Redistributive Monetary Policy

Markus K. Brunnermeier and Yuliy Sannikov

I. Introduction

Short-term debt financing played an important role in the run-up to the financial crisis, as increases in leverage helped boost growth, but also made the economy more susceptible to a sharp downturn. Since the recession, private agents have reduced their debt level while many governments have increased borrowing. This deleveraging process appears to be holding back the recovery, and the Japanese experience suggests that such deleveraging can continue over an extended period.

Economic activity depends on wealth distribution and the risk-bearing capacity of various sectors and actors in the economy. In a world with excessive debt financing, the amplification of adverse shocks can trigger large wealth redistributions across and within sectors, stifling growth. While in Japan, the nonfinancial business sector suffered most from liquidity and deflation spirals, currently in the United States, the household sector largely bears the costs of these spirals.

This paper argues that monetary policy can mitigate the redistributive effects of the adverse amplification mechanisms and help rebalance wealth across various sectors and households. The wealth-redistributive monetary transmission channel works through changes in asset prices and income flows. Importantly, it is the heterogeneity

in economic agents' asset holdings that allows monetary policy to redistribute wealth. Appropriate monetary policy can mitigate debt overhang distortions. This stabilizes the economy, reduces endogenous risk, and can spur growth, raising the overall wealth level in the economy. For specific scenarios, monetary policy can even lead to ex-post Pareto improvements, making all agents in the economy better off.

This wealth redistribution channel differs from the traditional Keynesian interest rate channel. In those models, the key friction is due to price stickiness, not financial frictions. As such, lowering the nominal interest rate lowers the real interest rate. A lower real interest rate stimulates aggregate consumption and investment as the representative agent brings consumption forward. In most New Keynesian models, the interest rates are set by a rule, for example, the Taylor rule, and money serves only as a unit of account. The zero lower bound of the nominal interest rate limits the effectiveness of conventional monetary policy.

In general, conventional monetary policy focuses primarily on the short end of the yield curve. Expectations about future policy indirectly affect the long end of the yield curve. Unconventional monetary policy directly targets the long end of the yield curve and prices of specific assets. All these measures can redistribute wealth across and within sectors. For example, we find that a decline of the 10-year interest rate that widens the 25-year to 10-year term spread hurts life insurance companies and pension funds while a widening of the 10-year to three-month term spread typically boosts banks' interest income. Hence, interest rate cuts, which typically widen the term spread, have very different redistributive effects from forward guidance (for example, commitments regarding future interest rates), which lowers the term spread.

Central banks also assume tail risk. They transfer risk away from the private sectors. More precisely, central banks redistribute tail risk to many nominal claim holders across the economy. The redistribution of risk is wealth redistribution in the future contingent on specific future (tail) events. For example, purchases of risky assets redistribute risk of the ultimate payoff of these assets to all nominal

claim holders in the economy. By relaxing collateral requirements for lending programs, central banks insure against the tail event in which the borrower and the collateral fail to cover the borrowed amount. Importantly, the redistribution of risk is not a zero-sum game. Most of the risk in the economy is endogenous—self-generated by the system. Hence, appropriate monetary policy can reduce the overall risk in the economy.

More generally, monetary policy (rules) can be seen as a stabilizing implicit insurance scheme across agents and sectors for economies beset by financial frictions. Essentially, monetary policy (partially) completes missing markets. The efficiency gains are largest when exogenous risk is small and self-generated endogenous risk is large. The latter is the case when there is a large productivity or valuation gap between natural holders and second-best holders of assets. With a large gap, fire sales from the natural holders of assets lead to large price movements amplified by liquidity and deflationary spirals. For monetary policy to work as a "social insurance scheme," the central bank has to follow and clearly communicate a policy rule that is well-specified ex ante.

Like any insurance scheme, monetary policy comes with the cost of moral hazard. To keep moral hazard costs under control, the design of the redistribution scheme is crucial. For example, if the recapitalization effects of monetary policy are proportional to the banks' net worth—the policy helps strong institutions more than weak ones—then competition among banks in normal times keeps moral hazard in check. Of course, supporting stronger healthy banks in times of crisis is ex-post more costly. Ex ante, however, this commitment makes monetary policy less prone to moral hazard compared to more targeted policy instruments that subsidize the weak institutions.

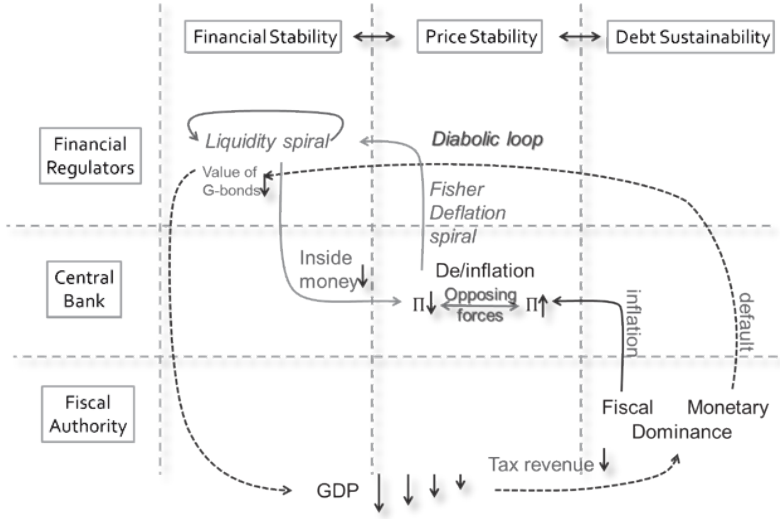
Generally, the intent of a monetary policy rule is to affect the economic agents' beliefs and behavior in order to steer the economy toward a socially desirable objective. Asymmetric information problems, such as moral hazard, limit the effectiveness of such rules and constrain the set of implementable rules. In other words, systemic financial institutions can undermine some desirable rules and may even be able to force the central bank to abandon its rule book.

Redistributive monetary policy should be strictly limited to undoing the redistribution caused by the amplification effects, taking into account moral hazard considerations.

Until recently, the predominant view was that the three objectives of price stability, financial stability and fiscal government debt sustainability could be treated independently from each other and assigned separately to monetary, regulatory and fiscal authorities, respectively. Using Figure 1 as a guideline, only the diagonal elements were considered of first order relevance, while off-diagonal cross effects were considered as less important. This article questions this view and stresses the importance of "cross effects" that link the three stability concepts. For example, financial instability prompts the financial intermediaries to shrink their balance sheets and creates less inside money. Consequently, the money multiplier collapses and Fisher deflation pressure emerges. This increases the real value of banks' liabilities and worsens financial instability. Financial institutions may "corner" central banks (financial dominance) by threatening with contagion if they are not bailed out—possibly through lax monetary policy. Fiscal authorities may also "corner" central banks (fiscal dominance). The central bank's position might be weak since monetary dominance makes a default on government debt more likely. As sovereign default probability rises, banks suffer losses and cut back their lending. This slows down the growth of the real economy as well as the tax revenue for the sovereign. At the same time, a bailout of banks might become necessary to stabilize the financial system. This diabolic loop between sovereign debt risk and financial sector risk links fiscal debt sustainability and financial stability, as depicted by the outer loop of Figure 1. The central bank may be forced to be passive even as inflation expectations rise. Inflationary forces and deflationary forces oppose each other in times of crisis. Overall, in such times, opposing deflationary and inflationary forces are strong and balancing them becomes challenging. The economy is very unforgiving to even small mistakes. It can easily drift off to a deflationary or inflationary trajectory.

To pre-empt these forces from taking over, forward-looking monetary and macroprudential policy has to incorporate early warning

Figure 1
Three Stability Concepts



Notes: The columns represent the three stability concepts; rows represent the accountable authorities. Off-diagonal elements capture the cross effects. The deflation spiral links financial stability and price stability. The diabolic loop (dashed) links fiscal debt sustainability and financial stability.

signals about the potential buildup of systemic risk. Low-volatility environments and financial innovations are conducive to such a buildup. Simple measures of debt-to-GDP ratio and leverage, or more sophisticated liquidity mismatch measures across sectors, are indicators of vulnerability.

The paper is organized as follows. The next section presents some summary statistics and outlines some preliminary empirical observations. Since data for counterfactual scenarios are sparse, the main part of the paper relies heavily on theoretical reasoning. Section III analyzes the run-up, crisis and recovery phase of financial recessions. Section IV analyzes various policy measures through the lens of two recent theoretical papers by Brunnermeier and Sannikov (2011, 2012), referred to as "BruSan" hereafter. Both papers build on earlier work on financial frictions in the macroeconomy by Bernanke and Gertler (1989), Kiyotaki and Moore (1997, 2011), and Bernanke, Gertler and Gilchrist (1999). For a detailed survey of the existing literature, we refer readers to Brunnermeier, Eisenbach and Sannikov (2012).

II. A Preliminary Look at the Data

We start with some stylized observations before conceptualizing the redistributive effects of various amplification mechanisms and studying policy responses to them. Following earlier work by economists (like Arthur Burns and Wesley Mitchell), Cooley and Prescott (1995) characterize stylized facts of business cycles without making much, if any, reference to financial variables or debt levels.

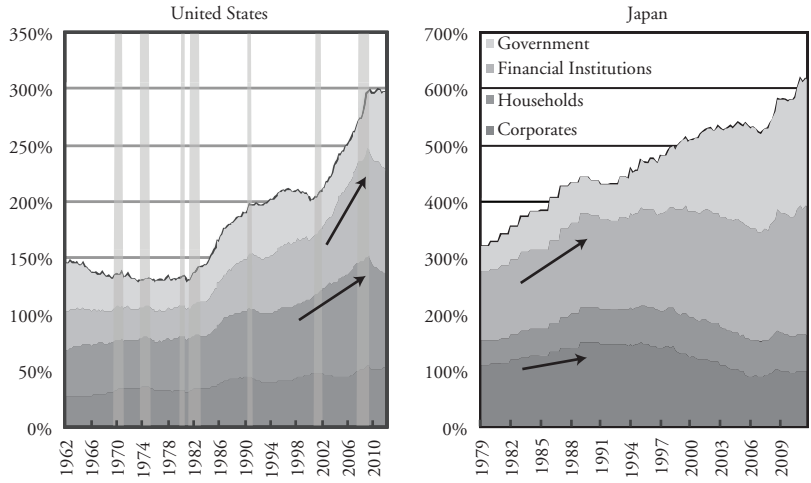
Because financial frictions limit the flow of funds, the distribution of wealth and agents' risk-bearing capacity are of huge relevance for the efficient allocation of economic resources.

