7</sup> This means that the Chicago Plan amounts to a large debt-to-equity swap, which like any debt-to-equity swap reduces borrower leverage and therefore matters for financial sector assessments of borrower sustainability.

The second step, as claimed by Fisher (1936), leads to a *reduction of private debts* and private interest expenses. As shown in the top right panel of Figure 1, our simulation assumes that treasury credit is used both to repay bank-held government debt and to pay out a citizens’ dividend, which in turn is used to repay all bank loans, except investment loans where banks continue to provide a valuable monitoring function. This citizens’ dividend extends the debt-to-equity swap to nonbank private agents. Because under the Chicago Plan money creation no longer requires debt creation, a money stock that is unchanged in size but changed in nature (backed by public money rather than by private loans) coexists with much lower public and private debt stocks, where the share of seigniorage allocated to private debt repayments is a policy decision. The separate balance sheets for money banks and credit banks in the top right panel of Figure 1, with their final position shaded in green, represent the now strict separation between the monetary and credit functions of the banking system.

The bottom panels of Figure 2 illustrate the balance sheet of the government, whose initial and final balance sheets are again shaded in yellow and green. On the bottom left, the reserve and treasury credit positions mirror those of the banking system. On the bottom right, the 100%

---

<sup>6</sup>Interest expenses also drop significantly because public money can be issued at low deposit-level interest rates while public debt must be issued at much higher loan-level interest rates.

<sup>7</sup>This is how treasury coin is currently treated under U.S. accounting conventions (Federal Accounting Standards Advisory Board (2012)).

of GDP citizens' dividend is a charge against government equity, which drops to 48% of GDP, and together with the 15% of GDP government debt repayment it is a charge against treasury credit, which drops to 33% of GDP. The initial government balance sheet showed net debt and equity positions of 75% and 0% of GDP, while the final balance sheet shows 27% and 48%. The government balance sheet therefore becomes far stronger, and this is after paying out two thirds of its gains to the private sector.

We now turn to Fisher's (1936) third claim that the Chicago Plan would *eliminate runs on the payment system*. The Chicago Plan would make runs on money banks impossible, because their deposits would represent public money, and holders cannot ask for repayment of public money in something other than public money. Deposit insurance could therefore be abolished for money banks. But the Chicago Plan would also make runs on credit banks much less likely. One reason is that these banks' marginal source of funding would be loans from the treasury, which are not subject to runs. Furthermore, regulatory policies should insist that all of credit banks' liabilities to the private sector must take the form of either private equity (as suggested by Kotlikoff (2012)) or longer-term non-monetary liabilities that are not covered by deposit insurance, because they represent risky investments rather than money. We note that credit banks, unlike modern banks, are true intermediaries, in that they can only lend public money if they have first borrowed public money from the private sector or the government, rather than being able to create private money themselves.

A substantial part of our analysis will deal with Fisher's (1936) fourth claim that the Chicago Plan reform will permit a much *better control of credit-driven business cycles*. Such cycles depend on changes in banks' willingness to lend, or attitude to risk, which can but need not be driven by economic fundamentals. The key insight is that banks can quickly act on changes in their attitude to risk because they are able to create their own funds to fuel lending booms. The reason is that banks always finance new loans by creating new deposits, so that there is never a risk of not being able to finance new loans, only a risk of having to refinance lost net deposits. Under normal circumstances the latter is not a serious risk, because all banks continuously make large numbers of new loans, and for a banking system where all banks expand or contract in lockstep, a bank will tend to gain as many deposits as it loses, and only the small difference remaining after netting deposit inflows and outflows will need to be refinanced, if there is a shortfall, or lent out, if there is a surplus. The average bank will experience neither shortfall nor surplus.<sup>8</sup> The key for macroeconomics is that, at the level of the aggregate banking system, so long as a new loan remains outstanding at some bank, so does the new deposit, at the same or some other bank. The aggregate money supply has therefore increased. In contrast, under the Chicago Plan the quantity of money,

---

<sup>8</sup>Cipriani et al. (2024) show, using confidential interbank daily US data, that the average bank's payments after netting are centered around zero, as their payments received and sent tend to cancel each other out.

which is now created exclusively by government but managed by private banks, and the quantity of credit, which continues to be allocated by private banks, become much more independent of each other. This makes it easier to independently control their volatilities, first because policy gains control of the interest rates on treasury credit and on public money, in addition to the interest rate on reserves, and second because credit banks need to attract deposits of existing public money rather than creating their own funding in the act of lending, with the vigilance of investors imposing additional constraints on their ability to start lending booms.

We show that, in addition to Fisher's (1936) claims, the economy also experiences *output gains* of over 15% relative to trend during the transition to the Chicago Plan. This happens for three reasons. First, the large debt-to-equity swap leads to sizeable reductions of public and private real interest rates, which stimulates investment and output. Second, the combination of lower interest rates on debt-based government financing with higher seigniorage income on public-money-based government financing, the latter due to especially low interest rates on public money combined with additional non-inflationary money creation to satisfy the needs of a growing economy, creates fiscal space that permits sizeable reductions in distortionary tax rates, which also stimulates real activity. And third, far fewer scarce resources have to be devoted to monitoring private loans whose purpose was mainly to create an adequate private money supply, because the money supply can easily be created publicly and debt-free.

Section 8 deals in detail with many potential objections to the Chicago Plan. We briefly summarize them here. One popular objection is that it is not clear what *market failure* the Chicago Plan tries to address. We show that there are two clear market failures in private money creation, rent seeking (high seigniorage rents due to market power and government support are documented in an extensive literature) and increasing returns to scale in the trust needed to underpin money creation. Another objection is the difficulty of preventing the creation of *money substitutes* by credit banks. Along with some eminent economists, we argue that this is not an insurmountable problem, and that it can be prevented through a sensible list of countermeasures that we discuss. The loss of the benefits of *maturity transformation* is frequently cited. We argue that the point of maturity transformation is maturity, not transformation, and that the Chicago Plan provides private-sector access to the desired maturities, accompanied by lower interest rates, without private-sector transformation. Another objection is the potential of the Chicago Plan to impair the *competitiveness of the banking system*. We expect the opposite, as money banks could operate the payment system without worrying about asset quality risks, while credit banks could operate the credit system with far fewer reasons to worry about liability management risks. A related objection is concern with *crowding-out of the banking system*. We discuss that at present the two functions of the banking system are the creation of the economy's aggregate money supply (other than cash) as private money and intermediation between heterogeneous net creditors and net debtors. The crowding-out



of the first function is indeed the purpose of the Chicago Plan, but the second function would remain, and demand for it would increase because the stimulus to real activity would increase transactions demand. A very frequent concern is with *government control over money issuance*, which is deemed to be inflationary and/or destabilizing. There is no support for this either in theory (inflation: the plan involves no significant changes in the quantity of money, only in the nature of money; stability: we show that stabilization policy could become much more effective) or in the historical record (crises occurred predominantly during periods of private control over money issuance). A related concern is with *government control over credit issuance*. However, under the Chicago Plan the government would not directly control the quantity of credit, and it would not control the allocation of credit at all. A final objection is the perceived danger of one country “going it alone” in an *open economy*, by becoming vulnerable to speculative attacks. However, the Chicago Plan would make the currency of this country a safe haven asset, it would give the country strong rather than weak economic fundamentals, and finally it would give the country much stronger tools to combat attacks not driven by economic fundamentals, because speculators would not have access to a private banking system that can create local currency on demand.

The rest of the paper is organized as follows. Section 2 briefly discusses the history of the Chicago Plan. Section 3 presents the model that describes the current monetary system, which we refer to as the pre-transition economy. Section 4 presents the model that describes the Chicago Plan or the post-transition economy. Section 5 discusses model calibration. Section 6 studies a simulation of the dynamic transition between the two economies. Section 7 compares the ability of pre-transition and post-transition policymakers to stabilize business cycles. Section 8 discusses responses to some common objections to the Chicago Plan. Section 9 concludes.

## 2. The History of the Chicago Plan

The history of the Chicago Plan is presented in Phillips (1994). The proposal was first formulated in the UK by the 1921 Nobel Prize winner in chemistry, Frederick Soddy (1926), followed by Professor Frank Knight (1927) of the University of Chicago. Knight (1933) is a version of the plan in the form of a memorandum to President Roosevelt. Many of Knight’s University of Chicago colleagues supported the plan, including Henry Simons, who was the author of the second memorandum to Roosevelt in November 1933 (Simons (1933)). The Chicago economists, and later Irving Fisher of Yale, were in constant contact with the Roosevelt administration, which seriously considered their proposals, as reflected in the government memoranda of Gardiner Means (1933) and Lauchlin Currie (1934), and the bill of Senator Bronson Cutting (1934).

Several of the signatories of the Chicago Plan were later to become known as the founders of the Chicago School of Economics. Though they were strong proponents of *laissez-faire* in industry, they did not question the right of the federal government to have an exclusive monopoly on money

issuance (Phillips (1994)).<sup>9</sup> In Fisher (1935) we find supportive statements from bankers arguing that the conversion to 100% reserve backing would be simple. Friedman (1960) concurs.

The Chicago Plan was never adopted as law, due to strong resistance from the banking lobby. But it played a major role in the passage of the 1935 Banking Act, which also faced resistance but was considered more acceptable to banks. As documented in Phillips (1994), the 1935 Act was at the time not considered the final word on banking reform, and efforts by proponents of the Chicago Plan, especially by Irving Fisher, continued for many years afterwards. The long list of academic treatments in the 1930s, almost universally sympathetic, includes Whittlesey (1935), Douglas (1935), Angell (1935) and Graham (1936). This continued after the war, with Allais (1947, 1984), Friedman (1960, 1967), who was a lifelong supporter, Tobin (1985), Werner (2005), Robertson (2012), Huerta de Soto (2012), Kotlikoff (2012), Pennacchi (2012) and Benes and Kumhof (2012).

### 3. The Model: Pre-Transition

The model economy consists of households (who include manufacturing firms), a banking sector, bond investors, unions, and a government. The banking sector in turn consists of wholesale banks, retail lending banks, and retail deposit banks. We can think of wholesale banks as the treasury department of the bank, which treats retail lending banks and retail deposit banks as independent profit centers. Bond investors are holders of government bonds and of high-interest-low-liquidity wholesale bank deposits. Households are holders of low-interest-high-liquidity retail bank deposits that support four different types of transactions: Investment deposits for investment goods purchases (index  $k$ ), working capital deposits for payments to workers and suppliers of capital (index  $y$ ), real estate deposits for purchases of land (index  $a$ ), and consumption deposits for consumption goods purchases (index  $c$ ). To obtain deposits, households-firms borrow in four different sectors: Investment loans secured against physical capital (index  $k$ ), working capital loans secured against sales revenue (index  $y$ ), mortgages secured against land (index  $a$ ), and consumer loans secured against after-tax labor income (index  $c$ ). We will use the shorthand notation  $x \in \{c, a, y, k\}$ .

The economy experiences constant technology growth  $\times = T_t/T_{t-1}$ , where  $T_t$  is labor augmenting technology. When the model's nominal variables, say  $V_t$ , are expressed in real normalized terms, we divide by the price level  $P_t$  and technology  $T_t$ . We use the notation  $\check{v}_t = V_t/(T_t P_t) = v_t/T_t$ , with the steady state of  $\check{v}_t$  denoted by  $\bar{v}$ . One period corresponds to one quarter.

---

<sup>9</sup>They also argued for a strong government role in infrastructure provision and regulation (Simons (1948)).

### 3.1. Households

#### 3.1.1. Preferences and Technologies

Households have unit mass and are indexed by  $j$ . They maximize lifetime utility subject to sequences of intertemporal budget constraints, deposits-in-advance constraints, and bank participation constraints. We assume GHH preferences (Greenwood et al. (1988)), which have been used extensively to match empirical regularities (see e.g. Raffo (2008) and Schmitt-Grohe and Uribe (2008)), including in the literature on the effects of changes in taxation (Diamond (1998)), which will play an important role in our transition simulation. Households choose plans for their external consumption habit  $c_t(j) - \nu c_{t-1}$ , hours worked  $h_t(j)$ , hours hired  $H_t(j)$ , investment  $I_t(j)$ , capital held  $k_t(j)$ , capital hired  $K_{t-1}(j)$ , land  $a_t(j)$ , retail loans  $L_{x,t}(j)$  (with sector-specific retail rates  $i_{r,t}^x$ ), and retail deposits  $D_{x,t}(j)$  (with homogenous retail rates  $i_{d,t}$ ). The objective function of household  $j$ , with discount factor  $\beta_{hh}$ , habit persistence parameter  $\nu$ , and labour supply elasticity  $\eta$ , is

$$E_0 \sum_{t=0}^{\infty} \beta_{hh}^t \left\{ (u_t(j))^{1-1/\varsigma} + \psi_a T_t^{1-1/\varsigma} \log(a_t(j)) \right\}, \quad u_t(j) = c_t(j) - \nu c_{t-1} - \psi_h T_t \frac{h_t(j)^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}}, \quad (1)$$

where consumption is a CES aggregate over goods varieties with elasticity of substitution  $\theta_p$ . The corresponding utility-based price index is  $P_t$ . The steady state intertemporal elasticity of substitution in consumption associated with these preferences is  $\varsigma \bar{u}/\bar{c}$ .

As in Schmitt-Grohé and Uribe (2004), each household  $j$  is the monopolistically competitive producer of one variety of intermediate goods, and as such sets the price of variety  $j$ ,  $P_t(j)$ , to maximize the difference between nominal sales revenue  $P_t(j)y_t(P_t(j)/P_t)^{-\theta_p}$  and costs. The production function is  $y_t(j) = (S_t^a T_t H_t(j))^{1-\alpha} (K_{t-1}(j))^\alpha$ , where  $S_t^a$  is a mean 1 first-order autoregressive process with iid normal error terms that represent shocks to technology,  $(S_t^a - 1) = \rho_a (S_{t-1}^a - 1) + \varepsilon_t^a$ . Nominal costs consist of wage payments  $W_t^{pr} H_t(j)$ , payments to capital  $R_t^k K_{t-1}(j)$ , and quadratic price adjustment costs  $G_{P,t}(j) = (\phi_p/2) P_t y_t (P_t(j)/P_{t-1}(j) - \bar{\pi})^2$ , where  $\bar{\pi}$  is the central bank's inflation target.

Household  $j$  also produces and accumulates the physical capital stock  $k_t(j)$ , which depreciates at the rate  $\Delta$ , subject to investment adjustment costs. The nominal after-tax return to capital is given by  $Ret_{k,t} = [(1 - \Delta) Q_t + R_t^k - \tau_{k,t} (R_t^k - \Delta Q_t)] / Q_{t-1}$ , where  $Q_t$  is Tobin's  $q$  and  $\tau_{k,t}$  is the capital income tax rate. Capital accumulation is  $k_t(j) = (1 - \Delta) k_{t-1}(j) + S_t^i I_t(j) - S_t^i I_t \phi_i / 2 (I_t(j) / (x I_{t-1}(j)) - 1)^2$ , where  $S_t^i$  is a mean 1 first-order autoregressive process with iid normal error terms that represent shocks to the marginal efficiency of investment,  $(S_t^i - 1) = \rho_i (S_{t-1}^i - 1) + \varepsilon_t^i$ .

