DNB Research programme 2011

Research at DNB focuses on selected themes. Concentration on certain themes may contribute to:
1. enhancing the policy relevance of research efforts
2. improved internal and external visibility of research
3. enhancement of research quality

Selecting policy relevant research themes that act as a framework for the consideration of new research proposals will increase the relevance of research efforts for the policy of DNB. Moreover, the internal visibility of DNB research will increase. This may contribute to increased cooperation and interaction between research and policy staff. External visibility too will benefit. Both vis-à-vis the ESCB and vis-à-vis the academic world, the research profile of DNB may be further reinforced. That will also advance the possibilities for attracting high-quality new researchers with an interest in one or more of the themes. In addition, concentration on themes will result in more critical mass, enabling the increased cooperation and intensified debates to contribute to further improvements in academic quality.

The focus on the themes listed below does not mean that *all* research should fit into these themes. First and foremost, a substantial part of research capacity will continue to be directed towards modelling (Delfi – our macro model of the Dutch economy – has already been published in 2011 and a DSGE model is scheduled to be published in 2011 as well). It is crucially important that DNB has a number of models available to support its policy. Also, research on subjects outside the framework will continue to be performed on a case-by-case basis, in response to specific questions from the Governing Board or consequent on recently completed doctoral research by newly hired staff members.

The Swank/de Haan memorandum, endorsed by the Governing Board, emphatically opts for a DNB-wide research programme: 'The (annual) research plan is to encompass all scientific research across DNB and will be drawn up under the direction of the Head of Research'.

Research will focus on five themes, described in more detail below. The themes have been selected on the basis of the following considerations:
- Policy relevance: the themes are to be closely aligned with the responsibilities of DNB;
- Academic relevance: the themes are to offer sufficient scope for publications to appear in high quality academic journals;
- The wish to build on niche positions DNB has acquired in certain areas of research (this applies to, for instance, themes #2 and #5 and to the subject of the payment system);
- It should also cover research done outside Ebo.

It has been decided not to change the research themes in 2011. In 2012 the themes will be reconsidered.
As follows from the specific projects for 2011 (as listed below), the distribution of research time across the various themes is non-proportional. The research questions phrased in the detailed description of the themes are illustrative only and in no way exhaustive.

1. Monetary strategy and price stability
To what extent should the ECB's monetary strategy be aimed at other objectives besides inflation (such as the prevention of asset bubbles and unbalanced house price rises)? How can (the persistence of) inflation differences within the euro area be explained? What is the relation between inflation expectations and inflation? How can the central bank influence inflation expectations? What is the relation between wage developments and inflation? What role is played by commodity prices? Can fiscal policy affect the credibility of monetary policy makers?

2. Central bank transparency and communication
How may central bank communication contribute to the realisation of monetary strategy objectives? What parallels exist between communication on monetary policy and communication on micro- and macro-prudential supervision? How do supervisors communicate and how can the difference be explained? What determines the effectiveness of communications? How should one communicate in the event of conflicting objectives? How can communications help improve public awareness and what are the effects on the behaviour of the public? Can communication influence public confidence in policy makers?

3. Financial stability and macro-prudential supervision
What is meant by the term macro-prudential supervision? What instruments should be used in exercising it? What institutional form should such supervision take? What is the relation between monetary strategy and macro-prudential supervision? What are the interactions between the financial system and the real economy? What role do global imbalances play in the genesis of financial crises? How may fiscal policy contribute to financial stability? How may central bank communications contribute to financial stability? How reliable are payment systems and can they respond adequately to changes in the larger payment system? Does competition on financial markets and between financial institutions contribute to financial stability? What role does contagion play in financial crises and how, if at all, is it affected by mutual exposures?

4. Micro-prudential supervision and conduct of financial institutions
By what factors is the conduct of banks, insurance companies and pension funds determined? How do boards of financial institutions reach decisions? What is the influence of micro-prudential supervision and regulation on institutions' risk attitude? How can supervisory authorities contain risks due to conduct and culture of financial organizations? To what extent do institutional factors play a role in financial institutions' behaviour? And what is the role of financial liberalisation?