High leverage exposes economic agents to sudden shifts in wealth. Therefore, we first report *debt-to-GDP* ratios across various sectors. Debt-to-GDP permits a better cross-sectional comparison than would debt-to-equity. Among flow variables we focus on debt service burden measures. People with high and variable *debt service burden* are more vulnerable to cash flow or liquidity shortages. However, looking at these measures based on existing data gives us only a rough guideline. A more advanced approach would involve looking at risk topography and liquidity mismatch across various sectors to capture the endogenous responses and feedback loops.[1]

As a second step, we would like some idea of how monetary policy helps mitigate effects of redistribution during the run-up to and in financial recessions. This is, of course, an even more challenging task because policy responses are endogenous. We do not observe wealth shifts that would have occurred in a counterfactual world without policy reaction.

The first task is to select the right *grouping into sectors*. Indeed, the whole analysis depends on the classification and clustering of various economic agents. The optimal clustering depends on the economic question and the availability of data. To begin, we follow the classic sector analysis, which divides the economy into a household sector, nonfinancial business sector, financial sector and government sector. This grouping into such large sectors removes a significant quantity of intrasector debt through netting of offsetting loans. Of course, aggregate total debt in a closed economy is zero. To further our analysis,

Chart 1
Debt-to-GDP Ratios for Several Sectors Over Time



Notes: Debt-to-GDP ratios for several sectors over time in the U.S. (Panel A) and Japan (Panel B). NBER recessions are represented as shaded columns.

we take a closer look at the financial sector and disaggregate it into various subsectors. This sector is of particular interest as it lies at the center of many balance sheet recessions.

II.i Debt and Leverage

Chart 1 depicts the debt-to-GDP ratios for the key sectors. Panel A shows the debt ratios for the United States; Panel B is the corresponding graph for Japan. NBER-designated recessions are represented as shaded lines.

Panel A clearly documents that the overall debt level in the U.S. economy has increased significantly over time. The first observation we can draw from the data is that not all recessions are the same. From 1960 to 1985, the debt-to-GDP ratios of the main sectors changed very little. For example, the recession in 1980 was not preceded by an expansion of debt and was induced by the Federal Reserve's tightening of monetary policy to conquer inflation.

In the recession of the early 1990s, after the savings and loan (S&L) crisis, the nonfinancial business sector reduced its debt level.

It is difficult to draw more detailed conclusions from the nonfinancial business-debt-to-GDP time series (bottom area). Indeed, the temporary reduction of nonfinancial business debt during the Great Recession is consistent with the empirical finding that this sector significantly expanded its cash holdings even before the crisis, as documented, for example, in Bates, Kahle and Stulz (2009).

The household-debt-to-GDP ratio steadily increases from the mid-1980s, despite the bursting of the Internet bubble in 2000 and the associated recession. The sharp drop following the Great Recession is striking. Households significantly reduced their spending and increased their savings in order to repair their balance sheets. A part of the decline can be attributed to defaults on mortgage debt, which induced losses in the banking sector. Financial sector debt also rose steadily, although it recorded a small decline during the recession of the early 1990s. Government debt declined during the Clinton years and significantly increased during the Great Recession—essentially replacing declining household debt.

Observation 1: Not all recessions are the same. Some recessions are preceded by a run-up in debt and then accompanied by a subsequent decline, but others are not.

Panel B of Chart 1 depicts the same graph for Japan. Prior to Japan's lost decades, asset price appreciation was even higher in Japan than in the United States in the 2000s. Panel B, however, clearly shows that in Japan the nonfinancial business sector, not households, built up large amounts of debt in the 1980s. From 1990 on, the nonfinancial business-debt-to-GDP ratio has remained roughly constant as this sector's balance sheets have been under repair. From late 1996 on, this deleveraging accelerated and the nonfinancial business-debt-to-GDP ratio declined for several years.

Interestingly, 1997 corresponds to the peak in nominal GDP, and that year can be seen as the transition from a deep recession to a sustained structural slump. In 1996, 8 trillion yen of assets were tied up in bankruptcy proceedings. By 1997, this number had jumped to 14 trillion yen (see Hamada, Kashyap and Weinstein 2011). In contrast, the household sector's debt level experienced only a marginal increase

over these years, with a small slowdown in the first few years of the 1990s. The 1997 watermark recession is almost undetectable in the time series of household debt.

King (1994) studied recessions in early 1990 across many countries. He documents that countries with the largest increase in private debt from 1984 to 1988 experienced the deepest shortfall of growth from 1989 to 1992. This evidence, and the contrast between Panels A and B, lead to the second observation.

Observation 2: Not all balance sheet recessions are the same; different sectors can be involved.

Another difference between the Japanese and U.S. crises is the extent to which foreign credit flow was involved. Hence, methods for preventing financial recessions might also differ, depending on which sectors suffer from debt overhang problems.

Finally, in the United States as well in Japan, financial recessions led to higher government debt.

Observation 3: Government debt in a crisis often increases by more than the combined decreases in household and nonfinancial business debt.

Higher government deficits often come along with higher current account deficits—typically referred to as the twin deficit problem.

Chart 1 groups all households together. However, households' debt exposure and real estate holdings vary a lot with their age and skill level. Consequently, interest rates and inflation can lead to large wealth shifts within the household sector across different age cohorts.

Mian and Sufi (2009) use microeconomic household data across U.S. counties to show that the rise in household leverage during the credit boom was a strong predictor of recession severity from 2007 to 2009. Counties that experienced the largest increase in household debt before the recession subsequently saw larger increases in unemployment and larger decreases in residential investment and durable consumption.

The redistributive effects of inflation have long been recognized (see, for example, Keynes 1923). It is useful to draw a distinction

between anticipated and unanticipated inflation, as emphasized in Kessel and Alchian (1962). Many studies focus on the U.S. Greenback era following the Civil War (see, for example, Friedman and Schwartz 1963) or Weimar inflation (see, for example, Bresciani-Turroni 1937). More recently, Doepke and Schneider (2006) provide a detailed and comprehensive study of the redistributive effects of inflation across different age groups within the United Sates. Coibion et al. (2012) study the impact of monetary policy decisions on consumption and income inequality. They argue that contractionary monetary policy increases labor income inequality.

So far, our focus has been primarily on debt, but, of course, one person's debt is another's financial *asset*.[2] Nonfinancial claims on real projects, property and physical capital differ in that they are not related to liabilities. The present real value of most of these assets depends on current and future interest and inflation rates. Inflation surprises can erode the value of long-dated nominal claims. The difference between assets and liabilities—net worth or wealth—of a sector shifts across time.

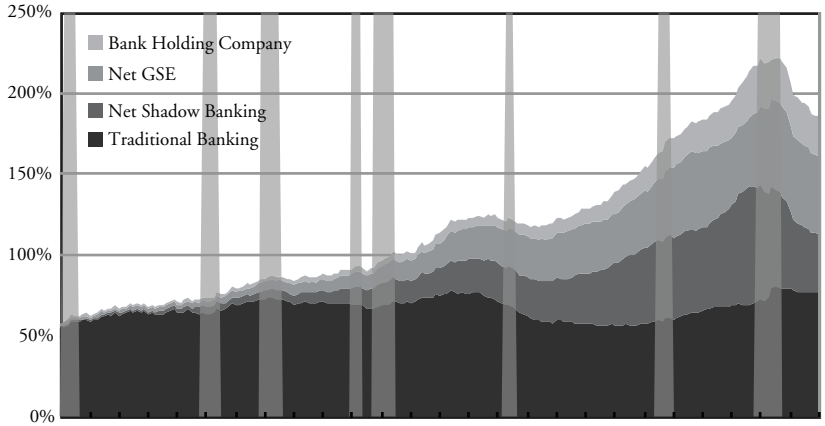
Ultimately, all claims are held by households. For example, firms' wealth (equity) is owned by its shareholders. When defining wealth shares, it is important to assign wealth to those sectors that are in control of resources. In this setting, it is clear that corporate executives, not households, possess the decisionmaking capital backed by this equity. When viewed from this perspective, it becomes apparent that flows are important as well.

II.ii Debt Service Burden

So far, we have focused on stock variables whose value might appreciate or depreciate as events unfold. To address liquidity, we must also consider flow variables, such as cash flows. Here, we focus on debt service burdens.

For the household sector, the Federal Reserve provides *the household debt service ratio* (DSR), which is an estimate of the ratio of debt payments to disposable personal income. Debt payments consist of the estimated required payments on outstanding mortgage and consumer debt. The *financial obligations ratio* (FOR) simply

Chart 2
Household Financial Obligations Ratio Compared to Relevant Interest Rates



Notes: Top to bottom
(left axis): Household financial obligations ratio controlled for price-to-rent; (no axis): price-to-rent ratio; (right axis): 30-year mortgage rate; three-month Treasury bill rate; Michigan inflation expectations.

adds lease payments, rental payments, homeowners' insurance and property taxes. These ratios can be high for two reasons: high (real) interest rates or high debt levels. A low-interest-rate environment is associated with high house prices and, thus, high debt levels. This explains why the financial obligations ratio for households in Chart 2 is relatively stable.

Observation 4: For the household sector, a decline in the mortgage rate has two effects. First, as households can refinance mortgages at lower rates, the debt service ratio declines. Second, lower interest rates lead to higher house prices, and households take out larger mortgages to finance their houses.

In other words, the debt service ratio should be proportional to the real interest rate times the debt level (or house prices). To separate the direct from the indirect effect, we regress the log of the debt service ratio to the log of the real interest rate plus the log of the price-rent ratio. We use the FHFA Home Price Index. The regression yields the coefficients shown in Table 1.

The lower part of Chart 2 depicts the real 30-year mortgage rate and the real three-month Treasury rate. To get real rates, we simply

Table 1
Log financial obligation ratio

Log-FO Ratio	Log-Real 30y Mtg. Rate		Log-Price to Rent		Constant	
Coefficient	0.0227	*	0.3697	***	-1.7486	***
Standard Error	0.0101		0.0603		0.0296	
R-squared	0.6045					

Notes: Log financial obligation ratio regressed on log real 30-year mortgage rate and the log-price to rent ratio using annual data from 1984-2011. *refers to 5 percent, ** to 1 percent, *** to 0.1 percent statistical significance.

subtract the expected inflation rate as measured by the Michigan survey. The shaded area between both rates reflects the spread between them. The chart confirms the empirical finding that low interest rates are associated with high house-price-to-rent ratios and the FOR controlled for the house price effect positively commoves with the 30-year mortgage rate.

Chart 2 shows the debt service burden for households. Two aspects are worth emphasizing. First, the debt service burden rises moderately from 1995. Relative to the overall increase of household debt, the increase in debt service burden has been modest because of the decline in interest rates. More pronounced is the sharp drop of the debt service burden since 2008. This sharp decline is due to the decline in debt and the drop in interest rates that eased the financial constraints on households.