#### 3.1.2. Deposits-in-Advance Constraints

Household  $j$  faces deposits-in-advance constraints  $\varkappa_k D_t^k(j) \geq S_t^{mon} 4 P_t I_t(j)$ ,  $\varkappa_y D_t^y(j) \geq S_t^{mon} 4 (W_t^{pr} H_t(j) + R_{k,t} K_{t-1}(j))$ ,  $\varkappa_c D_t^c(j) \geq S_t^{mon} 4 P_t c_t(j) (1 + \tau_{c,t})$ , and  $\varkappa_a D_t^a(j) = S_t^{mon} P_t^a a(j)$ ,

where  $\varkappa_x$  are velocity coefficients, the factor 4 annualizes quarterly flows,  $\tau_{c,t}$  is the consumption tax rate,  $P_t^a$  is the price of land, and  $S_t^{mon}$  is a mean 1 first-order autoregressive process with iid normal error terms that represent shocks to money demand. We verify that these constraints always bind in equilibrium. Their multipliers in the household optimization problem are  $\mathfrak{m}_t^x(j)$ . In order to satisfy their demand for deposits, households need to obtain bank loans. In doing so they are subject to small adjustment costs  $G_{L,x,t}(j) = L_{x,t}(j) \frac{\phi_\ell}{2} (\ell_{x,t}(j) - \ell_{x,t-1})^2$ .

### 3.1.3. Participation Constraints

Households face bank participation constraints when taking out bank loans. They have the general form  $\mathbb{E}_t [S_t^{cred} \kappa_x O_{x,t}(j) (\Gamma_{x,t+1} - \xi_x G_{x,t+1}) - i_{\ell,x,t} L_{x,t}(j)] = 0$ , with multipliers  $\Lambda_t^{hh}(j) \tilde{\lambda}_{x,t+1}(j)$ , where  $\Lambda_t^{hh}(j)$  is the multiplier of the nominal household budget constraint. The expressions  $O_{x,t}(j)$  represent total available sectorial collateral, with  $O_{k,t}(j) = Ret_{k,t+1} Q_t k_t(j)$ ,  $O_{y,t}(j) = 4P_t y_t$ ,  $O_{c,t}(j) = 4W_t^{hh} h_t (1 - \tau_{L,t})$ ,  $O_{a,t}(j) = Ret_{a,t+1} P_t^a a_t(j)$ .<sup>10</sup> The terms  $\xi_x G_{x,t+1}(j)$  denote banks' endogenous monitoring cost shares in gross returns to collateral, the terms  $S_t^{cred} \kappa_x$  are the shares, net of haircuts, of total collateral value accepted as loan security by banks, and  $S_t^{cred}$  is a shock to credit supply that can include news shocks,  $S_t^{cred} = S_{1,t}^{cred} S_{2,t}^{cred}$ ,  $S_{1,t}^{cred} - 1 = \sum_{i=0}^{12} \varepsilon_{t-i}^{news}$ ,  $(S_{2,t}^{cred} - 1) = \rho_{cred} (S_{2,t-1}^{cred} - 1) + \varepsilon_t^{cred}$ .

### 3.1.4. Budget Constraint

The simplified<sup>11</sup> representative household's flow budget constraint is

$$\begin{aligned} & \Sigma_x D_t^x(j) (1 + \phi_b (b_t^{rat} - \bar{b}_{ss}^{rat})) + P_t^a a_t(j) + Q_t k_t(j) - \Sigma_x L_t^x(j) + \Sigma_x G_{L,x,t}(j) - \Psi_t^{hh}(j) \quad (2) \\ = & \Sigma_x i_{d,t-1} D_{t-1}^x(j) + Ret_{a,t} P_{t-1}^a a_{t-1}(j) \left(1 - S_{t-1}^{cred} \kappa_a \Gamma_{a,t}\right) + Ret_{k,t} Q_{t-1} k_{t-1}(j) \left(1 - S_{t-1}^{cred} \kappa_k \Gamma_{k,t}\right) \\ & - 4W_{t-1}^{hh} h_{t-1} (1 - \tau_{L,t-1}) S_{t-1}^{cred} \kappa_c \Gamma_{c,t} - 4P_{t-1} y_{t-1} S_{t-1}^{cred} \kappa_y \Gamma_{y,t} \\ & + \tau_{L,t} \varpi^h W_t^{hh} h_t + \tau_{k,t} \varpi^k (R_t^k - \Delta Q_t) k_{t-1} \\ & - P_t c_t(j) (1 + \tau_{c,t}) + W_t^{hh} h_t(j) (1 - \tau_{L,t}) + \Omega_t(j) + \Pi_t^M(j) + \Pi_t^K(j). \end{aligned}$$

**Portfolio costs:** On the first line of (2), the term  $\phi_b (b_t^{rat} - \bar{b}_{ss}^{rat})$ , where  $b_t^{rat} = B_t / (4GDP_t)$  is the government debt-to-GDP ratio and  $\bar{b}_{ss}^{rat}$  is its initial steady state, represents transactions costs related to holdings of financial assets. This cost is taken as exogenous by households, and  $\Psi_t^{hh}(j)$  includes its lump-sum redistribution (it also includes lump-sum redistribution of loan adjustment costs). This allows the model to replicate the small but positive elasticity of US real interest rates with respect to defaultable government debt that has been found in the empirical literature. Interest

<sup>10</sup>Note the absence of the index  $j$  in the expressions for working capital and consumer loans. The interpretation is that firms and households cannot make the value of their flow collateral increase by promising higher individual effort. They can therefore only pledge the income of an average firm or household.

<sup>11</sup>See the Online Appendix for the derivation.

rates on all financial assets are affected in the same fashion, so that a change in the government debt-to-GDP ratio will affect the level of interest rates but not the structure of spreads.

**Credit:** On the second and third lines of (2), households' returns to land, capital, work, and production exclude returns that serve to repay loans, where  $\Gamma_{x,t}(j)$  are the endogenous shares of accepted collateral that go to banks to repay loans.

**Taxation:** To accurately account for both incentive and budgetary effects of income taxes, the model distinguishes between marginal and average tax rates on labor and capital. The marginal tax rates are  $\tau_{L,t}$  and  $\tau_{k,t}$ . The average tax rates are determined by tax exemptions for inframarginal income  $\varpi^h$  and  $\varpi^k$ , which are taken as given by households and therefore do not affect their decisions. The fourth line of (2) shows the lump-sum rebates of labor and capital income tax exemptions.

**Other income and expenditures:** The fifth line of (2) shows gross (of taxes) consumption purchases, net (of taxes) labor income, lump-sum net income  $\Omega_t(j)$ , and net profits from manufacturing  $\Pi_t^M(j)$  and from capital production  $\Pi_t^K(j)$ .  $\Omega_t(j)$  includes the dividends of banks, bond investors and unions, net fiscal transfers, and a share  $1 - \mathfrak{r}$  of borrower and bank monitoring costs  $\mathcal{M}_t$ . The remaining share  $\mathfrak{r}$  is a real resource cost.

### 3.1.5. Optimality Conditions

The first-order conditions for consumption of individual goods varieties, hours worked, and the Phillips curve are standard. In the optimality conditions for aggregate consumption, investment, land, hours hired, and capital hired, the effective price exceeds the direct purchase price by a mark-up due to monetary frictions,  $\tau_{x,t}^{mon} = \mathbf{m}_{x,t} S_t^{mon} 4$ ,<sup>12</sup> where the multipliers  $\mathbf{m}_{x,t}$  of the deposits-in-advance constraints are decreasing in the quantity of deposits. The distortion is a shortage of deposit money relative to the Friedman rule, a shortage that can never be completely eliminated because the cost of creating bank deposits can never go to zero, due to a combination of bank market power, monitoring costs, and regulation. There is an equivalence in Euler equations between distortionary fiscal tax rates and these mark-ups, which will therefore be referred to as money tax rates. The first-order conditions for capital and land feature additional terms related to their use as loan collateral, and the latter condition also features the marginal utility of land. In the first-order conditions for deposits, the asset return includes both a gross financial or interest rate yield and a net nonfinancial or convenience yield  $\mathbf{m}_t^x \mathfrak{x}_x$ . The first-order conditions for loans feature loan adjustment cost terms as well as the returns  $r_{\ell,t+1}^x \tilde{\lambda}_t^x$ , where  $r_{\ell,t+1}^x$  are real wholesale lending rates, and the multipliers  $\tilde{\lambda}_t^x$  are increasing in the tightness of banks' participation constraints. See the Online Appendix for the full set of optimality conditions.

---

<sup>12</sup>The factor 4 is absent in the condition for land.

## 3.2. Banking Sector

### 3.2.1. Wholesale Banks

Wholesale banks have unit mass and are indexed by  $j$ . They are ex-ante identical in terms of ratios of assets and liabilities to net worth, while they may differ in terms of the size of net worth. They issue wholesale loans  $L_t(j) = \Sigma_x L_t^x(j)$  at interest rates  $i_{\ell,t}^x$  to retail lending banks<sup>13</sup>, hold government bonds  $B_t^{bk}(j)$  that pay an interest rate  $i_{b,t}$ , and issue wholesale deposits  $D_t(j)$  at an interest rate  $i_t$  to retail deposit banks. Their net worth equals  $N_t^{bk}(j) = L_t(j) + B_t^{bk}(j) - D_t(j)$ . Their holdings of government bonds equal a fixed fraction of total assets.

Gross assets are subject to lognormally distributed idiosyncratic shocks  $\omega_{t+1}^{bk}$  with mean 1 and variance  $(\sigma^{bk})^2$  that represent shocks to banks' non-interest earnings, and that give rise to ex-post differences across banks in terms of capital adequacy. We denote the pdf and cdf of these shocks by  $f^{bk}(\omega_{t+1}^{bk})$  and  $F^{bk}(\omega_{t+1}^{bk})$ , the cutoff productivity shocks below which minimum capital adequacy rules (MCAR) are breached ex-post by  $\bar{\omega}_t^{bk}$ , and we define  $f_t^{bk} = f^{bk}(\bar{\omega}_t^{bk})$  and  $F_t^{bk} = F^{bk}(\bar{\omega}_t^{bk})$ .

MCAR limit wholesale banks' ability to create credit and money. Bank  $j$  faces a future penalty<sup>14</sup> of  $\chi \frac{P_{t+1}}{P_t} (L_t(j) + B_t^{bk}(j))$  if next period's net worth falls short of a fraction  $\Upsilon$  of risk-weighted assets. Net worth equals the difference between the gross returns on asset-side and liability-side items, plus net profits of retail deposit banks  $\Pi_{t+1}^d(j)$ , minus net losses of retail lending banks  $\Lambda_{t+1}^{bk}(j)$ . The regulatory risk weights on loans and government bonds equal  $\zeta_x$  and 0. Post-dividend net worth equals the same expression minus dividends that equal a fixed fraction of net worth, and that are paid out to households in a lump-sum fashion, a specification that can be obtained by applying the "extended family" approach of Gertler and Karadi (2011). Banks' total steady state equity ratio  $\tilde{\Upsilon}$  exceeds the minimum requirement  $\Upsilon$  in equilibrium, in order to provide a buffer against adverse shocks that could trigger penalties.

Net worth maximization involves taking first-order conditions with respect to all four loan classes, taking interest rates as given. Expected net worth includes the penalty payable in case of an MCAR breach, weighted by the probability of a breach. First-order conditions contain spreads, between wholesale lending rates  $i_{\ell,t}^x$  and the policy rate  $i_t$ , that price the fact that at the margin an additional loan increases the penalty payable in case of a breach. The size of this spread depends on the size of the MCAR ( $\Upsilon$ ), the risk weight ( $\zeta_x$ ), the penalty payable in case of a breach of the MCAR ( $\chi$ ), and the likelihood of a breach given the riskiness of banks ( $F_{t+1}^{bk}$  and  $f_{t+1}^{bk}$ ).

### 3.2.2. Retail Deposit Banks

Retail deposit banks have unit mass and are indexed by  $j$ . They finance the acquisition of wholesale deposits by issuing deposit varieties  $D_t^{hh}(j) = \Sigma_x D_t^x(j)$  to households and  $D_t^{bi}(j)$  to

<sup>13</sup>Wholesale lending rates can be interpreted as the rates that banks would charge to riskless borrowers.

<sup>14</sup>Furfine (2001) and van den Heuvel (2005) contain a list of such penalties, according to the Basel rules or to national legislation, such as the U.S. Federal Deposit Insurance Corporation Improvement Act of 1991.

bond investors. They behave as monopolistic competitors towards retail holders, and they have significantly more market power vis-à-vis households than bond investors. The pricing rules are  $i_{d,t} = \mu_d^{hh} i_t$  and  $i_{v,t} = \mu_d^{bi} i_t$  for household and bond investor deposits, with markdown terms  $\mu_d^{hh}$  and  $\mu_d^{bi}$  that are smaller than 1. The profits of retail deposit banks equal  $\Pi_{t+1}^d(j) = (i_t - i_{d,t}) D_t^{hh}(j) + (i_t - i_{v,t}) D_t^{bi}(j)$ .

### 3.2.3. Retail Lending Banks

Retail lending banks are modelled using a modified version of Bernanke et al. (1999). There are four retail lending bank sectors, who each have unit mass and whose household borrowers are indexed by  $j$ . Retail lending banks are homogenous, and each bank lends, against the security of collateral, the same amount to a borrower  $j$ . At the beginning of period  $t + 1$  each borrower draws an idiosyncratic shock  $\omega_{t+1}^x$  to the value of that collateral. The shock is log-normally distributed with mean 1 and variance  $\sigma_x^2$ , with pdf and cdf  $f^x(\omega_{t+1}^x)$  and  $F^x(\omega_{t+1}^x)$ . Each borrower receives a standard debt contract from the bank, which specifies a nominal loan amount  $L_t^x(j)$ , the percentage  $\kappa_x S_t^{cred}$  of total collateral value against which the bank is willing to lend, and a gross nominal retail rate of interest  $i_{r,t}^x$  to be paid if  $\omega_{t+1}^x$  is sufficiently high to rule out default. Default becomes optimal ex-post if  $\omega_t^x < \bar{\omega}_t^x$ , and we let  $f_t^x = f^x(\bar{\omega}_t^x)$  and  $F_t^x = F^x(\bar{\omega}_t^x)$ . Retail lending banks' cost of funding are the wholesale lending rates  $i_{\ell,t}^x$ , while their retail lending rates  $i_{r,t}^x$  are pre-committed in period  $t$ , rather than being determined in period  $t + 1$  after the realization of time  $t + 1$  aggregate shocks, as in Bernanke et al. (1999) and Christiano et al. (2014).<sup>15</sup> The latter assumption ensures zero ex-post profits for banks at all times, while under our debt contract banks make zero expected profits, but realized ex-post profits generally differ from zero, and banks need positive net worth to absorb negative shocks to profits without violating MCAR. In case of default, because of monitoring costs, the bank can only recover a fraction  $1 - \xi_x$  of the value of collateral. The remaining fraction represents monitoring costs, of which a fraction  $\tau$  represents a real resource cost, while the remainder is paid out to households lump-sum. Due to monitoring costs there is a risky spread between retail and wholesale lending rates. The participation constraints for retail loans equate wholesale interest charges (the opportunity cost of the loan) to the sum of the contractual retail interest income on loans to borrowers whose idiosyncratic shock exceeds the cutoff level, and the amount collected in case of borrower bankruptcy. In other words, the bank will set  $i_{r,t}^x$  such that its expected gross share in the earnings of the underlying collateral is sufficient to cover monitoring costs and the opportunity cost of the loan. The borrower is left with a share  $1 - \Gamma_{x,t}$  of the asset's earnings.

