Proposal for the Establishment of a Priority Programme

„Financial market imperfections and macroeconomic performance“

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Summary

The recent financial crisis and its subsequent economic repercussions have underscored the close link between financial market performance and macroeconomic outcomes. More specifically, a housing crisis has led to a financial crisis, which in turn has caused a severe recession that might adversely affect economic growth and employment for years to come. In response to the crisis, academic scholars and policy makers alike have discussed a number of important policy questions. For example, what type of financial market regulation will strengthen financial and macroeconomic stability without harming long-run economic growth? How should the banking sector be regulated when some financial institutions are systemically relevant? What are the macroeconomic implications of international capital market integration when countries differ with regard to their financial market institutions? And what type of monetary or fiscal policy is most effective in combating a severe recession caused by a financial crisis? Clearly, answering these questions requires a thorough analysis of the linkage between the financial sector and the real side of the economy. In particular, a satisfactory answer is likely to involve “financial market imperfections” like illiquidity of assets, credit constraints and default, missing insurance markets, and speculative asset price bubbles.

The central purpose of this programme is to advance research in Germany at the intersection of *macroeconomics* and *financial economics*. In other words, the programme aims at providing a common platform for the exchange and dissemination of new ideas and results in a research area of growing international importance. In particular, the programme is expected to foster the necessary interaction between macroeconomists and financial economists that has often been lacking in Germany. In contrast to their Anglo-Saxon colleagues, researchers based at German Universities face certain institutional obstacles that have often hindered fruitful collaboration due to a somewhat unfortunate division between macroeconomics on the one hand and finance on the other hand. A major goal of this programme is to bridge the gap between the two in order to ensure that economic research in Germany will be internationally competitive.

The programme is expected to improve our understanding of economic issues that are highly relevant to the proper functioning of markets and of society as a whole. In particular, we expect this programme to contribute to a better understanding of the way various financial market imperfections affect financial market stability, macroeconomic volatility, and long-run economic growth. An additional focus of the programme will be on public policy. For example, research in this programme will discuss the macroeconomic effects of different types of financial market regulation, consider the effects of explicit and implicit bailout guarantees for large financial institutions, and analyze monetary policy in a world where financial market imperfections are relevant.

1 Research Programme

1.1 Basic Issues

Recent events have highlighted the close link between financial market performance and macroeconomic outcomes. In other words, an accurate understanding of various macroeconomic variables (GDP, investment, consumption) requires a thorough analysis of the financial side of the economy. Conversely, financial market stability cannot be fully understood without any reference to macroeconomic risks. Mainstream research in macroeconomics has often downplayed the importance of understanding the actual functioning of financial markets. Specifically, large parts of macroeconomic theory as well as macroeconomic policy analysis are based on the hypothesis that financial markets are complete and frictionless, the so-called complete-market (Arrow-Debreu) paradigm. In a world with complete financial markets, all economic agents (households and firms) can write contracts for all sorts of contingencies and trade these contracts at no cost in competitive markets. The economic abstraction of complete financial markets has generated a number of celebrated results: the irrelevance of capital structure for the value of a firm (Modigliani-Miller theorem), asset pricing by arbitrage, non-existence of asset price bubbles, and the existence of a representative household. These results, together with the careful analysis of the assumptions underlying them, have been very useful for analyzing a wide range of economic issues.

Although the complete-market paradigm has provided economists with a powerful tool, there always has been some uneasiness among many economists whenever the theoretical abstraction was pushed too far. Clearly, in reality financial markets do not behave according to the complete market paradigm, and this deviation of reality from the ideal may have non-negligible effects on macroeconomic aggregates. Moreover, once financial markets are assumed to be complete, it is hardly possible to understand phenomena like financial innovation, default risk, or credit crunches. A substantial body of research in economics and finance has therefore investigated the causes and consequences of so-called financial market imperfections.

The objective of this priority programme is to promote research that incorporates some of the insights of this literature into macroeconomics. In particular, this programme will support work that develops, tests, and applies micro-founded macroeconomic studies in which financial market imperfections play an essential role. In the short-term, this is expected to lead to a better understanding of the link between financial markets and macroeconomic performance, in particular financial and economic crises. In the long-term, it might provide policy makers with better tools for implementing rules and regulations that render future crises less likely and less harmful to society without stifling long-run economic growth.

The literature on financial market imperfections is voluminous, though the part of this literature that deals with macroeconomic applications is much smaller (but expected to increase in the years to come). Given the size and diversity of the literature, this priority programme will concentrate on those areas that are likely to be of first-order importance for understanding the link between financial markets and macroeconomic performance. A survey among potential programme participants has shown that their planned research projects can be integrated into (at least) one of the following five research areas, though many research projects have connections to multiple areas and all of the projects contribute to the central research agenda. More specifically, the programme will promote research in the following five areas (“main research themes”):

- **Incomplete Markets:** The macroeconomic consequences of imperfections in credit and insurance markets
- **Imperfect Enforcement and Default Risk**: Limits on the enforceability of contracts and default risk as sources of macroeconomic volatility and as impediments to long-run growth
- **Bubbles and Expectations:** Financial market imperfections as the source of expectation-driven asset price movements, in particular asset price bubbles, and the effect on macroeconomic performance
- **Financial Intermediation:** Regulation of financial intermediaries (banks, insurance companies) and the implications for financial and macroeconomic stability
- **Monetary Policy:** The effect of monetary policy on financial markets and real economic activity when financial markets frictions are non-negligible

The first two themes (incomplete markets and imperfect enforcement) deal with two different financial market imperfections that are likely to have macroeconomic effects of first-order importance. The next theme (bubbles) focuses on one particular channel through which financial market imperfections affect the macroeconomic outcome. We consider this channel important enough to warrant an own research theme. The part on financial intermediation mainly deals with one particular part of the financial sector, namely the banking sector, which will play a central role in our programme. Finally, even though a main objective of this programme is the analysis of economic policy in general, we expect a significant number of contributions to deal with monetary policy in particular. Thus, we decided to discuss monetary policy as a separate research theme.

1.2 State of the Art

In line with our grouping of the expected research proposals into five topics, we have also structured our discussion of the literature around five (to a certain extent overlapping) main research themes, namely i) incomplete markets, ii) imperfect enforcement and default risk, iii) bubbles and expectations, iv) financial intermediation, v) monetary policy.