For the *nonfinancial business sector*, we conduct a similar exercise. We consider the interest expense as a fraction of earnings before interest, taxes, depreciation and amortization (EBITDA) and relate it to the short-term interest rate and the corporate term spread. Since the interest-to-EBITDA ratio is a real variable, we relate interest expense EBITDA ratio to the real interest rate. The long-term corporate term spread is relevant since firms also issue long-term debt and, hence, have to pay term and credit spreads. The data are from CompuStat, taking the ratio across the aggregate sector excluding financial firms, insurance companies and real estate (SIC Codes 60xx, 61xx, 62xx, 63xx, 64xx, 65xx).

Observation 5: Debt service burden for the nonfinancial corporate sector is positively related to the interest rate and the spread between

Table 2
Nonfinancial business-interest-to-EBITDA ratio

Interest-to-EBITDA	Corporate - 3m Tsy		Real 3m Tsy		Constant	
Coefficient	1.2067	**	1.4499	***	0.1169	***
Standard Error	0.3597		0.2538		0.0183	
R-squared	0.5298					

Note: Nonfinancial business-interest-to-EBITDA ratio regressed on the Corporate BAA index spread over the three-month Treasury rate using annual data from 1979-2011.

the Moody's corporate BAA index and the three-month Treasury interest rate.

For the regression of the debt service burden on the real three-month T-bill rate and the real corporate BAA credit spread, the positive coefficient on the spread is highly significant at a 0.11 percent level.

II.iii A Closer Look at the Financial Sector

Apart from its role in many balance sheet recessions, there are several other reasons to split up the financial sector. First, the funding flow within the financial sector is large. By simply aggregating all financial firms and netting out exposures, we miss systemic risk and amplification mechanisms that arise within the financial sector. Second, risk exposures of different groups in the financial industry differ significantly. For example, commercial banks are active in maturity transformation, while life insurance and pension funds have complementary exposure to yield-curve changes. Third, different accounting rules make it difficult to compare different financial industries. While most assets of investment banks are marked to market, for commercial banks only the smaller trading book (and not the banking book) follows market prices. Differences in accounting rules affect not only data, but also firms' behavior.

We group financial firms into commercial banks, bank holding companies together with investment banks, shadow banking institutions, government agencies, insurance companies and pension funds.

Traditional *commercial banks*' debt consists primarily of demand deposits, CDs, interbank market funding and funding from their bank holding companies (BHCs). BHCs issue long-term bonds, medium-term notes and (financial) commercial paper. Some BHCs

are also active in the investment banking business. After Lehman's failure in September 2008, all large investment banks became BHCs. Hence, we group BHCs with investment banks that have broker-dealer businesses.

BHCs and investment banks have net repo liabilities to the nonfinancial business sector and the household sector. Corporations use the repo market like a checking account to hold short-term funds. They also invest along with households in money market funds and other bond funds.

Money market funds are part of the (less regulated) *shadow banking* system. Money market funds invest in various other shadow banking institutions and structured vehicles, such as securitized mortgage pools, auto loans and credit card receivables. While many obligations (including repos) net out within the shadow banking sector, shadow banking institutions also hold long-term debt of BHCs and investment banks. Prior to the Great Recession, BHCs obtained cheap secured funding since they could re-hypothecate their customers' collateral at favorable haircuts. Their securities lending activity is part of this activity.

Government agencies like Freddie Mac and Fannie Mae were large players in securitization—often simply by pooling (qualified) mortgages and issuing agency bonds. The U.S. government initially implicitly guaranteed and, since July 2008, has explicitly guaranteed these agency bonds.

We look separately at *insurance companies* and *pension funds* since the maturity structure of their assets and liabilities is different from that of traditional and shadow banks. Insurance companies and pension funds have long-dated liabilities. Hence, changes in the yield curve affect them very differently from the rest of the financial sector.

Overall, it is difficult to find reliable measures of these sectors' debt obligations. This is especially true for the shadow banking sector. Many entities (such as hedge funds) do not report their holdings and liabilities. Another problem is the double-counting of debt within a sector as the intermediation chain grows. This double-counting explains a large part of the growth of financial institutions' debt in

Chart 1. Foreign banks that are active in the United States also complicate the picture.

The general trend is a steady and fast rise in shadow banking, partly at the expense of the traditional banking system from the 1980s. During that period, the following events occurred: 1) Basel I created incentives for securitization, and 2) interest rate regulation favored money market funds. At the same time, IT innovations made collateral management for repo markets easier.

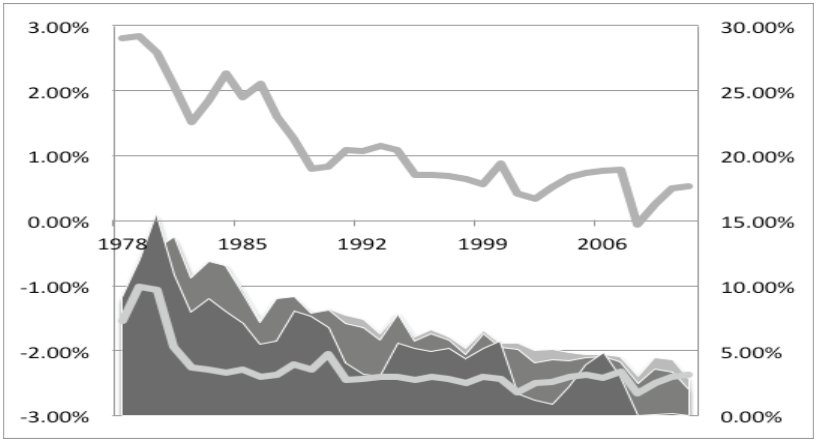
During the S&L crisis in the 1980s and early 1990s, the burgeoning shadow banking sector only partly compensated for the slowdown in traditional banking activity. However, financial sector liabilities grew at only a moderate pace prior to the S&L crisis.

This result is in stark contrast to the beginning of the current financial crisis, where we observed a sharp drop in shadow banking activity in the second half of 2007. The initial drop occurred as ABS issuance and the ABCP market froze. Interestingly, this drop was more than offset by an expansion in activity by the government-sponsored enterprises (GSEs) and Federal Home Loan Bank. A closer look at Chart 3 also highlights the role that GSEs played in the early part of the crisis. In July 2008, the debt of government agencies became explicit government debt and it seems that the GSEs lost their moderating role. The real collapse of the shadow banking system followed the demise of Lehman. At that point, investors fled to FDIC-insured demand deposits, leading to an increase in the liabilities of traditional banks at that time. For a more detailed description of these events, see Brunnermeier (2009).

Interest movements can affect the value of assets and liabilities of financial institutions and also affect future earnings. Different parts of the financial industry are sensitive to different parts of the yield curve. Hence, nonconventional monetary policy that tries to target the term spread directly has different redistributive consequences than a simple reduction in the short-term interest rate.

For commercial banks and *BHCs*, data from call reports allow us to split net income into net interest and net noninterest income. Accounting rules play an important role in the regression specification.

Chart 3
Debt-to-GDP Ratio of Various Components of the Financial Sector



Notes: Debt-to-GDP ratio of commercial banks, shadow banks, government-sponsored enterprises and bank holding companies including investment banks. NBER recessions are represented as shaded columns.

If assets are marked to market, then an interest rate cut that steepens the slope of the yield curve leads to an immediate capital gain reported as an increase in noninterest income. On the other hand, if the position is not marked to market, an increase in an institution's profitability through higher net interest margins shows up only with a lag in the net interest income line item.

A detailed study of the effects of interest rate changes on bank stock returns and income can be found in English, Van den Heuvel and Zakrajsek (2012). Here, we report a section of Table 8 from their panel regression results.

In their study, English et al. consider three income measures normalized by assets and regress them on maturity gap, other assets, other liabilities, savings deposits, demand deposits, loans and bank size all interacted with level and slope; the regressions also include level and slope as independent regressors and four lags of income.

The first row of regression coefficients shows that an upward parallel shift of the yield curve is associated with higher net interest and net income over assets. There are at least two reasons for this result. First, as the interest rate increases, the value of assets drops faster

Table 3
Income-to-Asset Ratios

	Net Interest Income		Noninterest Income	Net Income	
3m Tsy	0.088	***	-0.015	0.051	***
(Std Error)	0.014		0.011	0.010	
10y - 3m Tsy	0.071	***	0.005	0.037	***
(Std Error)	0.011		0.008	0.008	
R-squared	0.690		0.321	0.258	

Notes: This table reports three income-to-asset ratios regressed on level and slope of the yield curve and various other controls. The table is an excerpt of Table 8 in English et al. (2012).

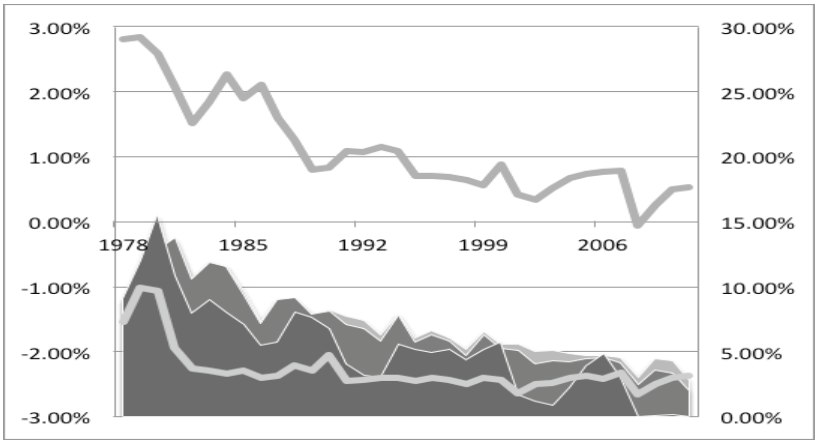
than the income. Indeed, the authors show that change in log assets is significantly negatively related to positive shifts in level of the yield curve. Second, this result could be simply driven by the fact that the level of the yield curve is high when economic growth is high. That is, a third omitted factor could be driving these results without any direct causal link between the level of the yield curve and the profitability of banks.

More interesting for our purposes is the coefficient on the term spread between the 10-year Treasury bond and the three-month Treasury bill rate. Banks are typically active in maturity transformation, and their net interest income and net income rise with the term spread. Noninterest income shows no significant change.

To control for the endogeneity of these interest rate changes, English et al. look at surprise interest rate movements relative to the predictions from the federal funds futures market. Bank stock prices fall following an unanticipated rise in the level of the yield curve. They also fall, however, with an unanticipated steepening of the yield curve.