---

<sup>15</sup>In Bernanke *et al.* (1999): "... conditional on the ex-post realization of  $R_{t+1}^k$ , the borrower offers a (*state-contingent*) *non-default* payment that guarantees the lender a return equal in expected value to the riskless rate."

### 3.3. Bond Investors

Bond investors have unit mass and are indexed by  $j$ . They represent the domestic wholesale bond and money markets, by holding domestic government bonds  $B_t^{bi}(j)$  that pay the nominal interest rate  $i_{b,t}$  and wholesale deposits  $D_t^{bi}(j)$  that pay the nominal interest rate  $i_{v,t}$ . The nominal budget constraint exhibits the same portfolio costs as households. Bond investors transfer part of their net interest earnings to households as lump-sum dividends  $\Pi_t^{bi}(j)$ , subject to dividend smoothing modelled as external habit persistence. The objective function for bond investor  $j$  is

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_{bi}^t \left\{ \left(1 - \frac{\nu}{x}\right) \log \left( \check{\Pi}_t^{bi}(j) - \frac{\nu}{x} \check{\Pi}_{t-1}^{bi} \right) + \varepsilon \frac{\left( \frac{b_t^{bi}(j)}{T_t} \right)^{1-\vartheta}}{1-\vartheta} \right\}, \quad (3)$$

where  $\beta_{bi}$  differs from  $\beta_{hh}$ . Bonds in the utility function allow us to calibrate the model to represent the highly interest-sensitive nature of wholesale money markets. The optimality condition for government bonds features a small convenience yield as in Krishnamurthy and Vissing-Jorgensen (2012).

### 3.4. Unions

Unions have unit mass and are indexed by  $j$ , where individual unions differ by the labor variety they sell. Unions buy homogenous labor from households at a competitively determined nominal wage rate  $W_t^{hh}$ . They set the price of their labor variety  $W_t^{pr}(j)$  subject to monopolistic competition and quadratic wage adjustment costs  $G_{W,t}(j) = (\phi_w/2) W_t^{pr} h_t (W_t^{pr}(j)/W_{t-1}^{pr}(j) - \bar{\pi}x)^2$ . Employers demand a CES composite of labor varieties with elasticity of substitution  $\theta_w$ . The optimization problem yields a familiar New Keynesian wage Phillips curve. Unions are owned by households, to whom their profits are transferred in lump-sum fashion.

### 3.5. Government

#### 3.5.1. Monetary Policy

Monetary policy is described by a conventional forward-looking Taylor rule with interest rate smoothing<sup>16</sup>

$$i_t = (i_{t-1})^{i_i} \left( \frac{x\bar{\pi}}{\beta_{bi}\mu_d^{bi}} \right)^{(1-i_i)} \left( \frac{\pi_{t+1}^p}{\bar{\pi}} \right)^{(1-i_i)i_\pi}. \quad (4)$$

#### 3.5.2. Fiscal Policy

The nominal government budget constraint is

$$B_t^{gov} = i_{b,t-1} B_{t-1}^{gov} + P_t g_t + P_t tr f_t - P_t \tau_t. \quad (5)$$

---

<sup>16</sup>The steady state real interest rate follows from the optimality conditions for wholesale deposits of bond investors and retail deposit banks.



Real government spending is  $g_t = s_g \overline{gdp}$ , real lump-sum transfers are  $trf_t$ , and tax revenue is raised through three distortionary taxes,  $P_t \tau_t = \tau_{c,t} P_t c_t + \tau_{L,t} (1 - \varpi^h) W_t^{hh} h_t + \tau_{k,t} (1 - \varpi^k) (R_{k,t} - \Delta Q_t) k_{t-1}$ . A fiscal rule stabilizes the deficit-to-GDP ratio  $gd_{b,t}^{rat} = 100(B_t - B_{t-1})/GDP_t$ :

$$gd_{b,t}^{rat} = \overline{gd_b^{rat}} - d^b (b_t^{rat} - \bar{b}_{ss}^{rat}) . \quad (6)$$

### 3.6. Market Clearing

The labor, capital, and land market clearing conditions are  $h_t = H_t$ ,  $k_t = K_t$ , and  $a_t = a$ , where  $a$  is the fixed and exogenous supply of land. The bond market clearing condition is  $B_t^{gov} = B_t^{bi} + B_t^{bk}$ . Finally, the goods market clearing condition is  $y_t = c_t + I_t + g_t + \mathfrak{r} \mathcal{M}_t$ , and  $gdp_t = c_t + I_t + g_t$ .

## 4. The Model: Post-Transition

The preferences, technologies and calibration of the pre-transition and post-transition economies are almost completely identical, with the exceptions discussed below. The transition takes place in a single period, and in this period budget constraints contain large one-off balance sheet changes. We therefore introduce a dummy parameter that will be set to  $\mathfrak{d} = 1$  in the transition period, and to  $\mathfrak{d} = 0$  in all subsequent periods.

### 4.1. Banks

The key requirement of the Chicago Plan is for banks to back 100% of their deposits  $D_t$  by government-issued reserves  $M_t$  rather than by loans and debt securities. This implies that banks are split into two groups with different functions.

*Money banks* correspond to the retail deposit banks of the pre-transition model. The government issues reserves at the policy interest rate  $i_t$ , and government-owned retail-facing money banks issue retail deposits at the two policy-determined retail interest rates  $i_{d,t}$  and  $i_{v,t}$ , passing the profits  $\Pi_t^d$  on to the government budget.<sup>17</sup> Given the default-free nature of reserves, money banks require no equity, and we have

$$M_t = D_t . \quad (7)$$

*Credit banks* correspond to the wholesale banks and retail lending banks of the pre-transition model. Retail credit banks continue to make retail investment loans against the collateral of the physical capital stock, using the same credit supply or haircut parameter  $\kappa_k$  as in the pre-transition period. Wholesale credit banks finance their stock of wholesale loans through a combination of equity  $N_t^{bk}$  and treasury credit  $F_t$ . The interest rate on treasury credit  $i_{f,t}$  is policy-determined.

Conceptually, the transition to the new balance sheets of money banks and credit banks takes place in three stages inside the transition period  $t$ . First, banks increase their reserve backing for

---

<sup>17</sup>An equivalent set-up is for the government to directly issue retail deposits.

deposits from 0% to 100%, by borrowing from the treasury, so that  $F_t^1 = M_t = D_t$ . Money banks are now separated from credit banks, and the treasury holds large treasury credit claims against credit banks. Second, the government repays all government debt on credit banks' balance sheets using its treasury credit balances, so that  $F_t^2 = F_t^1 - B_{t-1}^{bk}$ . Third, the government distributes treasury credit balances equal to the principal of mortgage, consumption, and working capital loans to households as a citizens' dividend, and households use them to repay those loans, so that  $F_t^3 = F_t^2 - L_{t-1}^a - L_{t-1}^c - L_{t-1}^y$ .<sup>18</sup> Net interest charges from the previous period remain the responsibility of the respective borrowers. The final balance sheet, letting  $F_t = F_t^3$ , is

$$L_t^k = F_t + N_t^b . \quad (8)$$

Wholesale credit banks' optimality condition for investment loans takes the same form as before, but in this case it determines the spread between the wholesale lending rate  $i_{\ell,t}^k$  and the rate on treasury credit  $i_{f,t}$  rather than the rate on reserves  $i_t$ . The net worth accumulation of wholesale credit banks features a one-off equity payout  $\Delta_t^{nw} = N_{t-1}^{bk} - \tilde{Y} L_t^k$ . The reason is that, after a large portion of their loans is repaid, their MCAR equity requirements drop significantly.

## 4.2. Households

Household preferences are unchanged. The new household budget constraint is

$$\begin{aligned} & \Sigma_x D_t^x(j) (1 + \phi_b (b_{net,t}^{rat} - \bar{b}_{ss}^{rat})) + P_t^a a_t(j) + Q_t k_t(j) - L_t^k(j) + G_{L,k,t}(j) - \Psi_t^{hh}(j) \quad (9) \\ = & \Sigma_x i_{d,t-1} D_{t-1}^x(j) + Ret_{a,t} P_{t-1}^a a_{t-1}(j) + Ret_{k,t} Q_{t-1} k_{t-1}(j) \left(1 - S_{t-1}^{cred} \kappa_k \Gamma_{k,t}\right) \\ & + \tau_{L,t} \varpi^h W_t^{hh} h_t + \tau_{k,t} \varpi^k (R_t^k - \Delta Q_t) k_{t-1} \\ & - P_t c_t(j) (1 + \tau_{c,t}) + W_t^{hh} h_t(j) (1 - \tau_{L,t}) + \Omega_t(j) + \Pi_t^M + \Pi_t^K \\ & - \mathfrak{d} \left( i_{\ell,t-1}^a L_{t-1}^a(j) + i_{\ell,t-1}^c L_{t-1}^c(j) + i_{\ell,t-1}^y L_{t-1}^y(j) \right) + \mathfrak{d} \Delta_t^{nw} + \mathfrak{d} \Delta_t^{citdiv} . \end{aligned}$$

The terms on the last line apply to the transition period. First, households pay the gross interest due on mortgage, consumer, and working capital loans. Second, they receive the dividend payout  $\Delta_t^{nw}$  from credit banks. Third, they receive a citizens' dividend from the government,  $\Delta_t^{citdiv} = M_t - F_t + B_t^{gov} - i_{b,t-1} B_{t-1}^{gov}$ , where  $M_t$  represents one-off government seigniorage income,  $F_t$  represents the part of  $M_t$  being lent out to credit banks, and  $B_t^{gov} - i_{b,t-1} B_{t-1}^{gov}$  represents the part of  $M_t$  being spent on repayment of bank-held government securities. The ratio  $b_t^{rat}$  in the interest rate premium on financial assets is now everywhere replaced by  $b_{net,t}^{rat} = (B_t^{gov} - \varpi F_t) / (4GDP_t)$ , where  $\varpi$  is the weight that investors attach to government assets vis-à-vis the private sector in computing net government debt.

---

<sup>18</sup>If households did not repay the loans, their net debt would nevertheless decline by the citizens' dividend.

### 4.3. Monetary Policy

Under the Chicago Plan, different combinations of policy rules are feasible. We have found that the following combination is highly efficient at stabilizing the economy: The government controls the level of interest rates and thereby intertemporal substitution through the interest rate on reserves  $i_t$ , the price of credit through  $i_{f,t}$ , the opportunity cost of money through  $i_{d,t}$  and  $i_{v,t}$ , and the quantity of wholesale money through  $M_t^{whs} = D_t^{bi}$ . Control over the size and velocity of circulation of the retail money stock is shared between the government, through its control over the price of treasury credit, and credit banks, through their control over collateral assessments and haircuts. Credit banks remain in complete control over the allocation of money among different borrowers. There is therefore nothing in these monetary arrangements that interferes with the efficient private allocation of capital.

**Primary Policy Rule:** Policy continues to control the primary policy rule or Taylor rule (4), but the steady state nominal interest rate now equals  $(\bar{\pi} (1 + \phi_b (\bar{b}_{net,ss}^{rat} - \bar{b}_{ss}^{rat}))) / (\beta_{bi} \tilde{\mu}_d^{bi})$ . The change in the numerator is due to the permanent reduction in the steady state real interest rate due to lower debt. The change in the denominator is due to the fact that wholesale deposit rates are not determined by private banks but by public policy (see (11) below).

**Public Money Rules:** The policy rules for public money are

$$i_{d,t} = \tilde{\mu}_d^{hh} i_t \left( \frac{gdp_t}{\overline{pot}} \right)^{-(m_y/4)}, \quad (10)$$

$$i_{v,t} = \tilde{\mu}_d^{bi} i_t, \quad (11)$$

$$\frac{\tilde{m}_t^{whs}}{\overline{gdp_t}} = \frac{\bar{m}^{whs}}{\overline{gdp}}, \quad (12)$$

where  $\overline{gdp}$  and  $\overline{pot}$  are steady state GDP in the pre-transition and post-transition economies. The first two conditions replace the retail deposit bank optimality conditions  $i_{d,t} = \mu_d^{hh} i_t$  and  $i_{v,t} = \mu_d^{bi} i_t$  of the pre-transition economy. The target spreads  $\tilde{\mu}_d^{hh}$  and  $\tilde{\mu}_d^{bi}$  are chosen by policy. The countercyclical element of the retail deposit spread reduces the retail deposit rate relative to the reserves rate in a boom, thereby reducing retail money balances and through this economic activity. For wholesale deposits, the policymaker can control both the interest rate spread  $i_t/i_{v,t}$ , which is very small and assumed to be held constant, and the ratio of these deposits relative to GDP, which is assumed to be held constant at the pre-transition ratio. The latter ensures that wholesale deposits grow in line with the large post-transition output growth. Countercyclical terms can be added to (11) and (12), but unlike the countercyclical term in (10) they can be shown to not have significant beneficial effects.

**Public Credit Rule:** The policy rule for public credit is

$$i_{f,t} = \tilde{\mu}_f i_t \left( \frac{gdp_t}{\overline{pot}} \right)^{(f_y/4)}. \quad (13)$$

The target spread  $\tilde{\mu}_f$  can be chosen by policy. The countercyclical element increases the treasury credit rate relative to the primary policy rate in a boom, thereby reducing credit and through this economic activity.

**Inflation Target Rule:** Our simulation includes a gradual transition to a zero inflation steady state, through a time varying inflation target  $\bar{\pi}_t$  that follows the rule

$$\bar{\pi}_t = (1 - \rho_{\bar{\pi}}) + \rho_{\bar{\pi}} (\mathfrak{d}\pi_{t-1}^p + (1 - \mathfrak{d})\bar{\pi}_{t-1}) . \quad (14)$$

Here the long-run inflation target experiences a step change at the time of transition. This ensures that the gross inflation target gradually drops from  $\pi_{t-1}^p$  to its assumed zero-inflation long-run target of 1.

#### 4.4. Fiscal Policy

The nominal government budget constraint is

$$B_t^{gov} + M_t - F_t = i_{b,t-1}B_{t-1}^{gov} + i_{t-1}M_{t-1} - i_{f,t-1}F_{t-1} + P_t g_t + P_t trf_t - P_t \tau_t - \Pi_t^d + \mathfrak{d}\Delta_t^{citdiv} . \quad (15)$$

There are four new items relative to the pre-transition economy, net inflows due to money issuance  $M_t - i_{t-1}M_{t-1}$ , net outflows due to treasury credit issuance  $F_t - i_{f,t-1}F_{t-1}$ , profits of public money banks  $\Pi_t^d$ , and one-off spending on the citizens' dividend  $\mathfrak{d}\Delta_t^{citdiv}$ .

The fiscal rule to stabilize the deficit-to-GDP ratio needs to be modified to reflect the fact that the deficit now corresponds to  $gd_{bm,f,t}^{rat} = 100(B_{bm,f,t} - B_{bm,f,t-1})/GDP_t$ , where  $B_{bm,f,t} = B_t^{gov} + M_t - F_t$ . To emphasize that the reserve part of government financing does not represent debt but rather sovereign equity, we will henceforth refer to  $B_{bm,f,t}$  as government financing. We have

$$gd_{bm,f,t}^{rat} = (1 - \mathfrak{d}) \left( \overline{gd_{bm,f}^{rat}} - d^b \left( b_{net,t}^{rat} - \overline{b_{net,ss}^{rat}} \right) \right) + \mathfrak{d}\Delta_t^{gd} . \quad (16)$$

To fix the deficit target in the transition period  $\Delta_t^{gd}$ , which experiences a large jump due to financial asset and liability stock changes, we exploit the steady state relationship between net-debt-to-GDP and quarterly net-deficit-to-GDP ratios and use the pre- and post-transition steady state values of  $\overline{b_{bm,f}^{rat}}$ ,  $\overline{b_{bm,f,pre}^{rat}}$  and  $\overline{b_{bm,f,post}^{rat}}$ , to obtain  $\Delta_t^{gd} = 4 \left( \overline{b_{bm,f,post}^{rat}} - \overline{b_{bm,f,pre}^{rat}} / (GDP_t / GDP_{t-1}) \right)$ .