1.2.1 Incomplete Markets

Credit constraints and missing insurance markets are two types of market imperfections that are likely to have substantial macroeconomic effects. For example, if firms are constrained in their borrowing and lack other sources for financing new investment projects, then the aggregate volume of investment and output will be adversely affected. Correspondingly, if households face uninsurable labour market risk (wage or unemployment risk), then they might be induced to save more for “rainy days” by increasing the aggregate amount of saving (precautionary saving). Since the early contributions by Aiyagari (1994), Huggett (1993), and Krusell and Smith (1998), a large literature has developed that has explored the macroeconomic implications of such financial market imperfections. Though many of the initial contributions to the literature have dealt with methodological issues due to the computational complexity of the equilibrium problem, subsequent work has applied the so-called incomplete-market model to a large variety of macroeconomic issues.

One strand of the literature has explored to what extent uninsurable labour income risk generates aggregate saving, and has concluded that the effect is quite substantial if labour income risk has a highly persistent or permanent component (Deaton 1991, Carroll 1997).

Carroll and Samwick (1997) provide additional evidence by regressing individual household wealth on labour income risk, and Fuchs-Schuendeln and Schuendeln (2006) show why such regressions may exhibit a selection bias when there is heterogeneity of risk aversion. Livshitz, MacGee, and Tertilt (2007) consider consumer bankruptcy and analyze how different bankruptcy codes affect saving and welfare.

The literature has also considered the implications for long-run growth and economic policy. For example, if saving is generated through the precautionary motive to self-insure against bad luck, then the lack of insurance markets increases the aggregate capital stock and future output, but this increase comes at the cost of decreasing current consumption. Thus, there could be "too much saving" in an economy with missing insurance markets, and it could be optimal to tax capital income to reduce the level of saving (Aiyagari 1995). However, if human capital is an endogenous choice variable, then missing insurance markets for labour income risk always have a detrimental effect on economic growth, and the implications for optimal tax policy are significantly altered (Krebs 2003a).

Another branch of the literature has analyzed if missing insurance in conjunction with counter-cyclical labour market risk might be a reason why business cycle fluctuations are costly. Based on a representative-agent model with only aggregate consumption risk, Lucas (1987, 2003) had argued that the welfare cost of business cycles are negligible, implying that the potential gains from short-run macroeconomic stabilization policy are small. Subsequent to Lucas's original contribution, a voluminous literature has developed analyzing carefully to what extent Lucas' surprising conclusion will survive scrutiny. In particular, Atkeson and Phelan (1994) and Krusell and Smith (1999) introduced uninsurable counter-cyclical labour income risk, but concluded that the welfare effects are quite small. However, subsequent work by Beaudry and Pages (2001), Krebs (2003b, 2007), and Storesletten, Telmer, and Yaron (2001) has shown that the welfare cost of business cycles are substantial if, as supported by the evidence, labour income shocks have a highly persistent component that increases during recessions.

The incomplete-market literature has also analyzed the asset price implications of uninsurable income risk. In particular, the literature has asked to what extent counter-cyclical income risk can explain the observed equity premium. Initially, several contributions (for example, Heaton and Lucas 1996, and Telmer 1993) found that the effect on the equity premium is quite small. However, subsequent work has shown that counter-cyclical labour income risk can explain the observed equity premium if income shocks have a highly persistent or permanent component (Brav et al. 2002, Constantinides and Duffie 1996, Krebs and Wilson 2004). Krueger and Ludwig (2007) extend this line of work to an international setting and show how demographic change affects capital returns in different countries.

Further, there is strong empirical evidence that financial constraints are an impediment for entrepreneurship (Evans and Leighton 1989). Starting with the work by Quadrini (2000), a large literature has investigated the quantitative effects of such credit constraints on entrepreneurship, growth, and the wealth distribution using a general equilibrium model with incomplete markets (for example, Clemens and Heinemann 2006,2008). Kaas (2009) explores the relation between firm volatility and credit in a business-cycle model with financial constraints on entrepreneurs.

Several questions have been left unanswered in the literature, and research projects in this priority programme are expected to address a number of them. For example, there is very little quantitative work about the effect of firm-level financing constraints on international capital flows and economic growth. Further, quantitative work on the optimal design of social security systems is still in its infancy. Finally, the optimal response of fiscal and/or monetary policy to an economic crisis has only been analyzed using a "black-box" approach to fiscal and monetary policy.

1.2.2 Imperfect Enforcement and Default Risk

Contract enforcement problems may have significant effects on the functioning of financial markets and macroeconomic performance. For example, if credit contracts cannot be enforced, then borrowers would have no incentive to repay, and therefore nobody would be willing to lend. Hence, the inability to enforce credit contracts leads to the breakdown of the credit market. More generally, the possibility of default will lead to endogenous borrowing constraints. A large literature has explored the effects of such endogenous borrowing constraints on risk sharing (Kehoe and Levine 1993, Kocherlakota 1996), asset prices (Alvarez and Jermann 2000, Azariadis and Kaas 2007), economic growth and total factor productivity (Azariadis and Kaas 2008, 2009, Wright 2003), and (using collateral constraints) aggregate output and business cycles (Kiyotaki and Moore 1997). Schneider and Tornell (2004) have shown how contract enforceability problems can generate boom-bust cycles. With a few notable exceptions (e.g. Krueger and Perri 2006), the literature has been mainly theoretical, an obvious gap in the literature that some projects in this programme are expected to close.

Many industrialized countries have witnessed a dramatic surge in government debt, which raises the question of fiscal solvency and the likelihood of sovereign default. Starting with the classic papers by Bulow and Rogoff (1989) and Eaton and Gersovitz (1981), a large literature has developed that has analyzed how imperfect enforcement of sovereign debt contracts affects the ability of individual countries to access international capital markets. A common theme in the literature is that equilibrium borrowing and lending is difficult to sustain if the only penalty for default is future exclusion from international credit markets. More recently, attention has shifted to the link between sovereign default risk and macroeconomic volatility (Arellano (2008)), the effect of default risk on optimal policy (Schabert 2009, Uribe 2006), the distinction between private and public debt (Jeske 2006, Wright 2006), and the political economy of sovereign default (Amador 2004, Harms 2000, 2002).