On the other hand, Begenau, Piazzesi and Schneider (2012) find that the big four BHCs benefit from interest rate cuts. This paper assumes a two-year swap rate as a single factor, so that all risks, even default risk, can be replicated with a combination of a long-maturity riskless public bond and cash. Within their framework, they find that banks are generally short cash and long the riskless bond. Instead of using interest rate derivatives to hedge, these BHCs amplify their interest rate exposure.

Chart 4
Life Insurance Companies' Net Income Compared to Relevant Interest Rates.



Notes: Top to bottom (left axis): Life insurance net income over assets; (right axis): 25-year T-bond; 10-year T-note; three-month T-bill; Michigan inflation expectations.

In sum, while accounting variables show a positive correlation between bank interest net income and the slope of the yield curve, evidence using stock market data is mixed.

Observation 6: Net income measures for BHCs are positively related to the term spread.

The maturity structures of *life insurance companies* and *pension funds* differ from those of banks. Their liabilities are very long term, often up to 30 years. Since the set of fixed-income instruments with such long maturity is limited, their assets are of shorter duration. Chart 4 indicates a negative relationship between the 25-year to 10-year Treasury spread and life insurance companies' net income.

Life insurance companies are not subject to special accounting rules, and they don't mark their positions to market. Hence, any change in the 25- to 10-year term spread will require some time to show up in the net income numbers.

In Table 4, Panel A reports the regression coefficient of net income over assets on the 25-year to 10-year term spread with various lags

Table 4

Insurance NI/Assets	25y-10y (-3)	25y-10y (-2)	25y-10y (-1)	25y-10y	Real 3m Tsy	Intercept
Coefficient	-0.8454*	0.2028	0.2368	-0.4622	0.1158*	0.0109***
Standard Error	0.3570	0.4318	0.4288	0.4801	0.0604	0.0029
R-squared	0.6552					

Pension Funding Status	25y-10y (-2)	25y-10y (-1)	25y-10y	Real 3m Tsy	Intercept
Coefficient	-16.9382*	2.1253	13.1257	7.5868***	-0.0483
Standard Error	7.5490	9.3954	10.6505	1.4540	0.0644
R-squared	0.8054				

Notes: Panel A reports the regression coefficients of level of life insurance companies' net-income-to-asset ratio on the contemporaneous and lagged level of the 25- to 10-year term spread and short-term real interest rate. Panel B reports the coefficients for the difference in pension funding status. Insurance data are annual from 1978-2011, while pension fund data are from 1985-2011.

and the short-term real interest rate. Panel B repeats the exercise for the funding status of pension funds.

Upward parallel shifts of the yield curve boost the net income of insurance companies and the funding states of pensions. However, a widening of the 25-year to 10-year term spread tends to hurts life insurance companies and pension funds.

Observation 7: While for banks the 10-year to three-month term spread was more relevant, for life insurance companies and pension funds the longer end of the yield curve—the 25-year to 10-year term spread—matters most.

So far, we have ignored the important interplay between funding liquidity on the liability side and market liquidity on the asset side of balance sheets. The next sections provide the conceptual underpinnings of deeper analysis and explain the role that monetary policy could play to mitigate redistributive amplification effects.

III. The Three Phases of Financial Recessions

This section provides a theoretical framework by which financial recession can lead to wealth redistributions. Without theory, it is impossible to interpret the stylized observations made above. The regressions linking expense or income statements with interest rates

are especially plagued by endogeneity problems. Interest rates are a (monetary) policy instrument and respond to the economic environment—for example, to losses in the financial system.

Financial recessions are typically preceded by a period of increasing imbalances, booming asset prices and growing credit. The subsequent financial recession sets in motion a number of amplification mechanisms, which often lead to significant and persistent reductions in economic activity. Recovery after financial recessions can be slow in large advanced economies.

III.i Boom Phase: The Run-up

Financial recessions stem from the earlier buildup of systemic risk in the form of unsustainable imbalances and bubbles. The accumulation of these imbalances can be attributed to incentive and belief distortions. *Incentive distortions* arise from moral hazard problems caused by expected bailout policies or simply because market participants fail to internalize fire-sale externalities. For example, when levering up with short-term debt, each speculator takes into account only that he might not be able to roll over his debt and might be forced to sell assets at fire-sale prices. However, the same investor does not take into account that his selling will depress prices, potentially forcing others to sell as well. Put differently, financial stability is a public good and each individual trader's contribution is less than socially optimal.

Inadequate data and anecdotal evidence of "this time is different" thinking make it difficult to rule out *belief biases*. Initially, booms can be rationalized by appealing to some form of innovation. This innovation could be technological change (railroads, telegraph, the Internet), financial liberalization (the removal of Regulation Q), or financial innovation (securitization).

However, as the imbalances and bubbles gain momentum, it ultimately becomes clear that the fundamental improvements that may have warranted an initial increase in asset prices cannot keep up with ever-increasing valuations. Even though some market participants are prone to extrapolative expectations, the question of how such

imbalances can build up for so long—and what prevents rational investors from correcting them sooner—remains.

One answer is that individual rational market participants find it more profitable to ride the trend rather than lean against it "as long as the music is playing." In a setting in which a correction occurs only after a sufficiently large number of market participants change course, each individual waits for others to move. Abreu and Brunnermeier (2003) model this *synchronization problem*. Market participants sequentially receive a signal that the current trajectory is unsustainable. Each market participant weighs the gain from riding the trend against the risk of being caught in the inevitable collapse. In equilibrium, large imbalances build up as agents initially choose to ride the trend, and the correction occurs only after a significant delay. The main problem is that the necessary correction often occurs after large imbalances have already developed.

Booms fueled by credit deserve special attention, since the bursting of credit bubbles leads to more deleveraging and stronger amplification mechanisms. For example, while the bursting of the technology bubble in 2000 triggered significant wealth destruction, its impact on the real economy was relatively mild in comparison to the Great Recession. The distinguishing feature of the Great Recession was the preceding credit boom. Similarly, the run-up in stock prices during the Roaring Twenties was, to a large extent, based on credit in the form of margin trading—it was financed through short-term loans. This credit-fed boom ultimately led to the Great Depression. Likewise, the Scandinavian crisis in the early 1990s and the Japanese "lost decade" were also preceded by lending booms that had led to unsustainable asset prices.

The core of our analysis and policy recommendations is derived from the framework developed in BrunSan (2011, 2012). We sketch the details and main implications in the next section, but will highlight here two important results that directly refer to the run-up phase:

1. volatility paradox

2. destabilizing financial innovation

The *volatility paradox* refers to the phenomenon that a reduction in exogenous risk level makes the system more prone toward systemic volatility spikes. The reason is that lower exogenous risk invites financial institutions to pay out more in dividends and bonuses, thereby increasing their leverage. This leads to higher systemic risk. In the end, whatever the exogenous fundamental risk, it is normal for the system to sporadically enter volatile regimes. Low-risk environments, like the Great Moderation, are conducive to greater buildup of systemic risk. In other words, a low-volatility environment, in which financing is easy to obtain, is the ideal foundation for a credit boom.

Second, *financial innovation* can be self-defeating. BruSan (2011) considers a setting in which productive institutions are exposed to idiosyncratic risk in addition to macro risk. Some firms go bankrupt when they suffer an idiosyncratic shock. Anticipating potential bankruptcy and foreclosure costs, bond holders charge a spread as a compensation for these expected losses up front. One might expect financial innovation that allows firms to hedge against these idiosyncratic risks would improve financial stability. However, when firms can hedge their idiosyncratic risk they feel emboldened and take on more leverage, which can make the whole system less stable. Thus, while securitization and other financial innovations are ostensibly quite beneficial in that they decrease the costs of idiosyncratic shocks and reduce interest rate spreads, they can unintentionally lead to amplified systemic risk in the economy.

III.ii Bust Phase: Liquidity and Deflationary Spirals

After the gradual buildup of a bubble and the associated imbalances, a trigger event can lead to the bursting of the bubble. The trigger event that catalyzes the crisis—sometimes referred to as the Minsky moment—does not have to be an event of major economic significance when considered independently. Strategic complementarities can lead to amplification or even to multiple equilibriums, with the possibility of a jump to a Pareto inferior equilibrium. In such environments, even a modest trigger event can cause large spillovers across the financial system.

Spillovers can be direct from one institution to its counterparty, leading to so-called domino effects, or they can be indirect. For example, depositor bank runs, or their modern reincarnation as counterparty runs in wholesale funding markets, are direct spillovers. Indirect spillovers, however, arise even if two parties have no contractual links. They work through common risk exposures through prices, constraints and the endogenous responses of market participants.

To better illustrate the underlying mechanism and to develop a framework that allows us to evaluate various policy measures, we sketch here the BrunSan (2011, 2012) model.

Any model that studies financial instability and the role of financial frictions must depart from the representative agent analysis and involve heterogeneous agents/sectors. Instead of focusing specifically on the sectors mentioned in Section II, BruSan splits agents into three groups: end-borrowers, savers and the financial sector. End-borrowers can be entrepreneurs that are more productive in operating a piece of equipment. They can also be agents that derive a higher utility from owning a house or who simply value it more than others. End-borrowers might also more risk tolerant, less patient, younger or simply more optimistic. What is important is that some agents would like to scale their operations, that is, their capital holdings, beyond a level that their own funding would allow.

Another element is that financial frictions limit funding and risk sharing among agents. For example, direct financial arrangements are limited when the fund provider cannot effectively monitor the borrower. Specifically in BruSan, contracts can be written on the value of physical capital but not on the (aggregate) efficiency level of capital.

The financial sector has a special (monitoring) technology that partially mitigates these financial frictions.[3] However, to align incentives, financial firms are required to have "skin in the game." That is, similar to the static setting of Holmström and Tirole (1997), the financial sector must be responsible for some of the risk of end borrowers (productive agents) in order to mitigate financial frictions. The risk-bearing capacity of the financial sector depends on how well the financial sector is capitalized—specifically, it depends on its net

worth. Of course, if the end borrowers have more wealth, then they are also able to scale up. The state of the economy is described by the net worth of the financial sector and the net worth of the productive sector. Aggregating the net worth shares of the financial sector and end borrowers yields a variable η that strongly affects economic activity. When η is low, the economy becomes financially constrained. In special cases, η becomes the only state variable important for system dynamics.

When the financial sector is sufficiently wealthy, competitive forces erode expected returns for financial firms. At that point, some of the bankers pay out their excess net worth and increase leverage to boost returns. Increased payouts imply an upper limit for the wealth share of the financial sector. The theoretical lower limit of the financial sector's wealth share is close to zero.