In our transition simulation we assume that  $\tau_{L,t}$  is endogenized to make the fiscal rule hold, with  $\tau_{k,t}$  and  $\tau_{c,t}$  following it in proportional fashion,  $(\tau_{c,t} - \bar{\tau}_c) / \bar{\tau}_c = (\tau_{k,t} - \bar{\tau}_k) / \bar{\tau}_k = (\tau_{L,t} - \bar{\tau}_L) / \bar{\tau}_L$ . In our post-transition business cycle analysis we assume that  $trf_t$  is endogenized, with all distortionary tax rates held constant. This allows us to focus on the monetary aspects of the Chicago Plan over the business cycle.

### 5. Calibration

Our calibration of the steady state is based on the literature and on sample averages, where available, over the period 2010Q1-2019Q4.

**Real Sector:** Trend productivity growth, the CPI inflation target, and the steady state real interest rate on reserves are calibrated at 1.5%, 2% and 3% in annual terms.<sup>19</sup> For preferences of households, we fix the elasticity of labour supply at 1 and the intertemporal elasticity of substitution at 0.5. We normalize both the steady state labour supply and price of land to 1. For preferences of bond investors, we set their bonds preference parameters to obtain a steady state real interest rate spread on government bonds of -0.20% (equal to the average difference between the Federal Funds rate and the 3-month treasury bill rate), and an opportunity cost semi-elasticity of demand for government bonds of 250. The latter ensures small movements in the spread between the interest rates on reserves and government bonds even for large movements in relative holdings. For technologies, steady state gross markups are fixed at 1.1, in line with much of the literature. The share of transactions and adjustment costs that represent real resource costs is set to 50%. Based on US sample averages, we set the steady state labor income share to 59.4% and the ratios of investment and government spending to GDP to 17.3% and 19%.

**Fiscal Sector:** The steady state total government debt-to-GDP ratio is set to 75%, with 60% and 15% of GDP held by households and bond investors. For the elasticity of the real interest rate on government securities with respect to changes in the government debt-to-GDP ratio see footnote 2. Our calibration, at 2 basis points, is more conservative than the 4 basis points used by the IMF (2021, 2022) in its debt sustainability analysis. For taxes, based on the detailed analysis in Goodhart et al. (2021), we set the marginal tax rates on labor, capital and consumption to 25.1%, 34.4% and 3.4%, and the ratios to GDP of labor and capital income tax revenue to 11.2% and 3.5%. In the fiscal deficit rule, we set the coefficient on the debt gap to 0.25.

**Capital Adequacy Ratios:** The steady state capital adequacy ratio is set to 10.5% which is the sum of the 8.0% Basel III total capital ratio and the 2.5% capital conservation buffer (see Basel Committee on Banking Supervision (2017)). In practice banks hold capital considerably above the regulatory minimum. In our model they do so to self-insure against the risk of violating the MCAR. Based on data in Federal Reserve Bank of New York (2018), we therefore set the actual steady state capital ratio to 15.5%.

**Regulatory Non-Compliance and Bankruptcy Rates:** The cumulative share of banks that violate the Basel minimum in any quarter is set to 2.5% in steady state, close to the approximate historical frequency of systemic banking crises in Jorda et al. (2011). Borrower default rates are set based on FRED data for delinquency rates, and equal 1.45% for investment and working capital loans, 5.01% for real estate loans, and 2.58% for consumer loans.

**Interest Rates:** The system is anchored by fixing the equilibrium real interest rate at 3%. To calibrate the wholesale lending rate on investment loans we use a 2000-2016 data set produced by Anderson and Cesa-Bianchi (2020) of “maturity-adjusted credit spreads” (MACS) for listed non-

---

<sup>19</sup>In this paper we do not wish to study issues connected to the zero lower bound on interest rates.

financial US AAA-rated firms, to obtain a rate of 3.46%. Based on the Basel-III regulations, we set the risk-weight parameters to 50% for mortgages, 75% for consumer loans, 100% for working capital loans, and 90% for investment loans. With this, the other wholesale lending rates equal 3.41% for consumer loans, 3.33% for mortgages, and 3.49% for working capital loans. To calibrate the retail lending rate on investment loans we calculate the difference between Moody’s seasoned Baa corporate bond yield and the market yield on US treasury securities at 10-year constant maturity. Over the sample period this spread averaged 189 basis points, and added to 3.46% this yields an overall retail lending rate of 5.35%. For working capital loans, we use the difference between the prime loan rate plus 50 basis points and the effective Federal Funds rate. Over the sample period this spread averaged 362 basis points, which yields an overall retail lending rate of 6.62%. For mortgage loans, we use the difference between the 30-year fixed rate mortgage average interest rate and the market yield on US treasury securities at 10-year constant maturity. Over the sample period this spread averaged 169 basis points, and added to 3.33% this yields an overall retail lending rate of 5.02%. For secured consumer loans, we use the difference between the interest rate on 60-month auto loans and the effective Federal Funds rate. Over the sample period this spread averaged 425 basis points, which yields an overall retail lending rate of 7.25%. The steady-state spread between the rate on reserves and the retail deposit rate is calibrated at 150 basis points, for a real deposit rate of 1.5%. Pre-GFC average spreads between the US policy rate and the effective interest rate on household checking accounts (from FDIC data) equalled around 300 basis points.<sup>20</sup> However, in our model deposits include a much wider range of financial sector liabilities, including deposits which attract rates much closer to the policy rate. To approximate the average convenience yield of total financial sector liabilities to non-banks, we therefore calibrate this spread at 150 basis points. This is similar to Ashcraft and Steindel (2008), who compute, for 2006, a spread of 134 basis points between the average rate of US commercial banks’ portfolio of treasury and agency securities on the one hand and the average rate on their complete portfolio of liabilities on the other hand. The steady-state spread between the rate on reserves and the wholesale deposit rate is calibrated at 10 basis points, for a real wholesale deposit rate of 2.9%, based on historic LIBID spreads.

**Balance Sheets:** Based on FRED and BIS data for the sample period, total retail loans are calibrated at 150% of GDP, with credit to households and NPISHs at 80% of GDP and credit to non-financial corporations at 70% of GDP. For households, the data show commercial bank credit for various types of consumer loans at just under 10% of GDP. This leaves mortgages at 70% of GDP. For corporate loans, we are unable to distinguish between investment and working capital loans using data, and use a reasonable split of 50% of GDP for investment loans and 20%

---

<sup>20</sup>This spread has been significantly compressed during the ZLB period, but we do not consider this period to be representative of normal conditions in the banking sector.

of GDP for working capital loans. The steady state ratios to GDP of deposits are calibrated at 60% for consumption deposits, 20% for investment deposits, 20% for real estate deposits, and 20% for working capital deposits. The foregoing calibration leaves bond investor wholesale deposits to GDP ratio as a residual, at 28.3% of GDP. We calibrate investment loans leverage, which equals the ratio of investment loans to the difference between the value of capital and investment loans, at 68%, based on FRED data on debt as a percentage of net worth at historical cost of nonfinancial corporate business. We calibrate mortgage loans leverage, which equals the ratio of mortgage loans (70% of GDP) to the equity in land, at 72%, based on the result in Goodhart et al. (2021) that the stock of land equals around 250% of GDP, and the fact that according to the US census around a third of US land is owned free and clear.

**Adjustment Costs:** Adjustment cost parameters approximately match the estimation results in Cesa-Bianchi et al. (2023) and Kumhof et al. (2023). Price and wage stickiness parameters are  $\phi_p = \phi_w = 350$ , investment adjustment costs equal  $\phi_i = 0.78$ , and loan adjustment costs equal  $\phi_\ell = 0.00035$ .

**Policy Rules:** For the Taylor rule, we set coefficients to  $i_i = 0$  and  $i_\pi = 3.0$  for the transition simulation. For fiscal policy, we set  $d^b = 0.25$  throughout.

**Post-Transition Steady State:** For the post-transition economy, we assume that nearly all the main structural parameters remain identical to those of the pre-transition economy. The exceptions are mainly due to the fact that the sizes of post-transition balance sheets are very different, and that there are new policy parameters. The steady state value of the gross government debt-to-GDP ratio is, following the permanent repayment of the government debt held by the banking system, reduced from 75% to 60%, by adjusting the deficit target. The weight of treasury credit in the calculation of net government debt is set conservatively to 50%. The balance sheet of credit banks shrinks with the repayment of government debt and of three out of four loan classes, and we adjust policy and behavioral parameters so that the minimum and steady state actual capital adequacy ratios remain unchanged at 10.5% and 15.5%. The inflation target is gradually ( $\rho_{\bar{\pi}} = 0.9$ ) lowered from 2% to 0%. In the new interest rate rules, the steady state spreads of the interest rates on money are set to -1.5% for households and -0.1% for bond investors, identical to the pre-transition economy. The steady state spread of the interest rate on treasury credit is set to +0.5%.

## 6. Debt-Free Money and Growth: The Chicago Plan Transition

In this section we study the response of the pre-transition economy to the introduction of the Chicago Plan. For clarity of exposition we assume that the reform is introduced overnight. Figure 1, which was discussed in the introduction, shows the immediate impact on balance sheets, while Figure 2 shows the long-run transition for the principal economic variables.

In Figure 1, the immediate effect on banks is that both treasury credit and reserves increase by 148% of GDP. A portion of treasury credit equal to 15% of GDP is used to repay the government securities held by the banking sector, and another portion equal to 100% of GDP is distributed to households as a citizens' dividend, which is used to repay all mortgages, consumer loans, and working capital loans. The post-transition banking system balance sheet is then separated into money banks that provide the same amount of money as before the transition, and credit banks that provide much less credit because much less credit is needed.

The underlying assumption in this representative household model is that each household not only receives the same citizens' dividend but also has the same amount of debt. If instead this is only true on average, so that some household groups have smaller/larger debts than their citizens' dividend, then the effect is that these groups retain net claims/debts vis-à-vis banks. Banks' function of intermediating between heterogeneous net debtors and net creditors therefore remains. What disappears is banks' function of creating the money supply through debt, and as a result the overall amount of debt can be far smaller than before. An example may help to illustrate this. Assume that there are 5 household groups of identical population size that each have money demands equal to 30% of GDP, while their debts equal 50%, 40%, 30%, 20% and 10% of GDP. Assume that the government pays out the full amount of its 150% of GDP seigniorage gains to households on equal per capita terms. Then credit drops from 150% to 30% of GDP, so that only one fifth of the initial money supply can be attributed to intermediation between heterogeneous households, and four fifths to debt-based creation of the money supply.

Returning to our transition simulation, on the government's balance sheet money issuance adds government financing equal to 148% of GDP, but as discussed in the introduction money is not a debt of the consolidated government, but rather is much closer in nature to equity. The citizens' dividend is a charge against this equity that reduces it to 48% of GDP, while government debt net of remaining treasury credit equals 27% of GDP. The government's net debt to total assets ratio equals 36%, and its net debt to equity (reserves) ratio equals 56%. We emphasize that none of these transactions involves real resources, instead they represent a rearrangement of book assets and liabilities that turn a large share of the economy's debt into equity, with the sum of government and household net debts dropping by 148% of GDP, from 225% of GDP to 77% of GDP.

Figure 2 shows the full dynamic adjustment of the economy to the Chicago Plan over the first 100 quarters. In this figure the dotted lines, which jump in the transition period, represent the pre- and post-transition steady states, while the solid lines represent the actual dynamic adjustment paths.<sup>21</sup> The key balance sheet magnitudes are shown in the right column. Public money increases by 146% of GDP in the long run rather than 148% of GDP as in Figure 1, because of a decline in

---

<sup>21</sup>Several subplots of Figure 2 show a gap in the transition period. This applies to all flow variables that represent changes in financial stocks. The reason is that the latter exhibit large jumps in the transition period. Showing these values in the transition period would render the remaining values unreadable.



demand for real estate deposits after mortgage borrowing ceases. Public credit increases by 47% of GDP in the long run rather than 33% of GDP as in Figure 1, because Figure 1 abstracts from two additional effects. First, the dividend payout by banks equals 9% of GDP, and paid-out bank equity is then replaced by treasury credit. Second, investment loans increase by around 5% of GDP in the long run, which calls for a roughly equal increase in public credit. Government debt initially undershoots its long-run level by almost 10% of GDP. Steady state net debt, which as discussed above assigns only a 50% weight to the treasury credit offset, declines by 38.5% of GDP in the long run, which implies a 77 basis points reduction in steady state real interest rates.

As a result, the steady state real interest rate on reserves drops from 3% to 2.23%, with the steady state real interest rates on public credit and public money at 2.73% and 0.73%. The wholesale and retail interest rates on bank loans drop from 3.46%/5.35% to 2.86%/5.00%. The drop in wholesale rates is especially large because banks become much less risky, with the share of credit banks violating the MCAR dropping from 2.5% to around 0.5% per quarter. However, these very large drops in interest rates take time to be realized, because in the short run the Chicago Plan is highly expansionary and inflationary, and this triggers a response from the real primary policy rate, which in fact increases slightly over the medium term. Nominal interest rates drop by more than real interest rates as the inflation target is reduced from 2% to 0%. In this simulation we assume that the countercyclical elements of the new monetary policy interest rate toolkit remain unused,  $m_y = f_y = 0$ , to make the transition simulation easier to interpret.

The bottom row shows the budgetary consequences. In the long run, the government can afford to reduce its tax revenue by around 4% of GDP, due in roughly equal measure to a reduction in the interest cost of government financing and a relative drop in government spending on goods, services and transfers, which are assumed to grow at the 1.5% trend rate rather than the much higher actual growth rate during the transition. This permits a drop in labor income marginal tax rates from 25.1% to 19.2%, in capital income marginal tax rates from 34.4% to 26.3%, and in consumption tax rates from 3.4% to 2.6%. The two main reasons for the increase in GDP are therefore lower real interest rates and lower distortionary tax rates. But in addition monitoring costs drop from 1.3% to 0.5% of GDP, with half of that saving being resource costs. In the pre-transition economy extensive monitoring is required to facilitate the private creation of money at an acceptable risk to banks and society. When this is replaced by debt-free public money creation, a large share of these monitoring costs becomes unnecessary, and this saves resources.

The fiscal policy rule plays a key role in the short-run adjustment. We assume a debt response coefficient of  $d^b = 0.25$ , which permits transitory increases in deficits during the transition to the eventual steady state. The reduction in distortionary taxes is therefore initially mostly funded through deficits rather than through lower interest costs, which is later reversed when inflation falls. It can be shown that with  $d^b = 0$ , which permits no additional deficits, the adjustment

consists of almost immediate reductions in both distortionary tax rates and real interest rates, but at the cost of very long-lived deviations of public debt from its targeted level.