Creditors can transfer credit default risk in the form of asset-backed securities. On the one hand, credit risk transfer can improve financial stability by smoothing out the risks among many investors and by transferring that risk out of the banking system to companies which are not as critical as banks for liquidity provision. On the other hand, a bank that has transferred a significant fraction of its exposure to a borrower's default has less incentives to monitor the borrower, so that credit risk transfer can raise the total amount of credit risk in the financial system to inefficient levels, and could lead to inefficient economic activities by borrowers (Duffie 2007, M.Hellwig 2008). Allen and Carletti (2006) show that credit risk transfer can be detrimental to welfare because it can induce domino effects in asset prices and thus contribute to contagion effects and financial crisis. Haensel and Krahnen (2007) present empirical evidence that credit securitization raises the amount of risk taking and thus could increase systemic risk. Hakenes and Schnabel (2009b) show that credit risk transfer may improve borrowers' access to finance for profitable and for unprofitable firms and that the welfare effects of credit risk transfer depend on the intensity of competition in the banking sector. The effectiveness of different policy options is discussed in Franke and Krahnen (2008).

The existing research in this field is mainly qualitative, and particularly lacks quantitative results for macroeconomic dynamics in closed and open economies. One contribution of this programme will be to support innovative work on the quantitative applications of some of the ideas discussed in the literature.

1.2.3 Bubbles and Expectations

Many asset prices undergo large movements that are difficult to link to changes in observable fundamentals, such as real interest rates and dividend flows. In particular, prices

of a number of long-lived assets, e.g., stock or real estate prices, often experience sustained periods of substantial price increases that are followed by more or less sudden price collapses. When an asset's price deviates from its fundamental value for a prolonged period, it is subject to a speculative bubble. As with goods price inflation, surging asset prices can distort price signals and cause a misallocation of resources, for example encouraging too much investment in housing and too little investment in productive capital. Further, bursting bubbles often have severe consequences for macroeconomic outcomes.

In equilibrium models with fully rational investors and complete financial markets, rational speculative bubbles can only exist under rather special circumstances which require a situation of dynamic inefficiency where the economy must grow at least as fast as the bubble (Tirole 1985, Santos and Woodford 1997). But this requirement is counterfactual, and it also implies that no infinitely-lived asset can pay dividends that grow at the same rate as the economy. In the presence of credit market imperfections, rational bubbles may exist even when the economy is dynamically efficient (Caballero and Krishnamurthy 2006, Kocherlakota 2008, 2009). C.Hellwig and Lorenzoni (2009) show how rational bubbles emerge in economies with self-enforcing debt constraints. Allen and Gorton (1993) develop a model in which an agency problem between investors and portfolio managers produces rational bubbles, and Allen and Gale (2000a) show how limited liability of investors causes risky assets to be priced above their fundamental value.

Another approach explores the consequences of relaxing the assumption of fully rational investors. Some authors introduce behavioural traders and argue that their presence can explain many of the observed asset pricing puzzles (e.g. Barberis et al. 1998, Shiller 2005). In such situations, there must be some limits of arbitrage that prevent rational traders to take advantage of arbitrage opportunities. Such limitations could come from risk aversion and finite time horizons (De Long et al. 1990), from liquidity constraints (Shleifer and Vishny 1997), or from coordination problems between investors (Abreu and Brunnermeier 2003). Others remain in the standard framework where investors behave optimally given a set of beliefs and examine the implications of learning the processes of dividends and stock prices (e.g. Timmermann 1993, Cogley and Sargent 2008). Adam et al. (2009) generate asset price movements by waves of optimism and pessimism of investors resulting from learning behaviour. They show how small deviations of future price expectations from fully rational ones can result in strong self-reinforcing price and belief dynamics.

There is also a literature that analyzes the role of public and private information in the determination of asset prices (Morris and Shin 2002, C.Hellwig 2002, Angeletos and Werning 2006). One conclusion of this literature is that prices can respond too much to public information and too little to private information, opening the scope for large price responses to weak public signals. Investors respond to public signals not necessarily because they believe them, but because they know other investors observe them as well and may thus respond to them. While Morris and Shin (2002) show that a restriction on public information dissemination is welfare enhancing, Cornand and Heinemann (2008) challenge this conclusion by arguing that public information should be as precise as possible, although possibly limited to a fraction of market participants. Heinemann and Illing (2002) show that crises can be prevented if the central bank provides information to agents with small idiosyncratic noise. Costain et al. (2007) and Heinemann et al. (2004) conduct laboratory experiments based on Morris's and Shin's (1998) model of self-fulfilling currency attacks to examine under what conditions speculative behaviour occurs.

Finally, a recent literature explores how news and changes in perceptions of future developments affect stock prices and may be an important driving force of macroeconomic fluctuations. Lorenzoni (2009) presents a model of business cycles driven by news shocks to consumer expectations regarding aggregate productivity. Using U.S. postwar data, Beaudry and Portier (2006) show that the stock market is a good predictor of long-run changes in total factor productivity and that news regarding long-run changes in TFP is correlated with the

stock market and has a positive effect on output. Beaudry and Lucke (2009) assess the relative importance of several candidate explanations of macroeconomic fluctuations. They include surprise changes to technology, monetary policy, preferences and news shocks, finding the latter ones to be by far the most important.

This overview reveals that current macroeconomic research needs to be advanced by explaining the emergence and bursting of bubbles under various types of financial frictions. Also, to date there is little work on the role of public policy for the prevention of speculative behaviour. Several projects in this area plan to address these open questions, using dynamic general equilibrium modelling, econometric studies on the role of fundamental versus non-fundamental explanations for asset price movements and laboratory experiments on bubble formation.

1.2.4 Financial Intermediation

Financial intermediaries take the savings of individual households and use them to provide firms with the financial funds necessary to undertake new investment projects. If financial markets are complete and frictionless, this process of financial intermediation is a trivial one and a detailed study of financial intermediaries can safely be neglected. Thus, in order to address the issues that are at the heart of this research program, one needs to genuinely consider financial frictions that can be reduced by financial intermediaries. The literature on financial intermediation has often put the presence of uninsurable liquidity risks at centre stage. In the seminal contribution of Diamond and Dybvig (1983), banks offer demand deposits and choose an appropriate mixture of liquid and illiquid investments, thereby providing complete insurance to investors against liquidity risk while simultaneously facilitating long-run investments in high-return projects.