5. Financial literacy and behaviour of households and companies
What role does financial literacy play in the financial behaviour of households? What factors determine households' payment behaviour or companies' payment streams? What do households expect from the supervision of financial institutions? How may the communication of supervisors influence households' literacy and behaviour? How does a household's indebtedness influence the way it behaves?

The research projects for 2011 are listed below. Some fit into more than one theme

Research projects 2011

1. Monetary strategy and price stability

Inflation differentials in the euro area and market flexibility (project started in 2010)
Jakob de Haan, Leo de Haan

This paper contributes to the ongoing search for determinants of inflation differentials within the euro area, focusing on the influence of market flexibility on bilateral inflation differentials. Using data for the countries in the euro area since the start of the currency union, we consider as many variables as possible that have been suggested in the literature to affect inflation differentials.

Experiments with monetary policy rules in a multi country macro model framework
Jakob de Haan, Ad Stokman and Peter van Els

Using the multi-country model NiGEM, this project will analyse to what extent redefining the price stability objective of the ECB by taking asset and house prices into account may contribute to maintaining financial stability in the individual countries in the euro area. It will also be analysed how different the ECB policies would have been in the past and the consequences for output growth if asset and house prices would have been taken into account.

Market views on the sustainability of fiscal burdens during the crisis
Gabriele Galati, John Lewis, Steven Poelhekke and Chen Zhou

Over the past two years, most governments in industrial countries have supported their domestic financial sector under stress and responded with fiscal stimuli to strong declines in output growth. As the global financial system showed signs of recovery and the global macro-economy started to rebound, attention has focused on the sustainability of the resulting growing debt burdens. We conduct an empirical study to test whether views on the sustainability of fiscal burdens have influenced the credibility of central banks' commitment to price stability.

The zero lower bound and ECB interest rate policy since the crisis
John Lewis, Stefan Gerlach (Frankfurt University)

Following the collapse of Lehman Brothers in September 2008, central banks across the world initiated a series of large interest rates cuts, with policy rates at or close to zero. Theory suggests that central banks should cut more aggressively if they believe they may be constrained in the future by the zero lower bound. On the other hand, some in policy circles have argued that central banks should cut less aggressively if they are worried about the zero lower bound, so as to "preserve ammunition". In this paper we estimate a forward looking reaction function and hence test whether our earlier results are robust, or simply reflected the ECB reacting to a rapidly deteriorating forecast outlook. Further, we compute a point estimate and confidence interval of the "target rate" implied by the reaction function to quantify the extent to which the zero lower bound constrained monetary policy.

The reliability of output gaps for forecasting inflation in times of persistent large output gaps
John Lewis, Simon van Norden (HEC, Montreal)

Policymakers in advanced economies appear to be confronted with a prolonged period in which output may remain significantly below its potential. Several recent contributions have attempted to analyse whether the relationship between measures of economic activity and inflation may differ during such episodes. However, these works typically ignore the problem of real time data, i.e. they rely on ex post estimates of the output gap, rather than contemporaneous ones available to the policymaker in real time. This research project uses real time data to examine the relationship between output gaps and inflation during persistent large output gap episodes for a sample of 25 OECD countries.

Price dispersion squeezing during economic downturns (project started in 2010)
Marco Hoeberichts and Ad Stokman

Half a century of price level dispersion data for Europe enables us to isolate short-term influences from long-term influences like market integration. In this paper we find that at the business cycle frequency, price dispersion across 11 EMU countries over 1960-2009 is significantly lower during economic downturns. The justification for such a squeeze lies in increased price sensitivity of economic agents during economic downturns. Our model can explain most part of the major drops in price level dispersion during severe economic recessions of the early 1970s, 1980s and 1990s, as well as the small change during the recent financial crisis.