The combination of lower distortionary tax rates, lower real interest rates, and transactions cost savings is highly stimulative. Output grows by almost 17% in the long run, driven mainly by a 24% increase in investment, with consumption increasing by almost 20%. The corresponding welfare gain is 12%. We emphasize that, while these benefits are very large, we made conservative assumptions to arrive at them. First, we calibrated the sensitivity of real interest rates to net government debt levels at half the rate that the IMF (2021, 2022) uses in its debt sustainability analysis, and furthermore we have assumed that 50% rather than 100% of treasury credit is taken into account when calculating net debt levels. Second, we have assumed that banks no longer have recourse to the collateral stocks and flows that are released by the repayment of three of the four loan classes. For example, if they continued to have recourse to corporate sales revenue in addition to corporate physical capital, output gains would increase very significantly.

The Chicago Plan results in a large transfer of seigniorage gains from private to public creators of money. We can distinguish two complementary classes of seigniorage. The first class equals the interest savings on a given stock of money, specifically the difference between the risk-free interest rate on a non-monetary instrument  $i_t$  and the interest rates on different classes of money  $i_{d,t}$  and  $i_{v,t}$ , multiplied by the respective stocks of money. Total post-transition earnings from this type of seigniorage equal 1.8% of GDP, which is almost identical to the pre-transition earnings that accrue entirely to banks. The second class of seigniorage equals the revenue from the issuance of additional money, which becomes possible because the growth of both the price level and output combine to reduce the size of the money stock relative to GDP over time, making it possible for the government to issue additional money to keep the money stock constant relative to GDP without causing inflation. We find that the government is able to run almost the same deficit post-transition ( $gd_{bmf,t}^{rat}$ ) as pre-transition ( $gd_{b,t}^{rat}$ ), despite a zero instead of a 2% inflation rate and therefore the complete elimination of the inflation tax. The reason is that a 146% of GDP stock of public money in the presence of a 1.5% trend growth rate permits the ongoing non-inflationary issuance of new money worth around 2.2% of GDP.

We conclude that Fisher’s (1936) claims (1) through (3) regarding the Chicago Plan are fully validated by our model. First, public debts are reduced because of a large debt-to-equity swap, where equity includes public money following the legal and economic arguments in Kumhof et al. (2020). To reiterate, public money is equity-like mainly because it is non-defaultable and irredeemable – holders of public money cannot claim repayment of public money in something other than public money. This treatment of money versus debt is furthermore consistent with their treatment in the debt sustainability analysis of the IMF (2021, 2022). As a result of the debt-to-equity swap, government debt net of total treasury credit (weighted at 100%), which starts

at 75% of GDP, ends at 13% of GDP in the long run. The government’s net equity position, which is assumed to start at 0% of GDP, ends at 46% of GDP in the long run. The government’s balance sheet therefore becomes much stronger, its debt sustainability improves, and its credit risk declines. Second, private debts are reduced if the government decides to share part of its seigniorage gains by paying out a citizens’ dividend. The key is that in this economy money creation no longer requires simultaneous debt creation. A large share of pre-transition bank lending serves the purpose of mortgaging various types of assets and activities in order to create a private debt-based money supply at an acceptable risk to banks and society. This is not necessary, because providing a money supply can instead be done by the sovereign, debt-free, at much lower cost. This substitution of public “money-backed money” for private debt-backed money is what makes the citizens’ dividend, and thus the reduction of private debts, possible. Third, bank runs can be completely eliminated. Money banks cannot default on public money, and credit banks cannot default on public credit unless the government wants this to happen. Credit banks can still experience runs from remaining private creditors, but this risk can be minimized through additional regulations that we will discuss in Section 8. And even if a run on credit banks were to occur, this would have no implications for the safety of the payment system.

## 7. Stability: The Chicago Plan over the Business Cycle

The government, in order to maximize the effectiveness of its new (plus existing) policy tools over the business cycle, needs to choose an optimized combination of policy rules. We therefore evaluate the welfare properties of different monetary policy rule parameterizations by way of parameter grid searches. To do so we approximate both the model and welfare around the post-transition steady state to second order. Welfare gains are presented in terms of the Lucas (1987) compensating consumption variation (CCV). The results are presented in Figure 3. Because we wish to compare only the effects of different monetary regimes, fiscal policy is deliberately made as neutral as possible. Specifically, we maintain the fiscal debt feedback coefficient at  $d^b = 0.25$  but now assume that the budget is balanced through adjustments in lump-sum transfers. Optimized monetary policy rule parameters are indicated by a superscript asterisk. We find that welfare is always very flat in the Taylor rule interest rate smoothing coefficient  $i_i$ . For the search over the Taylor rule inflation coefficient, we impose a lower limit of  $i_\pi = 1.1$  to satisfy the Taylor principle,<sup>22</sup> and an upper limit of  $i_\pi = 3$  following Schmitt-Grohe and Uribe (2004), who impose this to limit instrument volatility. We find that the optimum is at the upper limit, but with only small additional increments beyond  $i_\pi = 2$ . For the output gap coefficients in the public credit and public money rules  $f_y$  and  $m_y$  we search over the range between 0 and 2. The upper limits again limit instrument volatility, and we again find that welfare surfaces become flat near these caps.

---

<sup>22</sup>We have verified that the Taylor principle does indeed hold in this economy.

Figures 4-6 illustrate the welfare results by comparing pre-transition and post-transition impulse responses to boom-bust cycles. We will show three types of boom-bust cycles, driven by exogenous shocks to banks' credit supply, to households' investment demand, and to technology. In each case the pre-transition response is shown in red and the post-transition response in black, and the pre-transition scenarios are normalized to feature a 5% expansion of GDP at the peak of the boom. For easier interpretation, we present balance sheet ratios in percent of steady state GDP rather than actual GDP.

## 7.1. Welfare

Figure 3 studies the welfare properties of different post-transition policy rule parameterizations. The baseline zero-welfare point of reference is the combination  $i_i = 0$ ,  $i_\pi = 1.1$ ,  $m_y = 0$ , and  $f_y = 0$ . In other words, the welfare measure equals zero when the Taylor rule only just satisfies the Taylor principle, and the two new rules set their countercyclical components to zero.

For a quantitatively realistic analysis, Figure 3 is based on shock standard errors and persistence parameters that approximately reproduce, in the pre-transition model and over the sample period 1990Q1-2019Q4, the standard errors of the detrended real growth rates of per capita GDP, its aggregate demand components, and domestic credit, the deviations of PCE inflation and the shadow Federal Funds rate (Wu and Xia (2016)) from trend, and the BAA corporate bond spread. In this economy, aggregate demand shocks account for 49% of the variance of output, aggregate supply shocks for 13%, and financial shocks for 38%. However, we will find that the particular shock decomposition does not matter for our qualitative conclusions on relative pre-transition and post-transition volatilities, which turn out to hold for every single shock.

We find that the overall constrained optimum is  $i_\pi^* = 3$ ,  $f_\ell^* = 0.84$ , and  $m_y^* = 0$  – the primary policy rule responds strongly to inflation, the public credit rule responds strongly to positive output gaps by making credit more expensive, while the public money rule does not respond to positive output gaps by making money more expensive to hold. During an output boom the interest rate on public money therefore remains at a fixed spread to the primary policy rate, while the interest rate on public credit rises significantly relative to the primary policy rate. These results hold for each shock individually, with the exception that for financial (credit supply, money demand) shocks there are further (but small) gains from having the public money rule respond to output gaps.

The welfare surfaces in Figure 3 vary two countercyclical parameters at a time while holding the remaining parameter fixed. In the left column, the remaining parameter is held fixed at its baseline value, so that the welfare value  $\zeta$  shown at the origin equals zero. In the right column, the remaining parameter is held fixed at its overall optimum value, so that the welfare value  $\zeta$  shown at the maximum equals the overall maximum (over the range studied).

The first row of Figure 3 studies the joint properties of the primary policy rule and the public money rule. We find that when the public credit rule is not active ( $f_y = 0$ ), both rules make substantial and roughly equal-sized contributions to improving welfare by becoming more countercyclical, as the CCV increases by just over 0.15% for each rule. But when the public credit rule is active and optimized ( $f_y^* = 0.84$ ), only the primary policy rule realizes welfare gains by becoming more countercyclical, with the optimum at  $i_i^* = 3.0$ , while welfare is now clearly declining in the public money rule, with the optimum at  $m_y^* = 0$ .

The second row of Figure 3 studies the joint properties of the primary policy rule and the public credit rule. As above, both rules make substantial contributions by becoming more countercyclical,<sup>23</sup> but in this case this of course remains true at the overall optimum. For the public credit rule the initial welfare increments when moving away from  $f_y = 0$  are especially large.

The third row of Figure 3 studies the joint properties of the public credit rule and the public money rule. When the Taylor rule is parameterized with a very weak response to inflation, both rules make substantial and roughly equal-sized contributions to welfare by becoming more countercyclical. But when the primary policy rule is set at its optimized value, this feature disappears, with welfare decreasing in  $m_y$  when  $f_y$  is set at its optimum.

In the following illustrative shock scenarios in Figures 4-6, we will calibrate the model with  $i_i = 0.5$ ,  $i_\pi = 2.0$  (to limit interest rate volatility and because the further gains from a more aggressive policy are small),  $f_y = 0.84$  and  $m_y = 0$ .

## 7.2. Credit Supply Shocks

In Figure 4, banks receive a succession of 12 quarterly “good news” shocks  $\varepsilon_t^{news}$  whereby they increase the share of the value of collateral against which they are willing to lend. In quarter 13 they suddenly reverse their assessment, not only discounting the previous “good news” but also perceiving an additional adverse shock  $\varepsilon_t^{cred}$ . This captures the notion of a credit boom in which banks initially provide easier credit, and the resulting economic boom creates the conditions that make that optimism look justified. But at some point the debt burdens become so large that nervousness sets in about ability to repay, and again the sharp contraction of credit creates the very conditions that justify the pessimism. We can think of this as an economy’s “Minsky moment” (Minsky (1986)).

In the pre-transition economy, bank loans grow by around 11% of steady state GDP over the initial boom period, and banks create the corresponding bank deposits to fund the additional lending. While some of these are wholesale deposits, retail deposits, which support increased economic activity, increase by over 7% of steady state GDP, and as a result, at the peak of the boom the effective price of consumption declines by more than 1%, GDP increases by 5% relative

---

<sup>23</sup>The contribution of the public credit rule is slightly larger.

to trend, the inflation rate exceeds its target by 2.1 percentage points, and the real policy rate rises by over 4 percentage points. Lending rates increase by similar magnitudes. The credit contraction by the end of the third year is very large, with bank loans and bank deposits dropping by around 7% of steady state GDP in a single quarter. This is despite a sharp drop in the primary policy interest rate which, while it succeeds in limiting the collapse in lending, cannot prevent a severe contraction in real activity, with output dropping by over 6%. The main conclusion is that, even with an aggressive interest rate policy, monetary policy in this economy cannot prevent a very large financial and real cycle, because banks' ability to create and destroy money is only affected very indirectly and weakly by the policy rate.

In the post-transition economy, credit and money are no longer directly linked via a single banking system balance sheet, and credit has become much smaller relative to GDP. This is one reason why, despite a much greater willingness of banks to lend, loans increase by only just over 2% of steady state GDP, and significantly less of actual GDP. The other reason is that the government raises the interest rate on public credit by around 1.25 percentage points to discourage excessive lending, and this feeds through to lending rates. As a result, output only rises by around 1% rather than 5%, while inflation only rises by around 0.3 rather than 2.1 percentage points. The Taylor rule, which has to be used heavily in the pre-transition economy to control the lending boom, with limited effectiveness, is therefore used much less, while the public credit rule becomes very important.

The final row of Figure 4 shows clearly how under the Chicago Plan, both in the boom and bust parts of the cycle, money is primarily created and destroyed through fluctuations in treasury credit, and through this in public money creation. During the boom banks borrow from the treasury at the public credit rate and lend to households. This process of public money creation can be seen in the government budget constraint, where  $B_{bmf,t} = B_t^{gov} + M_t - F_t$ . We observe that when  $\Delta F_t > 0$ , changes in  $B_t^{gov}$  are comparatively small, and they only directly affect the creation of wholesale deposits, as government bonds are only held by bond investors. Then the extension of public credit implies the creation of public money  $\Delta M_t > 0$ .

We conclude that Fisher's claim (4), that the Chicago Plan enables policymakers to respond much more effectively to credit-driven business cycles, can also be fully validated. Furthermore, as for claims (1)-(3), the advantages go even further. As we will now show now, the greater effectiveness of countercyclical policy applies to all shocks, not only to credit supply shocks.

### 7.3. Investment Demand Shocks

In Figure 5, households/firms receive a succession of 12 quarterly positive shocks  $\varepsilon_t^i$  whereby the marginal efficiency of investment and therefore the incentive to invest improves. In quarter 13 they experience a very large negative shock  $\varepsilon_t^i$  that leads to a sharp contraction in investment. This

captures the notion of boom-bust cycles driven by the industrial rather than the financial sector.

In the pre-transition economy, GDP grows by 5% relative to trend during the boom. In this case the expansion of bank loans and deposits, which reaches around 9% of steady state GDP, is endogenous and driven by a combination of greater transactions demand from households and an increase in the value of physical capital collateral that makes banks more willing to lend. The increase in demand raises inflation by more than 1 percentage point, and the real interest rate by around 1.4 percentage points. Lending rates increase by similar magnitudes. The output contraction at the end of the third year is around 9%. This is despite a sharp drop in the primary policy interest rate which, while it succeeds in limiting the collapse in real activity, cannot prevent a severe contraction. The main conclusion is again that, even with a very aggressive interest rate policy, monetary policy in this economy cannot prevent a very large boom-bust cycle.

In the post-transition Chicago Plan economy, the economy is again substantially less volatile. Because the increase in output triggers a 1 percentage point increase in the public credit rate, bank loans and public credit expand by less than 1.5% rather than 9% of steady state GDP, retail money increases by 2% instead of 7%, and the gain in GDP is only just over 1% rather than 5%. In this case around half of the increase in money is due to an increase in public credit, and another half is due to increased government deficits after the net debt-to-GDP ratio declines during the inflationary boom.<sup>24</sup> Another effect of limiting the supply of money in the face of higher demand is to limit price movements, with inflation and the policy rate nearly flat during the boom phase. For demand shocks, countercyclical policy is therefore again almost completely performed by the public credit rule rather than the primary policy rule.

## 7.4. Technology Shocks

In Figure 6, households/firms receive a succession of 12 quarterly positive technology shocks  $\varepsilon_t^a$ . In quarter 13 they experience a very large negative shock  $\varepsilon_t^a$  that leads to a sharp output contraction.

In the pre-transition economy, GDP grows by 5% relative to trend during the boom. As in Figure 5, the expansion of bank loans and deposits, which reaches around 6.5% of steady state GDP, is endogenous and driven by a combination of greater transactions demand and greater collateral values. Inflation and the primary policy rate remain nearly flat, as the inflation-reducing effects of the shock itself are offset by the effects of greater demand. During the crash, the real policy rate is raised by just under 1 percentage point, and lending rates change by similar magnitudes. The output contraction at the end of the third year is around 7%. As before, policy cannot prevent a very large boom-bust cycle.

---

<sup>24</sup>Referring back to Section 4.4, by rewriting the deficit ratio as  $gd_{bmf,t}^{rat} = 100(\check{b}_{bmf,t} - \check{b}_{bmf,t-1}/(x\pi_t^p))/g\check{d}p_t$  we can see that when the deficit target is given and inflation is temporarily above trend, then for a given GDP the real stock of financing  $\check{b}_{bmf,t}$  will decrease.