Macroeconomic risks have long played a secondary role in the literature on financial intermediation. Instead, the early literature has focused on situations where risks could be disposed of by diversification, like the microeconomic liquidity shocks in the Diamond-Dybvig model. The nature of macroeconomic risks in banking has been discussed extensively by M.Hellwig (1994, 1998). He pointed out that the relevant question is how to efficiently allocate these risks across different agents, given the aggregate risk exposure of the economy. There are, in principle, two ways to introduce aggregate risk into models of financial crises: first, by assuming a random fraction of “early” consumers requiring liquidity (Wallace 1988, Chari 1989), second, by introducing a risky technology (Jacklin and Bhattacharya 1988, M.Hellwig 1994). The model by Chari and Jagannathan (1988) contains both aspects.

Whilst these earlier models are based on the analysis of a representative bank, they cannot be used to study the issue of contagion, which is considered to be of utmost importance by policy makers and regulators. The literature on contagion in banking broadly distinguishes three channels of how individual bank failures can spread to the entire banking system. The first operates through information (Chen 1999), the second through interbank liabilities (Allen and Gale 2000b), and the third through market prices (Allen and Gale 2004). A key insight is that small negative shocks can be amplified by cascade effects in a fragile network of interbank relations. This literature provides the theoretical underpinning for operational definitions of “systemically significant” banks. Uhlig (2009) develops a model of the 2007-2008 financial crisis in which a systemic bank run occurs when outside investors are only willing to buy asset-backed securities at steep discounts. Diamond and Rajan (2006) introduce money in a related banking model and analyze effects of open market operations. In particular, they find that monetary policy that responds to an aggregate liquidity shock can mitigate bank panics. Their model also provides a new version of the bank lending channel discussed by Bernanke and Gertler (1995) and Kashyap and Stein (2000). Departing from their work, Cao and Illing (2008) show that banks free-ride on the central bank’s liquidity

supply, so that they have an incentive to invest excessively in illiquid long term projects ex ante. To solve the commitment problem of the central bank, Cao and Illing (2009) propose the imposition of minimum liquidity standards for banks in combination with a lender of last resort policy.

Aside from providing liquidity insurance to depositors, a further prominent role for banks is delegated monitoring (Diamond 1984): because of scale economies of monitoring and small investor capacities, banks have a comparative advantage in monitoring activities. The influential paper by Holmstrom and Tirole (1997) considers both direct and intermediated lending so that only firms without sufficient equity borrow from intermediaries. To make sure that intermediaries have the proper monitoring incentives, investors want intermediaries to contribute some of their own funds. Thus, decreases in those funds will force intermediaries to cut on lending to entrepreneurs, leading to decreases in investment. Gersbach and Uhlig (2007) show how the co-existence of direct and intermediated lending leads to inefficiencies in the presence of both moral hazard and adverse selection. Rochet and Tirole (1996) point to an implication of delegated monitoring with regard to interbank exposures. They argue that, by generating incentives for lending banks to monitor interbank-borrowing banks, interbank exposures may also contribute to prudent market behaviour and reduce the risk of bank failures and systemic distress. Dinger and von Hagen (2009) empirically investigate whether banks that borrow from other banks have lower risk levels. Their results generally confirm the hypothesis that long-term interbank exposures result in lower risk of the borrowing banks.

An important aspect in the current financial crisis is that many banks are considered systemically relevant and thus “too big to fail”. Whilst hardly anybody doubts that rescuing systemically significant banks at the height of the crisis was an unavoidable necessity, these bailouts impair the incentives for prudent risk taking (Dewatripont and Tirole 1994, Freixas and Rochet 1997). Moreover, bailout guarantees for systemically significant institutions also affect the degree of bank competition and therefore banking stability. Starting with Keeley (1990), there is a large literature establishing a trade-off between competition and stability in the banking sector. Essentially, the reduction of rents through competition exacerbates the risk shifting problem at banks caused by limited liability (e.g. Carletti and Hartmann 2002). Hakenes and Schnabel (2009a) analyze the competitive effects of government bailout policies and find that it leads to higher risk taking by those banks that do not enjoy a bail-out guarantee, and Gropp et al. (2009) provide empirical support for their result. The relation between banking stability and competition is also relevant in the context of financial market integration. Empirical work suggests that foreign bank entry reduces profit margins for domestic banks but enhances their efficiency (Claessens et al. 2001). Buch et al. (2009) investigate what banks engage in international banking activities, finding that more productive banks are more likely to enter foreign markets.

The existing literature leaves a number of open questions that are particularly relevant in the context of the current crisis and for the prevention of banking crises in the future. Of particular interest in this area is the optimal design of bailout guarantees and their implications for systemic stability of the banking sector. It remains to be explored how systemically significant institutions should be protected and regulated, and what the macroeconomic effects of such regulations are. Since many of the relevant policy questions are likely to involve certain tradeoffs (e.g. between financial stability and credit growth), a proper quantitative exploration will require to embed a fully-fledged banking sector in dynamic general equilibrium models.

1.2.5 Monetary Policy

One major question in macroeconomics is how monetary policy affects the allocation of resources and the associated price level. Monetary aggregates that traditionally served as

the main central bank instrument have been replaced by short-run interest rates, and the celebrated Taylor-rule is now viewed as a sufficient summary of central bank behaviour (Taylor 1993, Clarida et al. 2000). Empirical research on the transmission of monetary policy has further established that monetary policy shocks lead to substantial short-run output effects and small changes in the price level (see Christiano et al. 1999), which has led to a revival of the sticky price hypothesis. Macroeconomic policy analysis experienced a convergence towards a "consensus model" (McCallum and Nelson 1999). Since then the so-called New Keynesian model has dominated the perception of macroeconomists and central bankers about monetary transmission and the optimal monetary policy strategy (see Clarida et al. 1999, Woodford 2003). In these models optimal monetary policy should mainly care about stabilizing the price level and closing the output-gap by committing to an inflation target and by adjusting the short-run interest rate.

The basic New Keynesian model has been augmented by considering labour market frictions and different types of lagged and costly adjustments to square the model predictions with empirical evidence. Impressive success along these lines, e.g. Christiano et al. (2005) and Smets and Wouters (2003, 2007), raised hopes that these models can be used quantitatively for policy device and for forecasts. Frictions specifically related to capital markets and foreign exchange has been disregarded in almost all of these models by assuming that financial markets are complete and frictionless. According to this view, changes in the policy rate are one for one passed through to the interest rate relevant for private sector saving and borrowing.