The economy is subject to exogenous macro shocks that affect the productivity of physical capital. Either fewer (or more) goods can be produced with the same amount of capital, as in BruSan (2011), or part of the capital can be misappropriated, as in BruSan (2012). These shocks affect the return on capital. Recall that the return on capital is lower for less productive agents, as physical capital held in their hands produces less output. In addition, it might depreciate faster because they may be less able to maintain the physical capital.

The equilibrium price of capital, q, depends on the aggregate net worth share of the financial sector and end borrowers η, which moves between two extremes 0 and η^*. The upper price limit arises when the financial sector is well capitalized and, therefore, capital is purely held by the productive sector. When banks are less well funded, the equilibrium price, q, drops as the demand for capital goods declines. The lower price limit arises when η approaches zero and all capital is held by the less productive agents.

An adverse exogenous shock can lead to sharp price movements because of amplifying adverse feedback loops. We first discuss three liquidity spirals before analyzing the deflationary spiral. To better understand the liquidity spiral, it is useful to distinguish between three liquidity concepts.

1. **Technological illiquidity**
   Physical capital is illiquid if initial investment is irreversible—that is, when capital cannot be converted back into consumption goods. Technically, technological illiquidity is captured by adjustment costs in the investment function. Of course, if projects are short-lived, that is, capital depreciates very fast, then they are de-facto reversible. The depreciation rate can be viewed as the "duration" of the capital good.

2. **Market illiquidity**
   Market liquidity is high if capital can be sold off to others without a large price impact.

   a. Physical capital enjoys high market liquidity if it can be easily redeployed, because its specificity is low. In other words, if it has a high second-best use.

   b. Financial claims have high market liquidity if there are no related informational problems: that is, incentives are aligned between principals and agents.

3. **Funding illiquidity**
   Unlike technological and market liquidity, funding liquidity refers to the liability side of the balance sheet. Funding liquidity is primarily determined by the maturity structure of debt and the sensitivity of margins/haircuts. If the margin can jump from 10 percent to 40 percent overnight, then 30 percent of the margin loan essentially has the maturity of one day.

A *liquidity mismatch* arises in BruSan since short-term (instantaneous) debt funding is used to finance the purchases of long-duration capital. Capital investment depreciates only at rate δ (in the hands of less productive agents, at rate $\underline{\delta}$). Moreover, the technological liquidity of physical capital is low because of (dis)investment adjustment costs. In addition, market liquidity is low because of the productivity difference between more and less productive agents. Capital "fire-sold" to less productive agents is employed only at its second-best use. (Note that liquidity mismatch, not maturity mismatch, is

important. For example, if market liquidity were perfect, the maturity mismatch would not matter.)

Liquidity spirals amplify any initial adverse productivity shock. The amplification depends on leverage and feedback loops that arise as prices react to changes in the net worth of constrained agents. Interestingly, when the financial sector is well capitalized, financial firms reduce payouts in order to avoid asset sales. This stabilizes the price of capital and dampens the adverse feedback loop. However, when the financial sector is less well capitalized, further adverse shocks lead to fire sales. As a consequence, the price of capital drops significantly and with it the net worth of banks and end borrowers. The severity of the *loss spiral* depends on the initial leverage of banks and on the productivity difference between more and less productive agents. Recall that less productive households provide a floor on the price of capital, as they can redeploy capital in its second-best use.

The financial sector's leverage depends on 1) the payout policy in good times, and 2) asset holdings. When choosing how much to pay out in the form of dividends and bonuses, each financial firm trades off safety with the cost of retaining earnings. Holding extra funds inside the firm provides safety, especially in a (endogenously) risky environment, as firms can sustain negative shocks without triggering asset fire sales.

In bad times, firms' payout is limited and their risk taking depends on the following trade-off. When the net worth of banks is low, their profit opportunities are high as competition is restrained. The marginal value of an extra dollar of net worth is high. On the other hand, risk is high since subsequent negative shocks depress prices even further. Because of the increased marginal value of wealth, a lower choice of leverage would have led to a superior outcome. At any moment in time, institutions balance this trade-off between endogenous return and endogenous risk. As their net worth drops, they reduce their holding of capital assets.[4]

The model exhibits interesting endogenous volatility dynamics due to systemic risk. Importantly, systemic risk depends on agents' behavioral responses and risk-taking decisions both before and

after adverse shocks. The model also explains the asymmetry (negative skewness) of business cycles.

One can extend the analysis of BruSan (2011) and introduce additional funding liquidity restrictions that explicitly depend on the volatility of the price process (see, for example, Phelan 2012). As price volatility increases, margin and haircut requirements tighten. In this case, an additional liquidity spiral (the *margin/haircut spiral*) emerges (see Brunnermeier and Pedersen 2009). Higher volatility leads to higher margins, forcing institutions to sell more capital. The resulting sharper price movements, in turn, increase volatility and adverse feedback obtains.

BruSan (2012) adds money to the analysis in order to study the interaction between financial stability and price stability. The model allows one to study the *Fisher deflationary spiral* and its interaction with the liquidity spirals. Unlike capital, which is risky, money's role is as a safe store of value. Outside (fiat) money is issued by the government and its value is determined endogenously. Inside money is issued by the financial sector in the form of short-term nominal debt obligations.

Again, let us start with the two extreme scenarios: 1) when the financial sector is close to bankruptcy and hence essentially absent, and 2) when the financial sector is extremely well capitalized. In the first case, agents can hold capital for their "own" enterprise and money. Productive agents (end borrowers) are willing to hold primarily physical capital, while less productive agents (savers) tilt their portfolio primarily toward less risky money. While all agents earn the same return from holding money, productive agents earn higher return from capital. In the second extreme case, the financial sector has a large risk-bearing capacity. The financial sector funds itself through short-term nominal debt (by issuing large sums of inside money), and channels the funds to the productive sector. It is assumed that, unlike agents who can invest only in their own enterprise, the financial sector can diversify across productive agents' projects.

As before, the extent to which less productive agents are willing to fund the financial sector depends on banks' risk-bearing capacity. The financial sector faces a "skin in the game" constraint. A well-

capitalized financial sector can channel sufficient funds to the productive sector, improving resource allocation in the economy. This also leads to more demand for and a higher price of physical capital, q. On the other hand, the price of money, p, is now lower since the extra supply of inside money created by the financial sector competes with outside money supply.

Next, consider an adverse macro shock. As before, the liquidity spiral creates adverse effects on the price of capital and intermediaries' net worth. Now, however, the reduction in the financial sector's net worth has a second important effect. As the financial sector cuts back its exposure to satisfy its "skin in the game" constraint, it issues less inside money just as productive agents are forced to sell off physical capital to less productive agents, depressing the price of capital. The money multiplier collapses. Overall money supply in the economy shrinks.[5] Hence, the value of money increases, i.e., deflationary pressure emerges.

As deflation increases the real value of the financial sector's liabilities and thereby reduces its net worth even further, a *deflationary spiral* arises. Because of these two spirals, a negative shock hits the financial sector on both sides of the balance sheet. On the asset side, the liquidity spiral depresses asset prices and reduces the banks' net worth. On the liability side, the real value of liabilities actually increases after a negative shock, leading to further erosion of net worth. Both spirals amplify the overall impact of the initial exogenous shock. Note that holding money is attractive also for hedging reasons, as in time of crisis the value of money increases as a result of deflationary forces.

Note that the Fisher deflationary spiral can also arise with positive inflation. For example, the amplification mechanism is also active when a negative shock sharply reduces inflation below the level that would have occurred absent the shock. In other words, the number zero inflation is not special in the BruSan framework.

Two important insights emerge from this analysis, which will also guide our policy discussion in the next section:

- First, financial intermediaries impose a negative externality on each other. As each intermediary delevers, it does not internalize

its contribution to either the asset price collapse or the deflationary pressure.

- Second, spirals after an adverse shock cause large redistributions away from the banking sector. However, this redistribution does not benefit other agents; rather, it leads to an overall wealth destruction due to inferior resource allocation.

So far, an adverse shock simply reduces the money supply as the money multiplier collapses. In a setting with non-log utility functions, money demand can also increase in times of crisis as the precautionary savings motive increases. At that point, demand for any safe store of value would increase even more. The demand for other assets thought to be safe would rise as well in this *flight to safety*. That is, asset price inflation sets in, while the CPI falls.

To allow for open market operations, BruSan (2012) introduces a perpetual government bond that pays a fixed nominal amount of interest in every period. A broad money measure then includes not only short-term money but also this government bond. If there is a danger that the government might default on long-term bonds, a diabolic loop between sovereign and banking risk arises. Furthermore, the monetary transmission mechanism could be impaired. Section IV focuses on policy responses and discusses these aspects in further detail.

III.iii Recovery Phase

Recovery from financial recessions can be sluggish and protracted. Sectors whose finances are impaired devote their resources to repairing balance sheets. After the bursting of the Japanese real estate and stock market bubble, the nonfinancial business sector scaled back investments and focused on paying off debt. Currently, in the United States, households are scaling back consumption to accumulate savings. In addition, the financial sector is slowly recapitalizing itself through retained earnings to satisfy higher capital requirements.

Bernanke and Gertler (1989) wrote the first theoretical paper to highlight the persistence of balance sheet recessions. In their work, the corporate sector returns to normal steady growth only after a long

period of recapitalization. In Bernanke, Gertler and Gilchrist (1999) and Kiyotaki and Moore (1997), this persistence into the future affects current asset prices and hence feeds back, exacerbating the initial amplification effect. BruSan (2011) gives a full characterization of the volatility dynamics. While the system is relatively stable with reasonable growth in the normal regime, it can be thrown off and trapped for some time in a recession with low growth and low market liquidity. This happens after moving through a high-volatility region. The stationary distribution in BruSan (2011) is U-shaped, implying that the system spends most of its time around the steady state, transitions very speedily through the intermediate region with high volatility, and also spends a considerable amount of time in the depressed regime with low growth.

Empirically, the profession has not settled the question of how fast recovery occurs after financial recessions. Reinhart and Rogoff (2009) define a slump as the period from the peak in GDP per capita to the date at which that peak is regained. They provide empirical evidence for a sluggish recovery phase. Bordo and Haubrich (2012) argue to the contrary, measuring the speed of the recovery by its slope. For the United States, only the Great Depression and Great Recession stand out as slow recoveries.

The speedy recovery of emerging-market economies after a sudden stop of capital inflow—coined as the "Phoenix Miracle" by Calvo, Izquierdo and Talvi (2006)—also seems to go at first sight against the above mentioned "slow recovery hypothesis" of financial recessions. A closer look, however, reveals that a key for emerging-market recovery is export growth resulting from real exchange rate depreciation. This leads to higher growth in output, working capital and temporary employment. However, despite the real exchange rate depreciation, credit and long-term employment are also subdued in emerging markets. Overall, the empirical evidence suggests that the effect has to interact with some other variables, such as housing debt or foreign exchange.