In the post-transition Chicago Plan economy, the economy is again much less volatile. In this case the primary policy rate drops by 1.6 percentage points during the boom phase, thereby accommodating a much larger drop in inflation of around 1.1 percentage points. The public credit rate rises by between 1.5 and 2 percentage points relative to the primary policy rate, which reduces credit supply by more than 2.5% of steady state GDP while the increase in retail money equals only 2% of steady state GDP. Below-trend inflation implies a temporary increase in net public financing, which in this case is shared in roughly equal measure between money issuance and a reduction in treasury credit net of government debt. As a direct result of the increase in lending spreads and the more limited increase in money, the peak gain in GDP is less than 1.5% rather than 5%. Policy also manages to reduce the severity of the crash, by lowering the public credit rate relative to the primary policy rate and thereby facilitating a slower contraction in money and activity. For technology shocks, similar to demand shocks, countercyclical policy is therefore almost completely performed by the public credit rule rather than the primary policy rule.

## 7.5. Additional Considerations

There are two additional reasons why the effectiveness of countercyclical policy would be enhanced under the Chicago Plan. First, banks know that they cannot create their own funds to fuel a lending boom. Instead, they have to borrow public money from the government, which will increase the interest rate it charges in a lending boom, or from private agents, who will be more cautious about the risks in the absence of deposit insurance. This knowledge makes it less likely that financial institutions will develop intermittent bouts of optimism and pessimism in the first place. Second, at present capital adequacy requirements impose only a weak constraint on lending during a boom phase. This is because at the level of the whole financial system the money that is injected into one set of banks as equity can be created by another set of banks through credit. This is impossible under the Chicago Plan, so that a prudential MCAR rule should become more effective.

## 8. Objections and Responses

This section deals with each of the objections to the Chicago Plan that we have encountered.

**What Is the Market Failure?** A frequent objection is that it is not clear what market failure the Chicago Plan tries to address. There are at least two very clear answers. The first is *rent seeking*. The literature documents that the combination of bank market power, regulation, and explicit or implicit government guarantees allows banks to function as a public-private “finance franchise” (Hockett and Omarova (2017)) and thereby to earn rents due to reduced yields on their liabilities and equity. These rents represent a transfer from taxpayers to the bank’s owners who, given market power (Drechsler et al. (2017)), may be able to keep some or all of the rents rather



than passing them on to bank borrowers. Moody's Analytics (2011), Anginer and Warburton (2011), IMF (2014), Gudmundsson (2016), Groenewegen and Wierds (2017), Wilmarth Jr. (2020), and Vasconcelos et al. (2024) document the very high value of such rents, with typical values around 100 basis points in terms of funding cost advantage and 1% of GDP in terms of absolute value. The Chicago Plan as envisaged in this paper appropriates these rents and applies them towards a reduction in distortionary income taxation that encourages growth. The second market failure is *increasing returns to scale* in trust. A fundamental requirement for an effective medium of exchange is general trust in its future convertibility at nominal par value. Such trust has historically required that the medium of exchange be issued by the sovereign, and even today issuance by private financial institutions generally requires a strong public backstop in the form of a lender of last resort, capital, leverage and liquidity requirements, and ultimately explicit or implicit bailout guarantees. The key for trust is therefore the scale of the issuer, and sovereign issuance offers maximum scale. The Chicago Plan as envisaged in this paper adopts sovereign issuance, and thereby makes both regulations and guarantees unnecessary for money banks.<sup>25</sup> A significant effect is a major reduction in the cost of regulations and loan monitoring that encourages growth.

**Near-Monies:** The creation of money substitutes, or near-monies, by credit banks can be prevented. A proliferation of near-monies could make the control of money and inflation more difficult. But Henry Simons, Irving Fisher, Milton Friedman and the other advocates of the Chicago Plan, while they were aware of this issue, did not think of it as prohibitive. The obvious solution is to insist on *treasury-funded and/or equity-funded* (Kotlikoff (2012)) credit banks, as in our model. But even for debt-funded credit banks effective countermeasures can be conceived. In increasing order of severity: First, none of the liabilities of the investment funds are protected by deposit insurance, so that they represent risky investments rather than money. Second, only longer-term lending is permitted to be financed by debt, and only with strict regulations on maturity mismatches, and with high penalties for early withdrawal. Third, tax advantages for debt relative to equity are removed or even reversed. Fourth, any party receiving payment in near-monies is allowed to keep that payment, and is thereafter allowed to sue on the grounds of not having received payment in public money (this would enlist one party in each commercial transaction in the enforcement of countermeasures). Fifth, the creation of near-monies is outlawed, and the assets of its issuers confiscated. This is of course not to argue for some of the more severe safeguards, only to show that there is a spectrum of possibilities.

**Maturity Transformation:** The benefits to non-banks of simultaneous access to short-maturity liquid assets and longer-maturity low-cost borrowing would not be lost, to the contrary. While Diamond and Dybvig (1986) argue that narrow banking would destroy the benefits of maturity

---

<sup>25</sup>Some regulation of credit banks may remain necessary, but without the rationale of ensuring the safety of the payment system.

transformation by banks, it needs to be recognized that the point of maturity transformation is *maturity, not transformation*. The Chicago Plan provides access to desired maturities without private-sector transformation, as investors continue to have access to shorter-maturity money in money banks and longer-maturity investment accounts in credit banks, while borrowers can access longer-term financing through credit banks.<sup>26</sup> As for the cost of borrowing, we have seen that in our transition simulation real wholesale lending rates decline by 60 basis points.

**Competitiveness of the Banking System:** The useful functions of a private financial system would not be diminished, to the contrary. Money banks could operate the payments system efficiently without having to worry about asset quality risks, while credit banks could operate the credit system efficiently with far fewer reasons to worry about liability management risks. What would cease to exist is credit created, at the almost exclusive initiative of private institutions, for the purpose of creating an adequate money supply that can easily be created debt-free.

**Crowding-out of the Banking System:** The banking system’s role as the (almost) sole creator of money would indeed be crowded out, but that is the purpose, not an undesirable side effect. We discussed in Section 6 that the two functions of the banking system are the creation of the economy’s aggregate money supply (other than cash) and intermediation between heterogeneous net creditors and net debtors. Under the Chicago Plan the first function would be replaced by public money while the second function would remain, except that net creditors would no longer hold money but investment accounts. The banking system’s balance sheet would therefore indeed shrink. As for the remaining bank lending to investors in physical capital, this is not crowded out but crowded in. The reason is that bank lending is not limited by a stock of physical household net savings (the “pot of savings” fallacy in much of the crowding-out debate), but rather by the willingness of banks and their customers to create gross loans and gross deposits, which is completely independent of physical savings and rather depends on household demand for gross transactions balances and bank balance sheet capacity and profitability. As long as lending is profitable, banks can accumulate the necessary capital and liquidity to support it. And when, as in our transition simulation, monetary reform stimulates real activity and therefore transactions demand, while at the same time reducing the marginal cost of borrowing, both household demand for liquidity and bank profitability increase, thereby crowding in investment loans, which increase by around 5 percent of GDP in the long run.

**Government Control over Money:** A frequent claim is that government control over money issuance would be inflationary, or cause financial instability, through excessive or volatile money printing. Theory does not support this claim – as shown in Figures 1 and 2, the Chicago Plan involves no significant changes in the *quantity* of money, only in the *nature* of money, and Figures 4-6 have shown that it would make it far easier, not harder, to stabilize inflation and financial cycles.

---

<sup>26</sup>In a very different sense, *transformation* between highly liquid transactions balances and valuable long-term assets also takes place under the Chicago Plan, where the government uses seigniorage gains to finance spending on long-term physical and human capital such as infrastructure, education and public health.

History does not support this claim either – it has been predominantly periods of private control over money issuance that have been plagued by crises, while periods of government control have exhibited much more stability. For the UK, Shaw (1896) found that, with one exception (Henry VIII), kings had used their monetary prerogative responsibly and with no major financial crises, while Del Mar (1895) finds that the Free Coinage Act of 1666 inaugurated a series of frequent commercial panics and disasters that hitherto had been completely unknown. For the US, Franklin (1729) and Del Mar (1895) argued that colonial paper monies were of the greatest economic advantage to the country. The main reason for inflation during the American (Franklin (1786), Schuckers (1874)) (and also French (Dillaye (1877))) revolution was massive British counterfeiting. Lincoln’s Greenbacks were also responsibly managed (Randall (1937), Studenski and Kroos (1952)). On the other hand, private note-issuing banks repeatedly triggered disastrous business cycles (Gouge (1833), Knox (1903)). As for the German hyperinflation of 1923, the Reichsbank president at the time, Hjalmar Schacht, explains in Schacht (1967) that this episode cannot be blamed on excessive money printing by a government-run central bank, but rather on a combination of excessive reparations claims (Keynes (1929)) and of massive money creation by private speculators and banks, aided and abetted by what was at that time a privately-run central bank.

**Government Control over Credit:** The government would not directly *control* the quantity of credit, and it would not control the allocation of credit at all. And while in Figure 1 the government *funds* all private credit (with the exception of bank equity), even this is not a necessary outcome. First, credit banks would continue to intermediate between heterogeneous private net creditors and net debtors, which are only omitted from our model and Figure 1 because of the representative household assumption. Second, the government could choose to redeem more government debt, which would replace treasury credit to credit banks with private investment accounts in credit banks. Third, the government does not control the quantity but the price of treasury credit, and unless its interest rate rule is extremely aggressive (which is not socially optimal, as we have shown), money creation remains substantially controlled by private financial institutions, and money allocation remains completely controlled by them.

While this paper therefore does not even propose quantitative and/or qualitative lending guidance, historical experience shows that such policies have for the most part been highly successful. Germany’s Reichsbank pioneered ‘window guidance’ in 1912 (Werner (2003a, 2003b)). This became the model for Japan’s window guidance in the post-war era (Werner (2002, 2003a)), which in turn became the basis for the systems introduced in Korea, Taiwan (Wade (1990)), and China (Chen and Werner (2011)). According to Werner, credit guidance was the single most important factor in the “East Asian economic miracle”, and this argument is supported by a World Bank study on this topic (IBRD (1993)). Goodhart (1989) discusses that lending guidance policies were at some stage used by almost all central banks in the world.

**Open Economy Considerations:** The existence of globalized financial markets does not make it dangerous for one country to “go it alone”. If the concern is with rational speculative attacks on a country’s currency due to weak country fundamentals, then clearly the Chicago Plan achieves the opposite of weak fundamentals. Furthermore, during global financial market turmoil the completely safe money offered by the country would become an attractive safe haven asset. If the concern is with speculative attacks based not on fundamentals but on suspicions of a new and unfamiliar monetary system, then as shown by the experience of the German hyperinflation of 1923, a determined central bank can quickly crush speculators if the latter do not have access to a private banking system that can create local currency on demand.

## 9. Conclusion

This paper revisits the Chicago Plan, a proposal for fundamental monetary reform that was put forward by many leading US economists at the height of the Great Depression. Its key feature is the separation of commercial banks into money banks that are required to maintain full backing of deposits by public money and credit banks that can only finance new credit through the borrowing of public money from non-banks or the government, and not through the ex nihilo creation of new private deposit money. Fisher (1936) claimed that the Chicago Plan had four major advantages, ranging from much lower public and private debt levels to the elimination of runs on the payment system to greater macroeconomic stability. In this paper we are able to rigorously evaluate his claims, by applying the recommendations of the Chicago Plan to a monetary DSGE model that contains, along with the usual ingredients for the real economy, a detailed and carefully calibrated model of the current US financial sector.

Our analytical and simulation results fully validate Fisher’s (1936) claims. The Chicago Plan would accomplish very large debt reductions by making government-issued money the exclusive transactions medium of the economy, while financial institutions concentrate on their two key strengths, the management of an efficient payment system and the extension of credit to investment projects that require monitoring and risk management expertise. The Chicago Plan has advantages that go even beyond those claimed by Fisher, most importantly large steady state output gains due to the removal or reduction of multiple distortions.

## References

- Allais, M. (1947), *Économie et Intérêt: Présentation Nouvelle des Problèmes Fondamentaux Relatifs au Rôle Économique du Taux de l'Intérêt et de Leurs Solutions*, 2 vols., Paris: Librairie des Publications Officielles.
- Allais, M. (1984), *The Credit Mechanism and Its Implications*, Paris: Centre National de la Recherche Scientifique.
- Anderson, G. and Cesa-Bianchi, A. (2020), “Crossing the Credit Channel: Credit Spreads and Firm Heterogeneity”, Bank of England Staff Working Papers, No. 854.
- Angell, J. (1935), “The 100 Per Cent Reserve Plan”, *Quarterly Journal of Economics*, **50**, 1-35.
- Anginer, D. and Warburton, A. (2011), “The End of Market Discipline? Investor Expectations of Implicit State Guarantees”, Working Paper, World Bank and Syracuse University.
- Arcand, J.-L., Berkes, E. and Panizza, U. (2015), “Too Much Finance?”, *Journal of Economic Growth*, **20**(2), 105-148.
- Ashcraft, A.B. and Steindel, C. (2008), “Measuring the Impact of Securitization on Imputed Bank Output”, Working Paper, Federal Reserve Bank of New York.
- Basel Committee on Banking Supervision (2017), “Basel III: Finalizing Postcrisis Reforms”, Technical Report, Bank for International Settlements.
- Benes, J. and Kumhof, M. (2012), “The Chicago Plan Revisited”, IMF Working Papers, WP/12/202.
- Bernanke, B., Gertler, M. and Gilchrist, S. (1999), “The Financial Accelerator in a Quantitative Business Cycle Framework”, in: Taylor, J.B., Woodford, M. (eds.), *Handbook of Macroeconomics*, Volume 1C. Elsevier, Amsterdam, pp. 1341-1393.
- Cecchetti, S. and Kharroubi, E. (2012), “Reassessing the Impact of Finance on Growth”, BIS Working Papers, No. 381.
- Cesa-Bianchi, A., Kumhof, M., Pinchetti, M., Sokol, A. and Thwaites, G. (2023), “Towards a New Monetary Theory of Exchange Rate Determination”, Working Paper, Bank of England.
- Chen, Y. and Werner, R. (2011), “The Role of Monetary Aggregates in Chinese Monetary Policy Implementation”, *Journal of the Asia-Pacific Economy*, **16**(3), 464-488.
- Christiano, L., Motto, R. and Rostagno, M. (2014), “Risk Shocks”, *American Economic Review*, **104**(1), 27-65.
- Cipriani, M., Eisenbach, T. and Kovner, A. (2024), “Tracing Bank Runs in Real Time”, Federal Reserve Bank of New York Staff Reports, No. 1104.
- Currie, L. (1934), “A Proposed Revision of the Monetary System of the United States”, submitted to the Secretary of the Treasury Henry Morgenthau, September, reprinted in Currie (1968), *The Supply and Control of Money in the United States*, New York: Russell and Russell.
- Cutting, B. (1934), “Is Private Banking Doomed?”, *Liberty* (May), pp. 7-10.
- Del Mar, A. (1895), *History of Monetary Systems*, reprint: New York, A.M. Kelley (1978).
- Diamond, P. (1998), “Optimal Income Taxation: An Example with a U-Shaped Pattern of Optimal Marginal Tax Rates”, *American Economic Review*, **88**(1), 83-95.
- Diamond, D. and Dybvig, P. (1983), “Bank Runs, Deposit Insurance, and Liquidity”, *Journal of Political Economy*, **91** (3), 401-419.