Several studies have shown that financial market imperfections, which play no role in the basic New Keynesian model, alter monetary policy effects. Specifically, agency costs associated with financial intermediation have been identified as a source of frictions that can affect the impact of monetary policy shocks. The so-called bank lending channel, which focuses on the supply of bank loans, and the balance sheet channel, where borrowers' net worth reduces investment costs, have been modelled (Bernanke and Gertler 1995, Holmstrom and Tirole 1997), and empirically evaluated (Kashyap, Stein and Wilcox 1993, Dale and Haldane 1995). Overall, empirical studies do not support an unambiguous conclusion on the impact of these channels on the transmission of monetary policy (see Kashyap and Stein 2000, Ehrmann et al. 2003). However, Ehrmann and Worms (2004) show that bank networks can explain why banks' liquidity positions are typically found to be important for transmission of monetary policy. Haselmann et al. (2009) further show by using bank level data that legal changes have an impact on banks' credit supply.

To clarify the quantitative role of credit market frictions for monetary transmission, Bernanke et al. (1999) developed a dynamic general equilibrium model. Assuming costly state verification and one period debt contracts, they show that an external finance premium is countercyclical and leads to an accelerated and persistent effect of monetary policy shocks on aggregate production. A similar framework has been used by Carlstrom and Fuerst (1997, 2001) who show that endogenous agency costs lead to a tension between amplification and persistence of policy responses and do not amplify monetary policy. Faia and Monacelli (2007) show that strict inflation targeting is in a financial accelerator model the welfare maximizing policy rule within the restricted set of policies.

Bernanke et al.'s financial accelerator model and Carlstrom and Fuerst's agency cost model have been extended in several ways. Linnemann and Schabert (2003) for example consider firms' demand for loans not only for wage payments but also to finance capital input, which gives rise to amplification of monetary policy shocks. By including bank's balance sheet effects, Meh and Moran (2008) show that aggregate shocks can be absorbed by the banking sector. Christiano et al., (2004) apply Bernanke et al.'s (1999) model to explain dynamic macroeconomic adjustments during the Great Depression. Heer and Maussner (2009) find that the introduction of capital formation with adjustment costs that lead to an equivalent reduced form structure as Carlstrom and Fuerst's (2001) agency costs model can hinder

output responses to be persistent and hump-shaped, while von Hagen and Zhang (2008) show that the introduction of endogenous capital accumulation and capital reallocation can lead to an amplification and of responses to aggregate shocks. Empirical evidence provided by Christensen and Dib (2008) and Meier and Müller (2006), indicate that its financial accelerator mechanism does not substantially affect short-run output dynamics.

While there already exists a vast literature on financial frictions and monetary policy, the role of market liquidity of asset and liquidity shocks for optimal monetary policy has hardly been noticed (an exception is Kiyotaki and Moore 2008). The current crisis has further led (monetary and fiscal) policy makers to conduct unconventional policies that have not been rigorously analysed until now. Moreover, the recent crisis episode provides a novel set of data on bank lending that can be exploited to solve the endogeneity problem faced by previous studies on the bank-lending channel. These questions should, among others, be addressed in the priority programme.

1.3 Scientific Goals

The first objective of this priority programme is to promote and co-ordinate research that aims at improving our understanding of the interactions between financial markets and macroeconomic performance. Research projects within the programme are expected to develop, test, and apply macroeconomic theories that are able to account quantitatively for linkages between financial market conditions and macroeconomic aggregates. This requires identifying the macroeconomic relevance of various financial market imperfections as well as detecting the role of macroeconomic dynamics and risks for financial stability. In other words, research in this priority programme will not only focus on the macroeconomic implications of financial market imperfections, but will also consider the feedback effects from macroeconomic aggregates to the systemic components of financial market risk.

Traditionally, research in this area is differentiated between micro-level financial studies and macro-level analysis that, even though micro-founded in many ways, pays little attention to the finer details of financial markets. This division has often been re-enforced by the separation between macroeconomics and financial economics in Germany, which is much less pronounced in the US and UK. As we have argued before, this differentiation seems inappropriate for the basic issues that research in this priority programme is supposed to tackle. Understanding the role of financial intermediation and asset prices for macroeconomic aggregates will have to rely on profound microeconomic analyses that go beyond the simple paradigm of complete financial markets. At the same time, a very narrow view on the banking sector or on corporate finance issues bears the risk of overlooking economy-wide feedback effects from macroeconomic developments. Hence, the priority programme supports an integrated approach, which is reflected both by the received research proposals as well as the expertise of the potential project leader. In fact, many research proposals will not be classified as pure micro- or macroeconomic research projects.

Research within the priority programme will nevertheless be advanced by the communication and exchange of ideas between macroeconomics and financial economics. We further expect fruitful interactions between currently disconnected fields of research (“main research themes”), like those focussing on the emergence of asset price bubbles and on monetary transmission. Workshops with a specific focus on one or two of these themes will help to stimulate the interaction between researchers with different backgrounds. The active integration of renowned macroeconomists and financial economists from outside Germany in some of the research projects, as well as their participation in the programme workshops, will be key ingredients of this programme.

A second objective of this priority programme is to improve our understanding of the impact of public policy on financial markets and macroeconomic outcomes. For example, research in this priority programme will address, among others, the following questions:

- How should we design the bankruptcy law if risk taking is both a possible cause of financial crisis and the engine of economic growth?
- What type of banking regulation reduces bank failure and systemic risk without stifling economic growth?
- Should financial market regulation and monetary policy be used to prevent the emergence of asset price bubbles?
- How should monetary policy be conducted in a world with financial market frictions?
- Is counter-cyclical fiscal policy an effective policy tool if recessions are caused by financial market crisis?
- How will international capital market integration affect individual countries with different financial market institutions?

Clearly, all of these policy questions involve certain trade-offs, and a satisfactory answer therefore requires careful quantitative analysis that goes beyond a mere qualitative discussion. A number of research projects will deal directly with such kind of quantitative policy evaluation, others will provide more foundational work, but all of the projects aim to contribute to the solution of new and open research questions and to the common goal of providing a sound basis for policy making. Each project is further required not only to advance research in macroeconomics and financial economics by international standards, but also to provide expertise to other projects within the priority programme.