Macro-economic evidence and consequences of time-varying price elasticities of demand
Marco Hoeberichts and Ad Stokman

In this project, we want to estimate equations for aggregate demand and aggregate supply when we allow the price elasticity of demand to be state dependent. In previous work we have shown that consumer price differences across European countries drop substantially during economic down turns. Evidence suggests that both households and firms become more price sensitive under worsening economic conditions. As a consequence, markets become more competitive. In macro-economic models, no account is taken of business cycle related changes in price sensitivity. Our aim is to incorporate and test for the presence of time varying price elasticities of demand in households' demand equations for a number of European countries and the US, and discuss the macro-economic effects and policy implications by means of simulations with a version of the multi-country model NiGEM that takes these new structural features on board. A comparison with the US is of particular interest as price setting in the US is found to be much more flexible in the short run. If the price elasticity of demand is found to be state-dependent, agents will react asymmetrically to changes in the monetary policy rate. As a result, optimal monetary policy might be asymmetric, as well.

House prices and aggregate demand
Vincent Sterk

In a basic macro-model, there is a representative agent who is buyer and seller at the same time, so house price changes have no effect. In reality of course there is heterogeneity between buyers and sellers, but even then it is not clear that house prices have substantial aggregate effects and in what direction these effects run. The central idea of this project is that house price fluctuations may generate swings in aggregate demand when agents use housing to insure against bad income shocks (like becoming unemployed). When such a shock occurs, a household can alleviate a large drop in consumption by moving to a smaller house, or become a renter, and consume housing wealth. However, when house prices have fallen, the proceeds of selling a house are lower. Thus, during those times homeowners are less well insured against idiosyncratic shocks. As a result, one may expect that when house prices fall, households will try to compensate for the decline in insurance by increasing financial savings, creating a decline in aggregate demand. The purpose of the project is to capture the idea outlined above in a formal model. This will require a model with incomplete financial markets and wealth heterogeneity.

2. Central bank transparency and communications

Clarity of central bank communication: a cross-country analysis
A. Bulir (IMF), Martin Cihak (IMF) and David-Jan Jansen

The clarity of central bank communication seems an important determinant of its effectiveness. For instance, Jansen (Contemporary Ec. Policy 2011) shows how greater clarity of communication by the Federal Reserve has gone hand in hand with lower levels of volatility in financial markets. To measure clarity, he uses readability scores based solely on textual characteristics. The question may be asked over what time horizon we may expect clarity to remain relevant. Therefore, in this project, we seek to identify whether clarity has longer-term consequences. We also take a cross-country perspective. We will relate the clarity (measured by readability scores) of communications by various central banks to macroeconomic outcomes such as inflation and economic growth. To do so, we consider using recent methods developed by Bulír and co-authors.

Did oral interventions by the Indonesian central bank support the rupiah?
Sahminan Sahminan (Bank Indonesia) and Jakob de Haan

Most previous studies on the effectiveness of oral interventions (statements of officials in support of the exchange rate) focus on developed countries. This paper examines whether statements of officials of Bank Indonesia (BI), i.e. the central bank of Indonesia, have had any effect on the level and volatility of the rupiah-dollar exchange rate, and whether the effects, if any, have been in the intended direction. For this purpose, we use a sample of statements by BI officials and the EGARCH modelling approach.

3. Financial stability and macro-prudential supervision

Small shocks, systemic risk and market breakdown
Itai Agur

This paper shows that a financial system need not be highly levered for small shocks to have large repercussions. The reason is the feedback between a bank's individual risk taking and systemic risk on the wholesale funding market. That market is characterized by adverse selection, which rises as banks take on larger risks. Aggregate adverse selection problems feed back to individual risk taking incentives, moreover. Small, even marginal, shocks can lead to market collapse. These shocks could materialize in bank project profitability, borrower monitoring costs or liquidity risk. Sunspots among multiple equilibria are an alternative source of breakdowns.

Can infrastructure-related systemic risk be eliminated or mitigated? (project started in 2010)
Ron Berndsen

Infrastructure-related systemic risk is the part of systemic risk that may arise from a malfunctioning in the financial infrastructure or where the infrastructure acts as a propagation channel for shocks coming from (potential) insolvencies of systemically important financial institutions (SIFI). The aim of this research is to investigate whether it is possible to eliminate the occurrence of infrastructure-related systemic risk or – if not – to what extent and costs is it possible to mitigate that risk. We follow a two-step approach. Firstly, we further develop a functional model for representing and eliminating settlement risk exposures in the financial infrastructure by expanding earlier work (Berndsen, 2010). Secondly, we propose a generalization of that model in order to arrive at infrastructure-related systemic risk and investigate the feasibility of an elimination of that type of systemic risk by considering alternative settlement arrangements in an economy.