- Dillaye, S. (1877), *Assignats and Mandats: A True History*, Philadelphia: Henry Carey Baird.
- Douglas, P. (1935), *Controlling Depressions*, New York: W.W. Norton & Co., Inc.
- Drechsler, I., Savov, A. and Schnabl, P. (2017), “The Deposits Channel of Monetary Policy”, *Quarterly Journal of Economics*, **132**(4), 1819-1876.
- Engen, E.M. and Hubbard, R.G. (2004), “Federal Government Debt and Interest Rates”, *NBER Macroeconomics Annual*, **19**, 83-138.
- Federal Accounting Standards Advisory Board (2012), *Federal Accounting Standards Advisory Board Handbook*, Statements of Federal Financial Accounting Standards 7, pp. 106-107.
- Federal Reserve Bank of New York (2018), “Quarterly Trends for Consolidated U.S. Banking Organizations, First Quarter 2018”.
- Fisher, I. (1935), “100% Money: Designed to keep checking banks 100% liquid; to prevent inflation and deflation; largely to cure or prevent depressions; and to wipe out much of the National Debt”, New York: The Adelphi Company.
- Fisher, I. (1936), “100% Money and the Public Debt”, *Economic Forum*, Spring Number, April-June 1936, 406-420.
- Franklin, B. (1729), *Modest Inquiry into the Nature and Necessity of a Paper Currency*.
- Franklin, B. (1786), “The Retort Courteous”, in Franklin, W., 1819, *The Posthumous and Other Writings of Benjamin Franklin*, London: A.J. Valpy, p. 488.
- Friedman, M. (1960), *A Program for Monetary Stability*, New York: Fordham University Press.
- Friedman, M. (1967), “The Monetary Theory and Policy of Henry Simons”, *The Journal of Law and Economics*, **10**.
- Furfin, C. (2001), “Bank Portfolio Allocation: The Impact of Capital Requirements, Regulatory Monitoring, and Economic Conditions”, *Journal of Financial Services Research*, **20**(1), 33-56.
- Gale, W. and Orszag, P. (2004), “Budget Deficits, National Saving, and Interest Rates”, *Brookings Papers on Economic Activity*, **2**, 101-187.
- Gertler, M. and Karadi, P. (2011), “A Model of Unconventional Monetary Policy”, *Journal of Monetary Economics*, **58**(1), 17-34.
- Goodhart, C. (1989), *Money, Information and Uncertainty*, London: Macmillan.
- Goodhart, C., Hudson, M., Kumhof, M. and Tideman, N. (2021), “Post-Corona Balanced-Budget Super-Stimulus: The Case for Shifting Taxes onto Land”, CEPR Discussion Papers, No. 16652.
- Gouge, W. (1833), *A Short History of Paper Money and Banking*, Philadelphia: T. Ustick.
- Graham, F. (1936), “Partial Reserve Money and the 100 Per Cent Proposal”, *American Economic Review*, 428-40.
- Greenwood, J., Hercowitz, Z. and Huffman, G. (1988), “Investment, Capacity Utilization, and the Real Business Cycle”, *American Economic Review*, **78**, 402-417.
- Groenewegen, J. and Wierdsma, P. (2017), “Two Big Distortions: Bank Incentives for Debt Financing”, ESRB Working Papers, No. 53.
- Gudmundsson, T. (2016), “Whose Credit Line Is It Anyway: An Update on Banks’ Implicit Subsidies”, IMF Working Papers, WP/16/224.
- Hockett, R. and Omarova, S. (2017), “The Finance Franchise”, *Cornell Law Review*, **102**, 1143-1218.

- Huerta de Soto, J. (2012), *Money, Bank Credit, and Economic Cycles*, Third English Edition, Auburn, Alabama: Ludwig von Mises Institute.
- IBRD (1993), *The East Asian Economic Miracle*, Oxford: Oxford University Press.
- IMF (2014), “Global Financial Stability Report”, Washington, DC: International Monetary Fund.
- IMF (2021), “Review of Debt Sustainability Framework for Market Access Countries”, IMF Policy Paper, Washington, DC: International Monetary Fund.
- IMF (2022), “Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries”, August, Washington, DC: International Monetary Fund.
- Jorda, O., Schularick, M. and Taylor, A. (2011), “Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons”, *IMF Economic Review*, **59(2)**, 340-378.
- Keynes, M. (1929), “The German Transfer Problem”, in *Readings in the Theory of International Trade*, 1949, Philadelphia and Toronto: The Blakiston Company.
- Knight, F. (1927), “Review of Frederick Soddy’s ‘Wealth, Virtual Wealth, and Debt’”, *The Saturday Review of Literature* (April 16), p. 732.
- Knight, F. (1933), “Memorandum on Banking Reform”, March, Franklin D. Roosevelt Presidential Library, President’s Personal File 431.
- Knox, J. (1903), *History of Banking in the United States*, New York: Rhodes, Bradford & Youngman.
- Kotlikoff, L. (2012), “The Economic Consequences of the Vickers Commission”, Civitas: Institute for the Study of Civil Society, London.
- Krishnamurthy, A. and Vissing-Jorgensen, A. (2012), “The Aggregate Demand for Treasury Debt”, *Journal of Political Economy*, **120 (2)**, 233-267.
- Kumhof, M., Rancière, R. and Winant, P. (2015), “Inequality, Leverage and Crises”, *American Economic Review*, **105(3)**, 1217-1245.
- Kumhof, M., Allen, J., Bateman, W., Lastra, R., Gleeson, S. and Omarova, S. (2020), “Central Bank Money: Liability, Asset or Equity of the Nation?”, CEPR Discussion Papers, No. 15521.
- Kumhof, M., Pinchetti, M., Rungcharoenkitkul, P. and Sokol, A. (2023), “CBDC Policies in Open Economies”, CEPR Discussion Papers, No. 17982.
- Laubach, T. (2009), “New Evidence on the Interest Rate Effects of Budget Deficits and Debt”, *Journal of the European Economic Association*, **7(4)**, 858-885.
- Lucas, R. (1987), *Models of Business Cycles*, Oxford, New York: Basil Blackwell.
- Means, G. (1933), “The Present Crisis and a Proposal for Banking Action”, Box 1, File: Banking and Currency Reform, The Papers of Gardiner C. Means, Franklin Roosevelt Library, Hyde Park, New York.
- Minsky, H. (1986), *Stabilizing an Unstable Economy*, New Haven, Connecticut: Yale University Press.
- Moody’s Analytics (2011), “Quantifying the Value of Implicit Government Guarantees for Large Financial Institutions”.
- Pennacchi, G. (2012), “Narrow Banking”, *Annual Review of Financial Economics*, **4**, 141-159.
- Phillips, R. (1994), *The Chicago Plan & New Deal Banking Reform*, M.E. Sharpe.

- Raffo, A. (2008), “Net Exports, Consumption Volatility, and International Business Cycle Models”, *Journal of International Economics*, **75**(1), 14-29.
- Randall, J. (1937), *The Civil War and Reconstruction*, Boston: Heath & Co., 2nd edition 1961, edited by D. David.
- Reinhart, C. and Rogoff, K. (2009), *This Time Is Different: Eight Centuries of Financial Folly*, Princeton and Oxford: Princeton University Press.
- Robertson, J. (2012), *Future Money - Breakdown or Breakthrough?*, Chelsea Green Publishing.
- Schacht, H. (1967), *The Magic of Money*, translation by P. Erskine, London: Oldbourne.
- Schmitt-Grohé, S. and Uribe, M. (2004), “Optimal Fiscal and Monetary Policy under Sticky Prices”, *Journal of Economic Theory*, **114**, 198-230.
- Schmitt-Grohé, S. and Uribe, M. (2008), “What’s ‘News’ in Business Cycle”, NBER Working Papers, No. 14215.
- Schuckers, J. (1874), *Finances and Paper Money of the Revolutionary War*, Philadelphia: John Campbell.
- Schularick, M. and Taylor, A. (2012), “Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008”, *American Economic Review*, **102**(2), 1029-1061.
- Shaw, W. (1896), *The History of Currency, 1252-1896*, Putnams, reprinted by New York: A.M. Kelley, 1967.
- Simons, H. (1933), “Banking and Currency Reform”, manuscript, printed in Warren Samuels, ed., *Research in the History of Economic Thought and Methodology*, Archival Supplement, Volume 4, Greenwich, CT: JAI Press.
- Simons, H. (1948), *Economic Policy for a Free Society*, Chicago: University of Chicago Press.
- Soddy, F. (1926), *Wealth, Virtual Wealth, and Debt*, 2nd American Edition, 1933, New York: E.P. Dutton.
- Studenski, P. and Kroos, H. (1952), *Financial History of the United States*, New York: McGraw Hill.
- Tobin, J. (1985), “Financial Innovation and Deregulation in Perspective”, *Bank of Japan Monetary and Economic Studies*, **3**, 19-29.
- Van den Heuvel, S. (2005), “The Bank Capital Channel of Monetary Policy”, Working Paper, Wharton School, University of Pennsylvania.
- Vasconcelos, L., Schiozer, R. and Giacomini, E. (2024), “Do Bank Resolution Reforms Reduce the Perception of Too-Big-to-Fail?”, Working Paper, Fundação Getulio Vargas.
- Wade, R. (1990), *Governing the Market*, Princeton: Princeton University Press.
- Werner, R. (2002), “Monetary Policy Implementation in Japan: What They Say vs. What They Do”, *Asian Economic Journal*, **16**(2), 111-151.
- Werner, R. (2003a), *Princes of the Yen: Japan’s Central Bankers and the Transformation of the Economy*, New York: M. E. Sharpe.
- Werner, R. (2003b), “A Reconsideration of the Rationale for Bank-Centered Economic Systems and the Effectiveness of Directed Credit Policies in the Light of Japanese Evidence”, *The Japanese Economy*, **30**(3), 3-45.



- Werner, R. (2005), *New Paradigm in Macroeconomics: Solving the Riddle of Japanese Macroeconomic Performance*, Basingstoke: Palgrave Macmillan.
- Whittlesey, C. (1935), “Banking and the New Deal”, Public Policy Pamphlet No. 16, Chicago: University of Chicago Press.
- Wilmarth Jr., A. (2020), “Taming the Megabanks - Why We Need a New Glass-Steagall Act”, Oxford: Oxford University Press.
- Wu, J. and Xia, F. (2016), “Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound”, *Journal of Money, Credit, and Banking*, **48(2-3)**, 253-291.

Figure 1. Balance Sheets in the Transition Period (percent of GDP)

## Banking Sector

Pre-Transition

Post-Transition

Assets		Liabilities	
15	Government Bonds		
100	Short-Term and Mortgage Loans	148	Deposits
50	Investment Loans		
		17	Bank Equity
148	Reserves	148	Treasury Credit

*Note: A red arrow points from 'Reserves' (148) to 'Deposits' (148) with the text '100% Reserve Cover'.*

Credit Banks		Liabilities	
15	Government Bonds	15	Marked Treasury Credit
100	Short-Term and Mortgage Loans	100	Citizens' Accounts
50	Investment Loans	33	Remaining Treasury Credit
		17	Bank Equity

Money Banks		Liabilities	
148	Reserves	148	Deposits

## Government

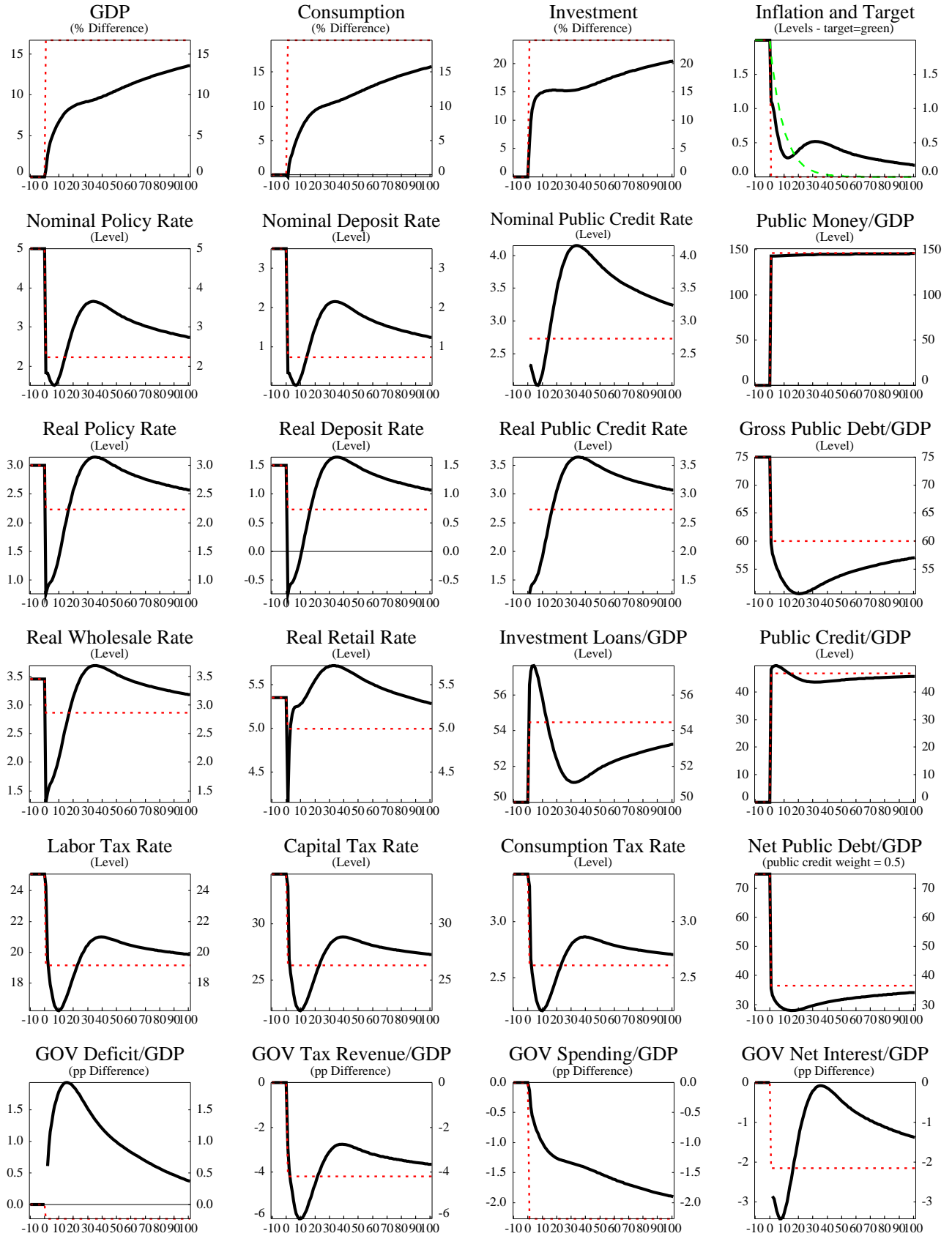
Pre-Transition

Post-Transition

Assets		Liabilities	
75	Other Assets	75	Government Debt
148	Treasury Credit	148	Reserves