Basic research in economics can only impact public policy if the policy recommendations that come out of individual research projects are communicated to policy makers. The priority programme will facilitate this communication process by co-ordinating the individual research efforts through research conferences and the establishment of a research network. Moreover, the programme will also foster the communication between individual participants, central banks and research institutions (e.g. World Bank, European Central Bank, Deutsche Bundesbank, ZEW Mannheim, CESifo München) as well as the national and international media (e.g. Economist, NY Times, Handelsblatt, FAZ), which already discussed the lack of financial market issues in modern macroeconomics in the last few months.

1.4 Work programme

Research in macroeconomics and finance has necessarily to build upon a solid theoretical and empirical basis. Correspondingly, some proposed projects are more theoretical in nature and others conduct empirical analyses based on asset price data, banking sector data, aggregate data, or data generated in experiments. Overall, empirical and experimental studies in the priority programme are primarily aimed to test theories or to gain insights that help designing economic policy and improving macroeconomic modelling. Whilst empirical contributions are expected to have a sound theoretical foundation, the more theoretical projects will often be motivated by empirical results or use empirical results as an important input into their analysis. However, all research projects will be connected by a common goal,

namely the exploration of the linkages between the financial sector and real economic activity.

Our survey of potential programme participants has shown that their planned research projects can be integrated into five research areas, so-called main research themes. Accordingly, we have structured our discussion of the work programme around these five themes. Needless to say, there are various interrelations between these areas, and several of the proposed research projects fit into multiple themes. To name but a few examples, the project proposals of E. Faia and G. Illing connect to 1.4.4 and 1.4.5. The proposal of Kaas fits both into 1.4.2 and 1.4.3, the project of von Hagen connects to 1.4.1 and 1.4.4, and F. Heinemann's project relates to both 1.4.3 and 1.4.5. All research projects will contribute to the common goal of this programme, and the connections between individual projects will be strengthened through the programme workshops and the research network that will be established through this programme.

1.4.1 Incomplete Markets

Credit constraints and missing insurance markets for certain types of risk are important financial market imperfections with severe consequences for macroeconomic performance. Research projects in this area will study how limited access to credit and insurance markets by individual households and firms affect a number of important financial variables (real interest rate, equity and home prices) and macroeconomic variables (consumption, investment, output).

The incomplete-market literature (Aiyagari 1994, Huggett 1993, and Krusell and Smith 1998) dealing with household-level labour income risk has usually simplified the description of the labour market by taking the (stochastic) labour income process as exogenously given. In contrast, the search literature (Merz 1995, Mortensen and Pissarides 1994, and Shimer 2005) has explicitly dealt with the matching process that brings together unemployed workers and vacant jobs, but has ruled out any interesting risk effects by assuming risk-neutral workers. Expected contributions from **Merz** and from **Waelde** will try to fill this gap in the literature and intend to develop frameworks that integrate the incomplete-market literature with the search literature.

Another short-cut often taken in the incomplete-market literature is to assume a closed-economy setting. Thus, the literature is silent about the international capital flows and their effect on economic growth and welfare. Research projects by **Clemens** and **von Hagen** plan to deal with this highly important, but often neglected issue. More specifically, Clemens will study the link between entrepreneurship and growth in a model of the world economy with financial constraints and international capital flows. Von Hagen plans to analyze the effects of incomplete capital markets on international capital flows, growth, and welfare. Moreover, he intends to study the implications for optimal capital market regulation.

Solving for the recursive equilibria in incomplete-market models with idiosyncratic and aggregate shocks is computationally challenging since the endogenous (and infinite-dimensional) wealth distribution becomes a relevant state variable. **Ludwig** plans to study the design of social security, in particular the shift from a public pay-as-you-go pension system to a private system, in a model with incomplete insurance and credit markets when there are idiosyncratic as well as aggregate shocks.

Market incompleteness can of course affect the transmission of macroeconomic shocks. Moreover, it can also be expected that interactions between frictions in labour markets and financial markets matter for the propagation of aggregate shocks. **Maussner** plans to quantify the impact of the effects of such interactions considering heterogeneous labour market profiles, uninsurable labour market risks, and financial endowments of individuals. It is expected that effects of aggregate shocks on macroeconomic aggregates will be amplified

when the joint distribution of agents with regard to their wealth and employment status is considered.

1.4.2 Imperfect Enforcement and Default Risk

Research on incomplete markets discussed in 1.4.1 takes the limitations on credit and insurance markets as exogenously given. In contrast, projects that fall into the current category can explain these financial frictions as the endogenous outcome when the enforcement of financial contracts is imperfect. In particular, the main focus is on the endogenous emergence of credit constraints in a world with default risk and limited (credit) contract enforcement. This approach has the advantage that it allows one to analyze the endogenous response of the financial system to changes in economic policy and economic institutions. Most projects in this area are concerned with the effect of default risk on financial market prices and real economic activity. Some of the projects focus on the risk of default by individual households or firms, while others deal with country-level (sovereign) default.

A voluminous literature has explored the effect of endogenous borrowing constraints on risk sharing, asset prices, economic growth, and business cycles. However, most of the studies in the literature have been purely theoretical. One exception is Krueger and Perri (2006), who show that the theory can account for the change in income and consumption inequality observed for the US in the last three decades. One problem the paper by Krueger and Perri (2006) points out is that the calibrated model cannot generate any sizable consumption volatility for individual households; that is, contrary to the evidence, in equilibrium most individual households are not borrowing constrained and are fully insured against idiosyncratic labour income shocks. Building on joint work with Wright (Krebs and Wright 2009), **Krebs** plans to explore different avenues to address this quantitative shortcoming of the theory. **M. Heinemann** also wants to provide a quantitative analysis of imperfect enforcement, but he will emphasize the effect on entrepreneurship and economic growth.

There is also a large open-economy literature on imperfect contract enforcement and sovereign default. However, the models still have some problems accounting quantitatively for the international transmission of country-specific shocks. **Scholl** will study different versions of an open-economy model with imperfect enforcement based on her previous work (Scholl 2005) and address these quantitative failures. Another issue that has so far only attracted scant attention is the role of private debt in triggering or exacerbating financial crises. **Harms** will account for different objectives of private and public decision makers and develop a model that allows one to identify the channels through which different types of borrowing and creditworthiness interact.