IV. Monetary Policy

Carefully designed policy can reduce the frequency of financial recessions and minimize inefficiencies once they happen. Our

analysis suggests that some seemingly natural policy responses can actually be counterproductive. Importantly, contrary to predominant view, the three objectives of price stability, financial stability and fiscal government debt sustainability cannot be treated independently from each other and assigned separately to monetary, regulatory and fiscal authorities, respectively. They are all closely interlinked.

The first part of this section looks at the optimal monetary response to an adverse shock, while the second part studies monetary policy rules from an ex-ante perspective with a special focus on moral hazard. Section V deals with fiscal policy and restructuring policy.

IV.i Monetary Policy Response to Adverse Shocks

Most central banks have the following monetary policy tools at their disposal: 1) short-term interest rate policies, 2) "helicopter drops" of money, 3) asset purchase programs and 4) collateral policies for lending programs. (Equity infusions and other restructuring policies are discussed in Section V.ii.) The effectiveness of these tools depends on the central bank's credibility about its future behavior conditional on the state of the economy.

Most macroeconomic models emphasize the Keynesian *interest rate channel*. The key friction in these models is some form of price or wage stickiness. Lowering the nominal interest rate leads to a lower real interest rate. A lower real interest rate stimulates aggregated consumption and investment as the representative agent brings consumption forward and investment projects become more profitable. In New Keynesian models, interest rates are set by a rule—for example, the Taylor rule—and money serves only as a unit of account. The zero lower bound of the nominal interest rate is an important restraining factor and the main justification for nonconventional monetary policy and fiscal measures.

"The I Theory of Money" in BruSan (2012) stresses a new channel: the *redistributional channel* of monetary policy. Instead of price stickiness, financial frictions are the source of inefficiencies. Monetary policy leads to changes in various asset prices and the values of debt/mortgage contracts. This monetary transmission channel works

primarily through capital gains, as in the asset price channel promoted by Tobin (1969) and Brunner and Meltzer (1972). Lower interest rates can also increase the risk-taking behavior of investors and asset price distortions, as shown in Adrian and Shin (2011).

An important element in BruSan (2012) is that asset holdings are not symmetric, and, hence, monetary policy affects different economic agents differently. As a consequence, monetary policy redistributes wealth. *Targeted* monetary policy can lead to redistributive effects that mitigate distortions, such as debt overhang problems that arise from amplification mechanisms described in Section III. These mitigating effects can spur growth and lead to an overall higher wealth level in the economy. For specific scenarios, monetary policy can even lead to Pareto improvements, making all agents in the economy better off. We therefore refer to these effects as *relative* wealth redistributions to stress that redistribution in our setting is not a zero-sum game.

To study monetary analysis, we have to add important elements to the bare-bones model of BruSan (2012) described in Section III. First, a central bank in BruSan (2012) pays interest on reserves (outside money), which mirrors the institutional framework in the euro zone and in the United States since fall 2008. In the model, these interest payments are fully financed by seigniorage. In other words, any interest policy is fully financed and budget neutral at any point in time. Varying the short-term interest rate is the key conventional monetary policy tool.

Conventional Monetary Policy

Conventional monetary policy can influence wealth distribution in two ways. First, lowering the short-term interest rate reduces banks' funding costs. If competition among banks is limited, banks are not forced to pass on the cheaper funding costs to their customers and, hence, are able to increase their profit margins. The increase in net interest margins is a slow way to recapitalize banks. English et al. (2012) show that banks' interest income is typically higher in a low-interest-rate environment. Redistributive effects of monetary policy

were debated in Japan in the mid-1990s when the Bank of Japan adopted a low-interest-rate policy.[6]

Second, interest rate policy can affect asset prices. BruSan (2012) focuses on the redistributive effects caused by asset price movements. The paper introduces a long-term bond—specifically, a consol bond with infinite maturity that promises nominal interest payments. Now, interest rate policy has an impact because low short-term interest rates increase the value of long-term bonds and redistribute wealth to long-term bond holders. In the model, the central bank simply reduces the interest it pays on outside money (reserves) to lower the short-term interest rate. In reality, central banks might also have to conduct (relatively small) open market operations that exchange short-term money for long-term bonds to ensure that the new short-term rate target is reached. In BruSan (2012), the sector that is exposed to the liquidity/deflation spiral risk holds the long-term bond, when it expects policy responses to cause the appreciation of these bonds in downturns. Hence, an accommodative interest rate policy after an adverse shock partly offsets the negative wealth shocks. This can be referred to as a "stealth recapitalization" because it is a way to redistribute wealth toward the distressed sector.

Note that this framework emphasizes money as a store of value. Both short-term money and long-term bonds are stores of value and, hence, are part of the total broad (outside) money supply.

For conventional monetary policy to control the long-term yield—to achieve a shift in the long-term bond price—it is necessary that the central bank credibly commit to a low interest rate until the economy strengthens again.

Interestingly, *forward guidance*, a central bank's commitment not to increase the short-term interest rate for several months, can have very different redistributive implication compared to a further interest rate cut. An additional interest rate cut, widens the term spread and hence benefits banks, which typically fund themselves at the short end of the yield curve and invest in assets of intermediate maturity. In contrast, a promise by the central bank not to increase the

interest rate lowers the term spread and hence is more advantageous for end borrowers.

Unconventional Monetary Policy

Unconventional monetary policy can take on different forms. First, the famous "helicopter drop" of short-term money or long-term bonds (which has a fiscal component to it). If the extra money supply is targeted at a specific sector, that sector will benefit the most. But even if the extra money is distributed symmetrically among all economic agents, those that hold nominal claims suffer compared to agents that own real projects, because the overall price level adjusts. The relative redistribution occurs between nominal and real claim holders.

Second, *asset purchase programs* directly benefit the holders of these assets. For example, long-term bond yields are determined by both credible short-term interest rate policy and bond purchase programs. For example, if a bond purchase program makes it more difficult (easier) to commit to a low interest rate environment, the overall impact of short-term interest rates on the long-term yield might be muted (larger). Krishnamurthy and Vissing-Jorgensen (2011) try to quantify the importance of various channels of the Federal Reserve's quantitative easing programs. To the extent that asset purchases signal the central bank's commitment not to increase the interest rate once the economy recovers, they can have similar redistributive effects as forward guidance.[7]

The central bank can also purchase other, more risky assets. By doing so, the central bank takes on (upside and downside) risk. For example, the central bank could purchase risky claims or capital directly, as in BruSan (2012). If the asset purchase program involves real claims, then the money supply increases. This also induces a relative redistribution between nominal and real claim holders. Note that even nominal bonds with default risk can have a real component if the default probability depends on the price level.

Lending programs are the third form of nonconventional monetary policy. Central bank's have lender of last resort role, Bagehot (1877).[8] These programs are subsidized lending arrangements with the purpose of inducing certain investors to purchase or hold on to

particular assets. This provides a price support for these assets and directly benefits the previous holders of these assets. Investors who take advantage of this program benefit only to the extent that they do not compete the rents away.

Unlike with straight asset purchase programs, with lending programs the central bank assumes only downside tail risk. The risk materializes only if both the value of the underlying collateral fails to cover the borrowed amount and the borrowing party defaults. By varying the collateral requirements, the central bank assumes more or less tail risk.

When is monetary policy *most welfare enhancing*? As outlined in Section III, absent any monetary intervention, an adverse shock leads to fire sales of physical capital from productive to less productive agents and, in addition, to disinflationary pressure. Monetary policy that is accommodating in these states of the economy provides support for the price of capital and other assets. The analysis in Bru-San shows that this is most welfare enhancing if

1. market liquidity of capital is low, since the difference between productive and less productive agents is large, and
2. the level of exogenous volatility is low.

Intuitively, if the productivity difference between agents is large, then reallocating physical capital to the less productive agents destroys more wealth. In addition, the larger price impact of fire sales amplifies the liquidity and disinflationary spirals. In such an environment, endogenous risk is very high. When exogenous risk is low, the resources required to effectively stabilize the system are low, and hence monetary policy can have the greatest benefit.

The *responsiveness of monetary* policy depends on the quantity and maturity of outstanding government debt and other long-dated assets, as well as on whether mortgage interest rates are primarily fixed or floating. For example, if the ailing sector holds more long-dated assets, then a smaller interest rate cut might suffice to generate the same capital gains effect. Surprisingly, interest rate derivatives that insulate banks from interest rate risk make monetary policy less

effective. However, there is evidence that large bank holding companies use these interest rate derivatives to amplify interest rate risk rather than reduce this risk (see Begenau et al. 2012).

Linking the 'I Theory of Money' with the Fiscal Theory of the Price Level: A Diabolic Loop

So far, we have assumed that the government budget is always balanced and, hence, government debt is sustainable. Indeed, the government's only expense was the interest payments on reserves financed by seignorage. Since reserves are a relatively small part of the total money supply, this is not a dominant effect. Next, we enrich the environment to allow for the possibility of government debt becoming unsustainable, such as after the economy suffers an adverse growth shock. This allows us to bridge the "I Theory of Money" with the *fiscal theory of the price level* and to study inflation, capital flight and the diabolic loop between sovereign and banking risk.

When government debt becomes unsustainable, there are three possible regimes. In the monetary dominance regime, the monetary authority is in the driver's seat in the sense that adverse shocks are mitigated by *fiscal spending cuts or tax increases* in order to return to a sustainable path of fiscal (primary) surpluses and stabilize the value of the currency. In the fiscal dominance regime, the fiscal authority determines government spending. In doing so, it has a large impact on inflation, and the monetary authority is de facto not in full control of *inflation*. Proponents of this fiscal theory of the price level literature question whether a central bank can ever be independent of the fiscal authorities.[9] The third regime involves a *default* on government debt.[10] Of course, ex ante, there can be policy uncertainty about which regime will materialize. This political uncertainty adds another layer of endogenous risk.

If the market expects that 1) the government will not return to a sustainable fiscal path and 2) the central bank will not monetize the unsustainable part of future government expenditures, then long-term bonds are subject to default and the difference between sovereign and private debt claims vanishes. In other words, government bonds lose their "moneyness" as their role as a store of value is

compromised. The overall supply of safe assets drops. A similar effect occurs for demand deposits, when demand deposit insurance is not sufficiently funded.