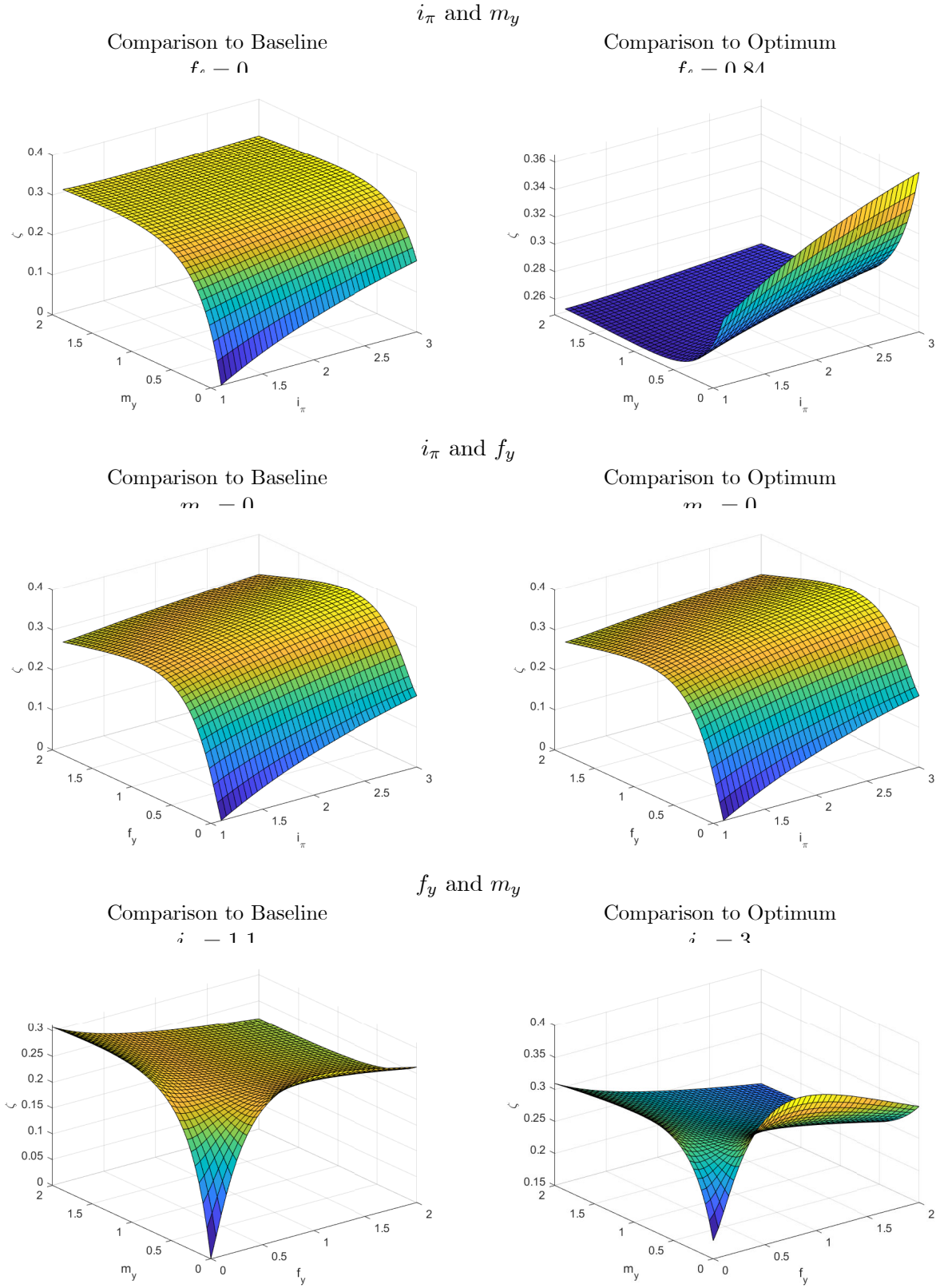
Assets		Liabilities	
75	Other Assets	60	Government Debt
33	Treasury Credit	48	Reserves minus Citizens' Dividend

Figure 2. Transition to the Chicago Plan



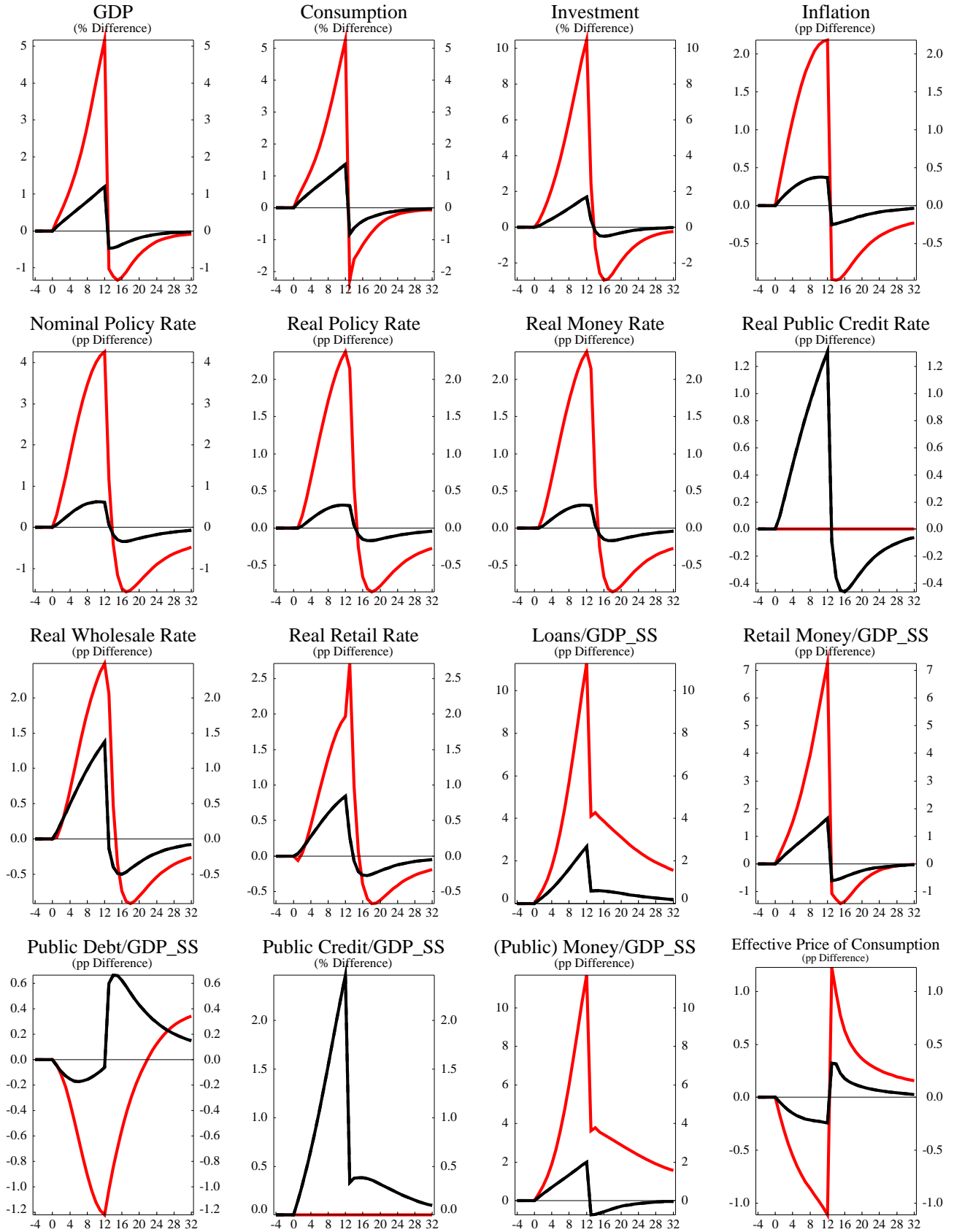
(\_\_\_ = transition path, --- = final steady state)

Figure 3. Policy Rules and Welfare - All Shocks



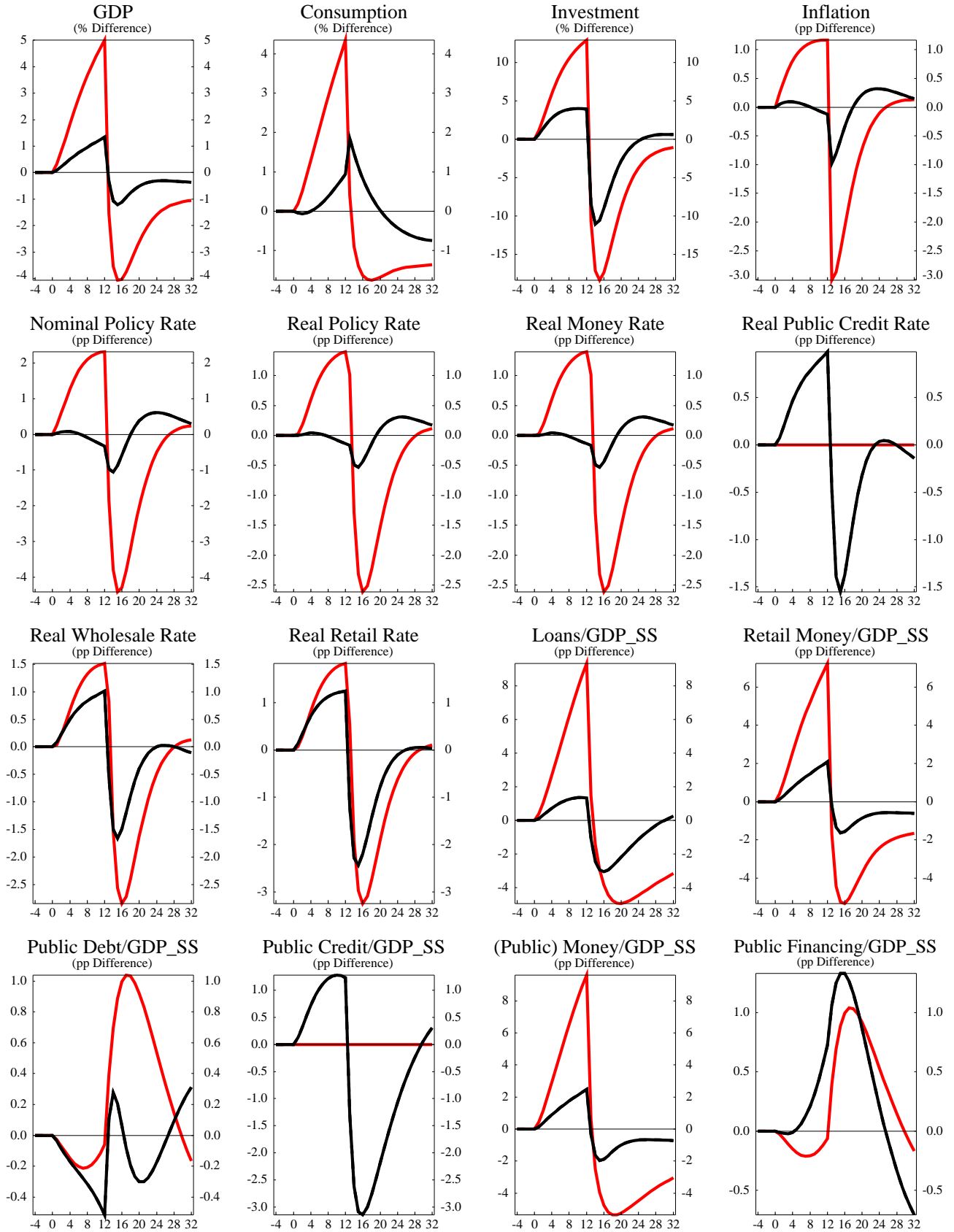
Overall Optimum:  $i_\pi^* = 3.0$ ,  $m_y^* = 0$ ,  $f_y^* = 0.84$

Figure 4. Credit Supply Shock Boom-Bust Cycle



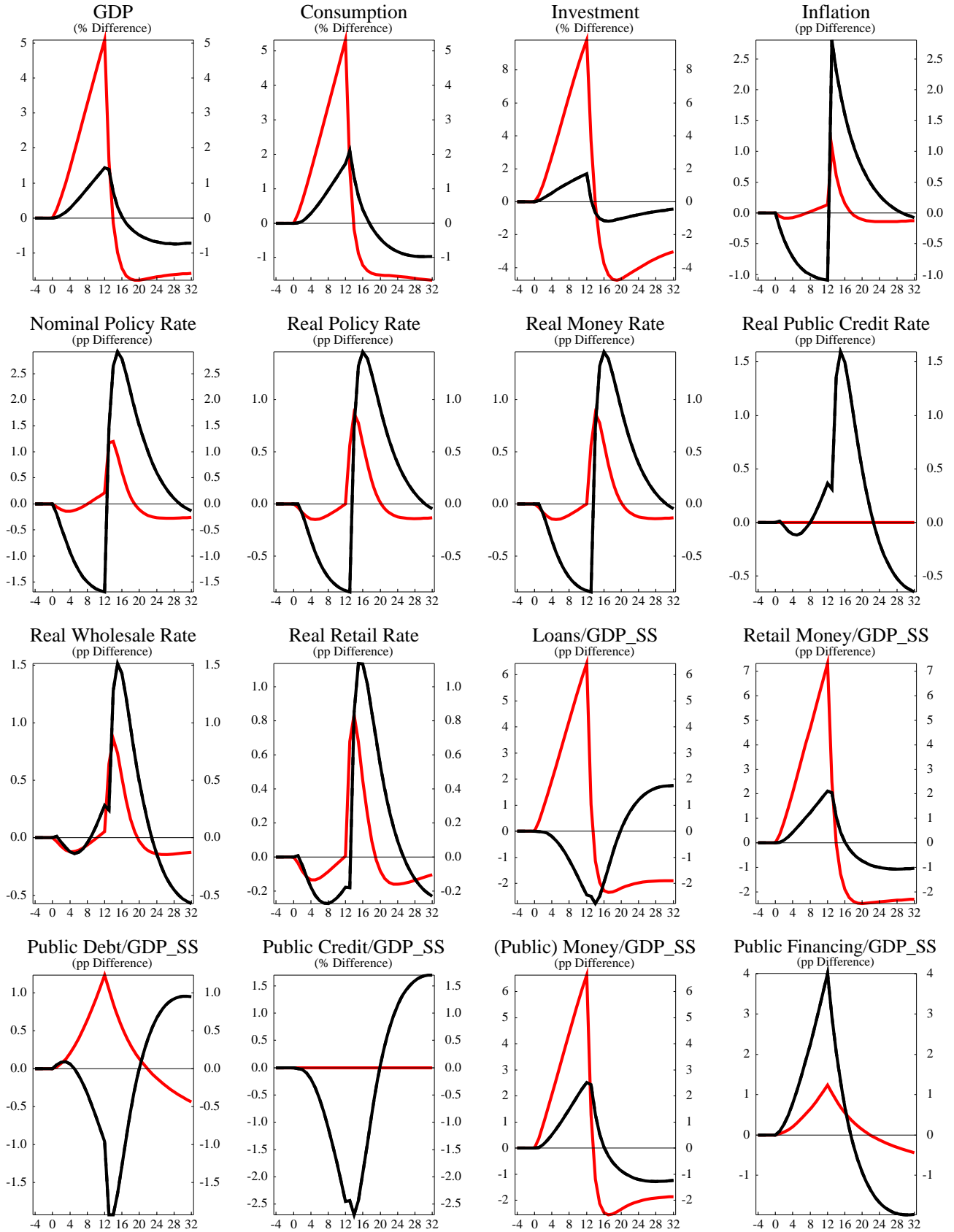
(red = pre-transition, black = post-transition)

Figure 5. Real Demand Shock Boom-Bust Cycle



(red = pre-transition, black = post-transition)

Figure 6. Technology Shock Boom-Bust Cycle



(red = pre-transition, black = post-transition)