A complex model for early warning for financial crises (project started in 2010)
Wilko Bolt and Maria Demertzis

Complex systems may give new insights in understanding financial crises. The analysis of so-called critical transitions may yield a useful framework for early warning signals that indicate an increase of the likelihood of a crisis, given observed financial data patterns. We attempt to apply this framework to the recession data of Rogoff and Reinhart (2010).

Debit or credit?
Wilko Bolt, Elizabeth Foote (London School of Economics) and Heiko Schmiedel (European Central Bank)

Consumer credit and its link to payment instruments played an important role in explaining the current crises. We will model that in the case of debit cards, the consumer can obtain credit through the overdraft on his current account. In the case of credit cards, the consumer can use the credit line associated with that card. We find that rates on overdrafts affect credit card fees, even when there is no debit card competition. The strength of the complementarity result depends on the expected income stream of the consumer. When we consider competition, we also find that there are degrees both of competition and complementarity between the debit and credit card networks.

Bank contagion during the EU sovereign debt crisis
Jakob de Haan and Mark Mink

During the EU sovereign debt crisis of 2010, the large exposures of EU banks to Greek as well as Spanish and Portuguese government bonds were a central concern to policy makers. We use an event-study approach to examine how banks that are exposed and banks that are not exposed to Greece's government bonds respond to news about Greece's fiscal situation. Likewise, we examine how banks with exposures to government bonds of Spain and Portugal are affected by news about these countries' fiscal developments, as well as how these countries' bond spreads are affected by news about Greece. This way, we can infer how financial contagion affected the stability of EU banks and countries as the sovereign debt crisis unfolded. By comparing this effect to the impact of news about the creation of the EFSF, we can draw some conclusions about moral hazard as well.

Trade dynamics in EMU: Are deficits and surpluses related?
Jakob de Haan and Peter Wierts

In the euro area, diverging current account developments have led to a renewed debate about the 'economic' pillar of Economic and Monetary Union (EMU). Originally the debate concentrated on country-specific adjustment processes in EMU. Recently the debate has broadened in a different direction. With persistent current account differences, and generally slow adjustment in real exchange rates, the question is who should bear the burden of adjustment. We investigate the dynamics of trade patterns of countries that participate in EMU. How have bilateral trade balances developed? How do adjustments occur (wage costs, real exchange rate, trade composition)?

Liquidity management of banks under stress (project started in 2010)
Leo de Haan and Jan Willem van den End

This paper investigates banks' adjustment behaviour with respect to their lending and borrowing when liquidity runs short in relation to supervisory minimum requirements. Supervisory liquidity data on Dutch banks over the period January 2004-March 2010 are used.

Public versus private information
Maria Demertzis

Using the model by Morris and Shin (2002), we distinguish between how people perceive a state and how they act upon it. We show than even for perceptions, where the coordination motive plays no role, improving the quality of public information does not always reduce the forecasting error. The reason why this happens is because better information is always more relevant information. But if improvements in information attract more attention than they deserve, the overall effect may be detrimental to the accuracy of perceptions. Increases in private information quality, on the other hand, are always beneficial to the decisions. Moreover, the assumption of no private information error on average implies that agents would do better collectively if there was no public information signal.

Investor mood and stock returns: high-frequency evidence
Michael Ehrmann (European Central Bank) and David-Jan Jansen

This paper contributes to our understanding of financial markets using a behavioural approach. Many papers in this literature study investor sentiment, which can be defined as a belief about future cash flows or risks that is not supported by the facts at hand. The literature has used various measures to proxy shocks to investor sentiment. One such proxy has been the use of sports results. Edmans, Garcia and Norli (Journal of Finance 2007) show that stock markets have shown negative abnormal returns after national teams lost international football matches. Our paper refines their analysis by using minute-by-minute data for a broad range of stocks traded in fifteen countries that participated in the 2010 World Cup.