An immediate consequence of this uncertainty is a *flight to safety*. When the government bond loses its "safe harbor" quality, investors will shift to other stores of value, such as foreign government bonds or gold. Which foreign government bonds are considered to be safe depends on foreign countries' debt sustainability and institutional arrangements. As safe assets are an equilibrium phenomenon, some assets can be considered "safe" owing to self-fulfilling expectations. If other investors tend to buy a certain asset in times of crisis, then the higher value of this asset can be more easily sustained. A classic example is gold, which has been a safe harbor for thousands of years. Its value rises in times of crises even though the fundamental value of gold is not strongly time-varying.

If the financial sector holds a lot of government debt, the *diabolic loop between sovereign debt and banking debt* can exacerbate the situation. There are at least two spirals at work here. As the real value of long-term bonds drops, the financial sector contracts its balance sheet. The resulting credit crunch stifles real economic growth. Lower economic growth lowers the tax revenue for the sovereign, making a default or monetization of government debt more likely. At the same time, the financial sector might need to be recapitalized by the government.[11] The increased probability of a bailout makes it less likely that the government will be able to honor its old debt. In addition, disinflationary and inflationary pressures are at work.

A negative shock on sustainability of government debt can trigger both disinflationary and inflationary forces. Mechanisms that lead to disinflation are not the same as inflationary mechanisms. In a sense, *disinflation is not simply negative inflation*. The Fisher disinflationary force outlined in Section III arises when a critical sector, such as the financial sector, is suddenly undercapitalized, possibly because of a drop in the real value of government bonds held by banks. If bond prices drop on fears of default by the fiscal authorities, then disinflationary forces can be very powerful. If the bond prices drop on expectations of government debt monetization, then inflationary forces

are prevalent. At the same time, the financial sector will contract if it holds a large quantity of this debt. This leads to an opposing disinflationary push, but also to a decline in growth. The latter makes the government debt even less sustainable, requiring even more monetization and inflation. In times of crises disinflationary and inflationary forces strongly oppose each other. Hence, future inflation is more difficult to predict and difference in inflation expectations across market participants are large. Consistent with our framework, Smith (2012) uses inflation option products to document a significant increase in inflation uncertainty since 2008.

In addition, we should also distinguish between *different types of inflation*. Inflation can be helpful to overcome debt overhang problems if it devalues debt and boosts the nominal income of the economic agents close to default. On the other hand, cost-push inflation (for example, due to higher oil prices), if not accompanied by higher wage growth of indebted households, is counterproductive.

Furthermore, flights to safety to other domestic assets lead to asset price inflation. Flight to safety to foreign assets lowers the exchange rate, makes imports more expensive, and, hence, increases CPI inflation.

In summary, during crises times, the opposing inflationary and disinflationary forces are very powerful.[12] Balancing these forces to target price stability is especially challenging. The system is not very forgiving: Small policy mistakes can lead the economy to drift onto an inflationary or deflationary path. In addition, as market participants find it difficult to predict future inflation, investment declines and growth is hindered. Traditional transmission mechanisms are impaired as information about potential default or monetization takes precedence over interest rate decisions.

IV.ii Monetary Policy Rules

So far, we have focused on monetary policy responses following shocks. In this section, we take one step back and analyze how a *policy rule* should be designed from an ex-ante perspective. Independent of whether monetary policy tries to mitigate financial frictions or price rigidities, any general monetary policy rule must take into account how it affects economic agents' beliefs. Viewed more abstractly, if a

central bank can perfectly commit to a rule, then the optimal policy rule is simply the result of a complex implementation/mechanism design problem. The intent of the rule is to affect the economic agents' beliefs and behavior in order to steer the economy toward the socially desirable objective. Before discussing how such rules affect economic agents' behavior, including moral hazard, we contrast the two different objectives monetary policy could have: mitigating distortions that result from financial frictions or from price rigidities.

Financial Friction View

In an economy with financial frictions, markets are incomplete. Financial frictions prevent agents from insuring each other against shocks. Hence, shocks lead to shifts in the wealth distribution. Initial shocks can be amplified through price movements, and a large part of the risk is endogenous. Redistributive monetary policy can mitigate these wealth shifts. By doing so, it also reduces endogenous risk and stabilizes the economy. In other words, a predictable and well-communicated monetary policy rule can provide a missing insurance contract across various economic agents. It acts like a contingent wealth tax that tempers wealth shifts. In this process, it reduces endogenous risk, enables more funding to be channeled to profitable projects, and stimulates growth.

Viewed in a multiperiod setting, monetary policy redistributes wealth along the whole multiperiod event tree. At any point in time, future (contingent) redistribution of wealth can be viewed as current redistribution of risks. By conducting certain monetary policy measures, the *central bank assumes tail risk*. For example, when lending to financial institutions against collateral, the central bank assumes risk in the state of the world in which the counterparty goes bankrupt and the collateral value falls short of the borrowed amount. Strictly speaking, the central bank is not assuming the tail risk but simply redistributing it to others—primarily to those who hold nominal claims. Again, in doing so, the overall risk may be reduced. Hence, this is redistribution only in a relative sense. In an absolute sense, it is possible that the wellbeing of all economic agents will be improved.

Of course, any form of insurance leads to moral hazard, as agents change their expectations and behavior. Some of the changes are desirable because they reduce endogenous risk. Others are excessive and have to be addressed with macroprudential regulation.

Price Stickiness View: A Contrast

Before we deal with the moral hazard question, it is worth contrasting the "financial friction view" with a "stylized" New Keynesian perspective. There are at least three major differences.

First, the key friction is price stickiness, not financial frictions. To sharpen the contrast, let us focus on New Keynesian models in which markets are complete, and hence a representative agent analysis is justified. The main role of monetary policy in these models is to overcome distortions that arise from the price rigidity. Monetary rules try to influence the *behavior of price setters*, which in turn influence the reaction of other economic agents and the response of output to real shocks. As before, adhering to policy rules is important to ensure that economic agents can form reliable expectations and their reaction maximizes the desired objective.

Second, the New Keynesian paradigm focuses on the role of money as a *unit of account*. As a consequence, interest rate rules, like the Taylor rule, fully characterize monetary policy, and money only plays a role in the background (see King 2002, Woodford 2003). In contrast, the "I" theory and the work by Kiyotaki and Moore (2008) focus on money as a *store of value*. The latter naturally integrates unconventional policy measures and macroprudential tools in the monetary analysis.

Third, New Keynesian models with complete markets focus on a single interest rate and its deviation from the natural rate. Financial frictions necessitate a risk component and not simply an intertemporal perspective.

We now return to the *financial friction* view of monetary policy and discuss the potential of policy rules in creating moral hazard.

Moral Hazard: Interaction with Macroprudential Regulation

Like any insurance scheme, ex-post redistributive monetary policy comes at a great price: moral hazard. Economic agents might respond to anticipated conditional redistribution in unintended ways. For example, financial intermediaries might take on too much risk since they anticipate that any adverse shock will then be met with some accommodative monetary policy that (implicitly) recapitalizes them. This makes the system ex-ante more risky and undermines the overall objective.

Hence, ex ante, the central bank wants to commit itself to limit the redistributive aspects of monetary policy. Ex post, it would like to redistribute wealth to stimulate the economy, but this undermines the credibility of the rule. The central bank faces a classic time-inconsistency problem. Under certain circumstances, the moral hazard problem may be so severe that the central bank is "cornered" and forced to abandon its rule book altogether. When this happens, the central bank loses credibility, and its ability to steer the economy is impaired.

The central bank can be "cornered" by 1) fiscal authorities and 2) systemically important economic agents. Fiscal authorities will try to force the central bank to monetize government debt in order to avoid politically unpopular austerity measures. Brinksmanship between proponents of monetary dominance and proponents of fiscal dominance leads to uncertainty in the economy. The aim of any central bank should be to monitor the fiscal situation in order to avoid battles between fiscal and monetary authorities.

To avoid being cornered by systemically important economic agents, such as large financial institutions, central banks have two types of tools at their disposal: 1) a clever design of ex-post recapitalization rules that reduce moral hazard problems, and 2) ex-ante measures that lean against the buildup of systemic risk.

For example, an ex-post recapitalization scheme that punishes the worst performers over others in the same sector mitigates moral hazard concerns. See, for example, Farhi and Tirole (2012) for a model in

which these strategic complementarities arise. An extended version of BruSan (2011) studies the case in which each institution is recapitalized in proportion to its net worth after the shock. That is, institutions that had lower leverage and hence suffered less from the adverse shock benefit more from the ex-post recapitalization. The analysis shows that such a simple, blunt scheme keeps moral hazard problems under control. However, such a blunt "macro intervention" comes at a cost. It requires larger ex-post redistribution than a more targeted ex-post "micro intervention" that targets the weakest institutions.

Interestingly, monetary policy, if employed appropriately, can be a "clever" redistributive tool in specific environments. For example, in BruSan (2012) an interest rate cut benefits the whole intermediary sector, but especially those whose portfolios are tilted toward (default-free) government bonds and away from risky investments. This gives intermediaries an incentive not to lever up too much prior to the crisis.

The goal of *ex-ante measures* is to build up larger safety cushions in normal times—to lean against the buildup of systemic risk. In BruSan (2012), an interest rate increase leads to capital losses on financial intermediaries' bond positions. As a consequence, financial intermediaries reduce their bonus and dividend payments. A higher interest rate also gives the central bank more room for future stabilizing interest rate cuts.

Arguably, even more powerful ex-ante preventive policy tools are the *macroprudential* measures, such as loan-to-value (LTV) ratio limits and leverage and capital requirements that work through explicit quantity restrictions. LTV ratios are a powerful macroprudential tool for households in many countries (see, for example, Wong et al. 2011). The Japanese real estate and stock market bubble was brought down by "total volume control," a measure implemented in April 1990 and terminated in December 1991. It limited the growth rate of real estate lending to the growth rate of overall lending in the economy and forced banks to report their lending to the construction and nonbank financial industries. BruSan (2011) studies the effects of leverage constraints and shows that they are counterproductive if they are not countercyclical.

Leverage constraints have both stabilizing and destabilizing effects. In times of crisis, they are destabilizing, as leverage limits amplify the leverage and disinflationary spirals discussed in Section III. In good times, the fear of destabilizing spirals leads to lower payouts and hence a larger safety cushion. The analysis in BruSan (2011) shows that the second stabilizing effect is small compared to the destabilizing effect. It is, therefore, important for these macroprudential tools to be countercyclical.

In order to tighten macroprudential measures in time, policymakers need some *warning indicators* about the vulnerability of the system and the buildup of systemic risk. Credit and money aggregates might give a glimpse of when growing imbalances make the system vulnerable to large wealth shifts triggered by small shocks. Simply looking at credit volume might be misleading because it may expand even as the economic situation deteriorates. Firms have an incentive to draw on outstanding credit lines as their financial outlook worsens. Excessive draw-downs on credit lines might be an early warning sign about a forthcoming crisis. Monetary aggregates are important because short-term credit makes the banking sector especially vulnerable. As the funding structure becomes more short-term, certain credit measures become part of the monetary aggregates. Studying the volume of repo financing arrangements might also bring out new insightful connections (see, for example, Adrian and Shin 2011).