1.4.3 Bubbles and Expectations

Experience from the recent crisis and many other historic examples have taught us that the collapse of bubbles on real estate and stock markets can have long-lasting detrimental effects on macroeconomic performance. Although there are numerous studies exploring the emergence of bubbles in different environments, mainstream macroeconomic research, typically founded in dynamic general equilibrium models, abstracts from speculative bubbles altogether. Thus, this programme aims to support more research in this area, especially those that can be used in applied macroeconomic modelling. To this end, we want to gain a more profound knowledge of the role of speculative behaviour in macroeconomics and on its normative implications.

First of all, it is important to identify features of the economic environment that make the existence of speculative bubbles possible. As we know from economic theory, bubbles can only occur under certain circumstances, and these circumstances may have relevance for

whether economic policy should aim to prevent them. Often, bubbles occur because the economy is distorted in some way, for example by arbitrage limitations or by borrowing constraints. Intervention by policymakers to fight asset bubbles can exacerbate these distortions that allowed the bubble to emerge in the first place.

Second, if it is normatively desirable to fight bubbles, it should be explored whether and how economic policy should react. In practice it is difficult (if not impossible) to determine whether an asset is overvalued, so there is a risk of deflating assets that are not overvalued, possibly at substantial macroeconomic losses. But even if central banks could accurately identify asset price bubbles, any attempt to stabilize asset prices may come at the cost of large deviations of inflation from its optimal path. In the past, central banks and most monetary economists have argued that they only have one instrument (the short-term interest rates) better suited to target inflation in the medium term and, possibly, to contribute to the stabilization of output in the short run. Additional goals might require additional instruments, as stabilizing asset prices might otherwise come at the price of increased volatility of macroeconomic aggregates. Recent bubbles provide good examples for a situation in which asset-price inflation did not translate into consumer price inflation. Monetary authorities saw no need to tighten money supply and, as they had no other instruments at hand, low real interest rates led to an expansion in monetary aggregates and in the credit volume that was feeding bubbles on real estate markets in various countries.

Research projects contributing to this theme will theoretically and empirically analyse the emergence of speculative behaviour and its implications for macroeconomic policy.

Adam wants to study to what extent small amounts of investor optimism and pessimism induced by learning behaviour contribute to the emergence and collapse of asset price bubbles. Investors' waves of optimism and pessimism are fuelled by the observation of past capital gains, provided agents believe these to be somewhat informative regarding the capital gains they should expect for the future. **F. Heinemann** aims to examine the role of information on the formation of bubbles and crashes by laboratory experiments. He wants to explore which information structure (number, quality, and publicity of different signals) makes it most likely that extrinsic non-fundamental events (sunspots) affect behaviour.

Kaas intends to study rational bubbles in dynamic stochastic general equilibrium models with binding credit constraints. Features of the enforcement technology will be characterized under which infinitely-lived assets, regardless of their intrinsic values, can carry bubbles and agents are willing to invest in such bubbles despite their positive probability of bursting.It will be explored whether policy should fight the bubble from emerging in the first place, and what policy can do to smooth the macroeconomic downturn after a bubble has collapsed.

In an empirical project, **Lucke** intends to develop methods that are capable of identifying the role of expectational shocks for stock market volatility and for the emergence of macroeconomic boom-bust cycles. Anticipated technological innovations often imply non-invertible representations of the data so that the innovations cannot be identified from vector autoregressions on current and lagged observations. Thus bubble identification based on standard VARs may be grossly misleading. It will be explored how non-invertibility affects traditional identification procedures.

1.4.4 Financial Intermediation

It is not only times of financial crises when the banking sector plays a significant role for macroeconomic performance. As banks intermediate between aggregate savings and aggregate investment, any disturbance in this intermediation process will have quantifiable consequences for macroeconomic volatility. Further, since banks are the connecting link between the central bank and the real sector, the banking sector is important for propagation of monetary policy. At present, the majority of macroeconomic models leave no scope for

financial intermediation; at the same time, microeconomic work on banking often ignores systemic risk and does not take into account the response of the public sector to financial turmoil.

Different project proposals address the implications of bailout guarantees and lender-of-last-resort policies on stability of the banking sector. The issue of public guarantees to large banks that are "too big to fail" has long been discussed in the academic literature. The current financial crisis has taken this problem to a new dimension. As we have seen in the recent crisis, nowadays almost all banks, apart from a few minor ones, are considered as being "systemically significant." It is likely that such implicit guarantees will have undesirable consequences for risk-taking behaviour. Therefore, some propose to make public guarantees explicit in order to be able to impose strict limits on them. Those institutions that are explicitly protected by guarantees will probably be subjected to particular regulation, such as a capital surcharge.

The empirical project of **Schnabel and Weder di Mauro** asks how it can be operationally defined whether a bank is systemically significant. They aim to describe and to quantify different aspects of systemic significance, including the number of connections an institution has to other banks, and also the degree of systemic risk stemming from the illiquidity of a bank's assets. **Hakenes and Schnabel** want to evaluate different regulatory proposals regarding systemically significant institutions in a theoretical model. Potential candidates are outright restrictions on size or market share, or penalties for systemic banks, such as capital requirement surcharges. Hence, an expansion of banks is either prohibited beyond a certain size, or it is punished with additional regulatory burdens. The question is whether such measures are desirable and appropriate to counteract the threats and distortions arising from systemic banks.

Faia plans to apply a dynamic stochastic general equilibrium model with an optimizing banking sector, which allows to study regulation policy, fiscal bailouts, the relation between monetary policy and financial stability. **Illing** aims to study the impact of liquidity provisions by central banks on the incentives of financial intermediaries to invest in activities creating systemic risk. Whilst existing work mostly considers liquidity risk, in practice solvency and liquidity problems are closely intertwined and hard to distinguish for regulators and central banks. In a framework that allows for both solvency and liquidity risk, he wants to analyze what mix of liquidity and solvency regulation and monetary policy can achieve constrained-optimal outcomes.

Financial market integration through cross border lending and foreign bank entry has increased the competitive pressure for domestic banks. The change in the degree of integration has been particularly pronounced in emerging markets and in transition economies, but cross-border capital flows have also increased dramatically in industrialized countries. The current crisis has particularly heightened concerns about the link between international capital flows and the stability of the banking system. **Buch and Schnitzer** intend to investigate the impact of this increase in competition on the stability of the banking sector in domestic banking markets.