Financial crises and macroeconomic performance
Gabriele Galati and Chen Zhou

Within the ECB's monetary policy framework, there is a possibility to contribute to avoiding the build-up of massive financial imbalances, which in the longer run may turn out to have disruptive effects on price stability once they burst. The idea is to keep our mandate of price stability unchanged while extending the monetary analysis to encompass monitoring the build-up of financial imbalances and associated potential risks for price stability in the medium- and longer run. There is a need to build analytical underpinnings of this extended monetary analysis, and in particular to improve analytical tools that allow us to make realistic assessments of risks in the financial system and their impact on the macro economy. An important aspect is to investigate empirical relationships between financial crises and macroeconomic performance. This research paper aims at verifying the existence of changes in the distribution of financial variables over time. In the extreme value literature, these changes can be classified into three categories: changes in shift, in scale or in shape. A change in *shift* would reflect the influence of time-varying factors. A change in *scale* could be interpreted as a change in underlying risk, to the extent that movements in explanatory factors translate into movements in the variance/scale of financial variables, which change the risk propositionally. Such a change may influence both the frequency and the magnitude of a crisis if one fixes the magnitude/frequency in the definition of a crisis. In the case of a change of the third type – in the *shape* parameter – the relation between magnitude and frequency of crises is affected. This research project aims at identifying the relative importance of possible changes of each type, and tries to relate their occurrence to structural changes in the properties of macroeconomic variables.

Industry performance and leverage during the financial crisis
Theoharry Grammatikos (Luxembourg School of Finance) and Robert Vermeulen

We investigate whether indebted industries have suffered more during the financial crisis in terms of profitability and stock market returns. Special attention is devoted to the role of short-term debt financing. The sample consists of 140 industries from the S&P 1500 index. While most of the literature studies solely manufacturing industries, this paper incorporates the large service sector in the analysis. Basically, Rajan and Zingales (1998) show that financial development increases the growth of capital intensive industries. We reverse the question and investigate if these capital-intensive industries suffer more when capital is scarce.

EMU financial contagion and the sovereign debt crisis
Theoharry Grammatikos (Luxembourg School of Finance) and Robert Vermeulen

This paper tests for the transmission of the 2007-2010 financial and sovereign debt crises to fifteen EMU countries. We use daily data from 2003 to 2010 on country financial and non-financial stock market indexes. First, we find evidence of crisis transmission to European non-financials from US non-financials, whereas the increase in dependence of European financials on US financials is rather limited. Second, in order to test how the sovereign debt crisis affected stock market developments we split the crisis in pre- and post-Lehman sub periods. Results show that financials became significantly more dependent on changes in Greek CDS spreads after Lehman's collapse, compared to the pre-Lehman sub period. However, this increase is not present for non-financials. Third, before the crisis euro appreciations are associated with European stock market decreases, whereas during the crisis this is reversed. Finally, the reversal in the relationship between the euro-dollar exchange rate and stock prices seems to have been triggered by Lehman's collapse.

Bank credit constraints and automatic stabilizers (project started in 2010)
Willem Heeringa, Job Swank

In this theoretical paper, we consider an economy in which individuals decide on consumption, saving and borrowing over a 2-period lifetime. Individuals are heterogeneous in that they are faced with common as well as idiosyncratic income shocks in both periods. In an attempt to smooth consumption over the lifetime, some of them will save in the first period, whereas others may want to borrow. Financial intermediation is performed by banks that either maximize expected profits or aim at curbing the probability of bank failure over a generation's lifetime. We show that under both strategies, it is optimal for banks to introduce a non-discriminatory credit constraint, as they don't know in advance which borrowers will default on their loans or are most likely to do so. Since individual borrowers have no information edge over banks on their future income prospects, credit rationing in our model is not caused by asymmetric information, as in Stiglitz and Weiss (1981), but results from incomplete information due to borrower heterogeneity. While underestimation of borrower heterogeneity (or tail density) always causes banking profits to be lower than anticipated, we also show that it does not necessarily increase the probability of bank failure under expected profit maximization. This depends crucially on the credit constraint profit maximizing banks would have imposed had the true tail density of idiosyncratic shocks been known. So, contrary to common wisdom, underestimation of tail density is not always a bad thing. We finally analyze within this framework how a public system of proportional income taxes and lump sum benefits can help stabilize consumption over a generation's lifetime and reduce the risk of intergenerational debt transfer due to bank failures.