More to the point, it is important to study the *risk topology* of the economy (see Brunnermeier et al. 2012). How exposed are certain sectors to factor shocks? How large is the liquidity mismatch—the difference between market/technological liquidity on the asset side and funding liquidity on the liability side? The liquidity mismatch provides information on how firms respond to shocks—that is, whether they shed assets at fire-sale prices or hold on to them.

V. Alternatives: Fiscal and Restructuring Policies

In addition to monetary policy, the government sector can also respond to a crisis with fiscal measures or use a more targeted restructuring policy.

V.i Fiscal Stimulus to Boost Aggregate Demand

Koo (2008) and Eggertsson and Krugman (2012) argue that balance sheet recessions are best dealt with by increasing government expenditure. These authors take issue with the claim that fiscal stimulus simply replaces household or nonfinancial business debt with government debt and argue that it makes a difference who owes the debt. Koo's main argument is that firms with impaired balance sheets focus too much on paying their debt off and are willing to forgo many profitable investment opportunities.[13] Similarly, households drastically cut back their consumption.

Eggertsson and Krugman provide a formal model in the New Keynesian tradition, in which price stickiness and the zero lower bound on nominal interest rates play a central role. Formally, the model considers two groups of households. Impatient households borrow from patient households up to an exogenous debt limit. An unexpected drop in the debt limit requires impatient households to scale down their consumption in order to satisfy the new lower debt limit. Impatient households' immediate savings efforts have to be more drastic the shorter the transition period is. An increase in the consumption of patient agents can offset the immediate cutback in the consumption of impatient agents. However, the less patient agents will do so only if the real interest rate drops considerably, possibly into negative territory. With a zero lower bound for nominal interest rates, a negative real interest rate can be achieved only if expected inflation is sufficiently high.

Assuming that the central bank cannot commit to a high future price level, the only way to make room for inflation is to decrease the current price level: deflation. Deflation does not increase the debt burden if debt is indexed. However, the real value of nominal debt increases, which constrains the impatient households and lowers the national real interest rate further. The authors argue that increased government spending when the economy is against the zero lower bound is a feasible way out of this dilemma. The key is to replace consumer demand temporarily with government demand, which lowers deflation and, hence, benefits indebted impatient consumers. Any dollar that is (indirectly) channeled to constrained impatient consumers relaxes their constraint and allows them to increase their

consumption significantly. Specifically, the marginal propensity to consume for these consumers is 100 percent. Even if these agents don't spend every dollar right away, this policy will at least shorten the transition period.

Guerrieri and Lorenzoni (2011) also study a decrease in debt limits within a Bewley-style model. A decline in borrowing capacity makes households less insured against future idiosyncratic shocks and hence they increase their long-run precautionary savings buffer. While developing this buffer, households' consumption is depressed even further.

Several other New Keynesian papers make the point that the Keynesian fiscal multiplier is large when the nominal interest rate is at its zero lower bound. The reason is that at the zero lower bound additional government spending and debt financing does not lead to a higher real interest rate and hence does not crowd out private spending. Rather, the fiscal expansion raises aggregate demand and raises inflation (with sticky prices). This lowers the real interest rate leading to a crowding in effect.

V.ii Restructuring Policies

The restructuring of the ailing sector is more targeted than that induced by outright fiscal expansion. Such debt forgiveness has a long tradition. In Mesopotamia, farmers regularly ended up overindebted when harvests turned out worse than expected. To avoid social unrest, debts were wiped out and farmers given a fresh start. In similar fashion, in ancient Greece, the Solonic reforms of 594 B.C. canceled debts and outlawed enslavement for debt in order to improve the situation of debt-ridden farmers (see Brunnermeier and Oehmke 2012). In the United States, statewide debt moratoria were introduced following the Panic of 1819 after cotton farmers suffered from the more than 50-percent drop in cotton prices in the period from January 1818 to June 1819 (Bolton and Rosenthal 2002).

The advantage of a targeted restructuring process is that it requires clear *loss recognition* and assignment. This reduces uncertainty and asymmetric information, but also rules out regulatory forbearance. The intent of *regulatory forbearance* is to give debtors time to regain solvency. Arguably, many banks would have already been insolvent

had they been forced to write off losses on Latin American debt in 1982-83. On the other hand, Japan's lost decades provide a clear warning about the dangers of regulatory forbearance.

The restructuring tool kit depends on which sector's balance sheets are impaired. If households are overly indebted, then targeted debt forgiveness programs are the main option. For the corporate sector's *asset sales, carve outs and mergers* are important restructuring instruments in addition to wiping out existing shareholders and various bond claims. For the financial sector, often even the threat of insolvency is sufficient to induce a self-fulfilling run. Financial institutions that are subject to such a threat distort their behavior with adverse consequences for the real economy. If close to insolvency, they may cut off credit flow and induce a credit crunch. If they are insolvent, they may gamble for resurrection. Hence, regulators have to take control early on through *prompt corrective actions*.

A showcase of effective intervention is that of the governments in the Nordic countries in 1992. In one example, the Swedish government immediately stepped in, took control, cleaned the books, recapitalized and later reprivatized the financial sector. Importantly, toxic assets were carved out and "managed" by the bad bank to ensure that the remaining good bank still had incentives to grant new credit, enabling the real economy to grow. [14]

Any restructuring initiative also has to reflect viability of the sector given the overall market structure. If profit margins are too low (as they are, for example, when the economy is "overbanked"), more restrictive cleanup operations are required.

Conclusion

The traditional Keynesian interest rate channel emphasizes the role of monetary policy in stimulating aggregate demand by influencing agents' intertemporal trade-off. Monetary policy tries to mitigate effects from price stickiness. In contrast, this paper stresses the redistributive role of monetary policy analyzed formally in the "I Theory of Money." We focus on financial frictions and destabilizing amplifications effects. Monetary policy redistributes not only current wealth, but also risk—contingent future wealth. Central banks'

assumption of tail risk can reduce the endogenous self-generated risk in the economy and increase overall welfare.

We conclude by summarizing first some guiding principles and then some specific lessons about the implementation of monetary policy.

First, price stability and financial stability are closely interlinked. This discredits the view that monetary policy's primary objective is price stability and that financial stability should be achieved with independently operated prudential instruments and banking regulation. Monetary policy affects balance sheets through asset prices and flow payments and hence has direct effects on financial stability.

Second, policy rules that ignore financial stability fail to lean against the buildup of imbalances and systemic risk in normal times and are not credible in crisis times. On numerous occasions, financial turmoil has forced central banks to intervene in markets to stabilize the financial sector with the potential to compromise long-run price stability.

Third, unsustainable fiscal debt levels can also undermine the credibility of monetary policy rules. In the fiscal dominance regime, the central bank is forced to choose between inflation and government default. A possible government default has adverse knock-on effects on the financial system and its stability. The diabolic loop between sovereign risk and banking risk amplifies the initial effect.

Fourth, the traditional monetary transmission mechanism is impaired if news about possible government default and credit risk dominates any interest rate policy.

All four points argue for an integrated view of monetary and macroprudential policy (and to some extent even fiscal policy) measures. In terms of specific monetary policy implications, we draw the following lessons:

First, asset holdings and interest rate sensitivities of these assets matter when choosing between conventional or nonconventional monetary policy tools. For example, an important issue is whether households have floating mortgage contracts or are locked into fixed-rate mortgages. A choice to target the short end or long end of the yield

curve should also be informed by the ownership, the amount, and the maturity of outstanding government debt. Interest rate derivatives exposures can drastically alter the monetary transmission channel.

Second, it is not wise to have policy rules for normal times that focus exclusively on price stability and then have additional rules for crises states. Imbalances and systemic risk can build up in seemingly quiet times (volatility paradox). Importantly, macroprudential policies have to be most restrictive during the run-up phase of booms and then relaxed in crisis times.

Third, rules should condition on early warning indicators, such as liquidity mismatches across various sectors in the economy.

Viewing monetary policy as a redistributive tool opens up a wealth of questions. For example, redistributive monetary policy also has important implications across regions in a currency area. This is especially important in the European context. Second, a complete analysis should also take some form of price rigidities into account. These and other aspects are left for future research.

Endnotes

[1]For example, Brunnermeier, Gorton and Krishnamurthy (2012, 2013) propose to elicit from each financial firm its 1) value exposure and 2) liquidity exposure to changes in key risk factors and scenarios. This information can be fed into a general equilibrium framework to determine the impact of key risks on asset prices.

[2]Indeed, when calculating the net liabilities of the banking sector, we simply totaled the fixed-income claims by the other sectors (including the foreign sector).

[3]In BruSan (2012), financial intermediaries also have the advantage in being able to hold a diversified portfolio across many productive agents' projects.

[4]In BruSan, active institutions' net worth is always non-negative. Hence, they do not gamble for resurrection as was arguably the case during the S&L crisis. In the ongoing Great Recession, exposure reductions were more prominent. Banks could more easily extract money with dividend and bonus payments than by gambling through risky investments.

[5]Such a collapse occurred during the Great Depression, creating painful deflation with long-lasting effects on borrowers. However, this experience contrasts with that of the recent financial crisis, where the money multiplier collapse was offset by a tremendous increase in the monetary base.

[6]For example, Ono (1997) finds no direct income transfers from depositors to banks. Banks' surge in profit was primarily due to capital gains in long-term fixed-rate bonds.

[7]Woodford (2012, this issue) discusses the differences between asset purchases and forward guidance in detail. We stress the redistributive effects of such policies and that they might be useful tools even away from the zero lower bound.

[8]In our framework financial and price stability are closely linked and we consider financial stability instruments as part of monetary policy instruments.

[9]Further complications arise in the European context, in which a central bank has to deal with several fiscal authorities. See, for example, Sims (1999) and Canzoneri et al. (2010).

[10]Governments often default in more subtle ways on their obligations. For example, they may force publicly owned pension funds and banks to hold government paper at unfavorable rates. These and other measures go often under the heading "Financial Repression."

[11]This diabolic loop is very prevalent in the ongoing European crisis. See Euronomics (2011) for their ESBies proposal that alleviates this problem.

[12]See also Leijonhufvud (2012).

[13]Similarly, Tobin (1980, p. 11) wrote earlier "Debtor corporations, their equity positions impaired, give priority to restoration of financial structure above real investments."

[14]Sweden also benefited from a depreciation of the currency and subsequent export growth in a time when global economy was booming.

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