1.4.5 Monetary Policy

When a central bank implements monetary policy in usual terms, i.e. by conducting open market operations in a way that enables it to control short-term risk-free interest rates, the effectiveness of its actions crucially relies on the functioning of financial markets. In order to achieve its goals, there should be a reliable and stable relationship between macroeconomic target variables and the policy rate that serves as the main operating target of the central bank. Ideally, changes in the policy rate should one-for-one be passed through to changes in interest rates relevant for saving and borrowing of the private sector, which is presumed in

the majority of macro models. It is already well established that lending rates differ from policy rates, especially due to agency-cost considerations that lead to risk premia. Policy rate changes can further be associated with shifts in the supply of external funds, leading to endogenous borrowing constraints and credit rationing. Several proposed research projects address these issues.

Haselmann, P. Mueller and Weder di Mauro want to assess empirically how banks tighten credit conditions and how lending squeezes are transmitted to the economy. While this analysis typically suffers from the endogeneity due to the bank-lending channel of monetary transmission, the events in the crisis of 2007-2008 may serve as an exogenous shock that allows for identification of independent changes in bank lending. In particular, the relationship between tightening of credit conditions and economic activity should be examined using German loan data provided by the bank supervisory department of the Bundesbank. This analysis is expected to shed light on the impact of refinancing and investment strategies of banks on their lending behaviour, and to help understanding the relationship between credit tightening, economic activity, and monetary policy effectiveness.

As shown in previous studies (e.g. De Fiore and Tristani, 2009), the existence of financial market frictions should also be taken into account by optimal monetary policy. At the same time, a central bank might not be perfectly informed about both, the exact nature and the extent of the financial market imperfection. Uncertainty about the structure of the economy is known to matter for the central bank's trade-off. Extending these lines of research, **Tillmann** aims at analyzing how the design of stabilization policy and the design of monetary policy institutions are affected by uncertainty about financial market frictions

Changes in the monetary policy rate might further be imperfectly passed through due to differences in the market liquidity of assets. In normal times the spreads between interest rates on secured debt and interbank rates are negligibly small, while in times of financial stress (like 9/11 or 2008) it might increase to even more than 100 basis points. Most apparently, interest rates on corporate debt do not approach the zero lower bound, even when the policy rate does. **Schabert** aims at explaining these spreads by considering the re-saleability (market liquidity) of assets, as in Reynard and Schabert (2009) Unconventional policy measures are then expected to be a powerful tool, which is not the case in standard models (see Eggertson and Woodford 2004). A "qualitative easing" policy, i.e., the acceptance of corporate debt as collateral, reduces the spread between corporate debt rate and the policy rate. The central bank can thereby reduce firms' costs of external finance, which acts as a favourable supply impulse.

Not only do financial frictions complicate monetary policy making, but also can shocks emanating from the financial sector place the economy against the zero lower bound of interest rates (the latter point is discussed in Christiano et al. (2009). Both arguments naturally lead to the question whether fiscal policy could efficiently be used in support of monetary policy. **Linnemann** plans to take this as a starting point to analyze the effectiveness and welfare properties of counter-cyclical fiscal policies in a setting where a substantial fraction of agents face endogenous collateral constraints.

2 International collaboration and research transfer

Foreign researchers will be integrated in the priority programme either as participants of programme-wide conferences, as lecturers for workshops, or as collaborators (e.g. as co-authors) in individual projects. The following researchers outside Germany have expressed their interest in participating in this priority programme. All of these researchers are leading experts in the field of macroeconomics or financial economics, and many of them have made seminal contributions that deal with the link between financial markets and macroeconomic

performance. Without exception they are personally known by the coordinator or one of the deputy coordinators.

Costas Azariadis, Washington University in St. Louis
Paul Beaudry, Oxford University
Aleksander Berentsen, University of Basel
Markus Brunnermeier, Princeton University
Wouter den Haan, University of Amsterdam
Harris Dellas, University of Bern
Matthias Doepke, Northwestern University
Darrell Duffie, Stanford University
Hans Gersbach, ETH Zurich
Mathias Hoffmann, University of Zurich
Robert Kollmann, ECARES Brussels
Mark Hugett, Georgetown
Per Krusell, Princeton University
Dirk Krüger, University of Pennsylvania
Felix Kübler, University of Zurich
Albert Marcet, London School of Economics
Dirk Niepelt, University of Bern
Monika Piazzesi, Stanford University
Vincenzo Quadrini, University of Southern California
Karl Schmedders, University of Zuerich
Martin Schneider, Stanford University
Kjetil Storesletten, Federal Reserve Bank Minnesota
Michèle Tertilt, Stanford University
Harald Uhlig, University of Chicago
Mark Wright, UCLA
Fabrizio Zilibotti, University of Zurich

We further expect close interactions via conference participation and visits of programme participants with research departments in central banks and with economic research institutes. In particular, the following institutes have already signalled their interest in being an international cooperation partner (in brackets are the persons who were contacted):

CESifo München	(Hans-Werner Sinn, Head of Institute, and Kai Carstensen, Head of Macroeconomics Group)
Deutsche Bundesbank	(Axel Weber, President, and Heinz Hermann, Head of Research Department)
European Central Bank	(Frank Smets, Head of Research Department)
World Bank	(Luis Serven, Head of Macroeconomics Group)
ZEW Mannheim	(Wolfgang Franz, Head of Institute and Head of Macroeconomics Group)

3 Programme committee

The members of the programme committee are chosen to represent expertise in all five research fields mentioned above. They will support the programme coordinator at programme-wide activities, e.g. as members of conferences committees, and monitor the scientific success of individual projects at further stages of the programme.

Claudia Buch, Department of Economics, University of Tuebingen, Mohlstrasse 36, 72074 Tuebingen

Gerhard Illing, Faculty of Economics, University of Munich, Ludwigstrassse. 28, 80539 Munich

Leo Kaas, Department of Economics, University of Konstanz, 78457 Konstanz

Jan-Pieter Krahnen, Department of Finance, University of Frankfurt, Mertonstr. 17-25, 60054 Frankfurt am Main

Tom Krebs, Department of Economics, University of Mannheim, L7, 3-5, 68131 Mannheim

Andreas Schabert, Faculty of Economic and Social Sciences, Technical University of Dortmund, 44221 Dortmund

Isabel Schnabel, Faculty of Law and Economics, University of Mainz, Jakob-Welder-Weg 4, 55128 Mainz

Jürgen von Hagen, Department of Economics, University of Bonn, Lennéstrasse 37, 53113 Bonn

References (researchers in Germany in bold face)

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