The empirical relationship between demographics and real house prices: the Netherlands versus the US (project started in 2010)
Willem Heeringa, Job Swank

The aim of this paper is to investigate the empirical relationship between demographics and real house prices. Some people expect that the retirement of the baby boom generation could result into an asset price meltdown. The basic idea behind this is that older generations will sell most of their assets after retirement in order to consume their wealth. Applied to the housing market, this could imply a fall in house prices when the babyboomers start to retire after 2010 (Mankiw and Weil, 1989). Several papers in the literature have investigated this hypothesis for the US, but (except for the UK) no such studies exist for European countries. In this paper, we apply a panel data approach on 76 regions of Netherlands to estimate the relationship between demographics and real house prices, while controlling for income differences. We repeat the analysis for the US at the State-level and compare the empirical results.

Is this bank ill? The diagnosis of doctor TARGET2
Ronald Heijmans and Richard Heuver

The current financial crisis clearly illustrated the mutual dependence of the banking system at a worldwide scale. The failure of Lehman Brothers clearly shows that the problems of one bank can easily affect the liquidity position of others. Besides this failure there were many other events and news facts, although less shocking, which made financial institutions very cautious. Some banks went bankrupt and many systemically important banks in Europe and United States received state support or were nationalised to prevent them from going bankrupt. Before these failures and before this support was given there were in most cases rumours or clear signals in the market on these banks that there were serious financial and/or liquidity issues with a certain bank. We use the algorithm developed by Furfine (1999) and improved by Heijmans et al. (2010) to extract information on the pricing and volume developments of interbank loans in the Dutch market. We also use TARGET2 transaction data and collateral data to obtain information on the changes in timing of payments, change in amount and use of collateral and signs of a bank run. By selecting the relevant payment types relevant changes and potential behavioural aspects can be identified. By studying the differences between the pre-crisis en crisis period information can be obtained on behavioural reaction patterns in times of high stress.

These behavioural reaction patterns are translated into a first order model of behaviour in payment systems which can be used to improve the quality of simulating stress scenarios.

Reconnecting the pipes: The plumber of the interbank money market.
Ronald Heijmans and Richard Heuver

Banks are used to “liquidity shocks” arising from unexpected changes in liquidity demand. These unexpected liquidity fluctuations can impact the smooth operations of payments and RTGS systems, besides that it affects the banks’ liquidity management. The interbank money market is a crucial market for banks to obtain liquidity to solve temporary liquidity shocks and shortages. The failure of Lehman Brothers caused a huge shock wave through the financial markets. We want to study the trading behaviour of the banks in Dutch/European unsecured interbank money market and the network properties of this market. Besides we want to study the effect of the liquidity injections of the ECB and the use of the standing facilities on the unsecured interbank money market as a whole and on individual banks. We use the algorithm developed by Furfine (1999) and improved by Heijmans et al. (2010) to extract information on the pricing and volume developments of interbank loans in the Dutch market. The algorithm extracts this information from TARGET2 transaction data by matching an outgoing payment with a repayment of the same value including a plausible interest rate. The network properties defined by Dorogovtsev and Mendes (2003) and applied to large value payment systems by Pröpper et al. (2008) are used to describe the topology of the interbank market.

Enforcing the Stability and Growth Pact in real time
John Lewis

The goal of this research is to analyse the effectiveness of the current arrangements, and other simple binary punishment schemes using real time data. Using a variant of the technique developed by Hughes Hallett et al. (2010) to quantify the number of correct, false and missed punishments, the research will gauge the performance of each rule and to estimate the trade-off between false and missed punishments. Using a Monte Carlo method allows not just to estimate the trade-off line itself, but also to compute confidence intervals for the likely trade-off. The project has clear policy relevance for DNB in the context of the ongoing debate about reforms of the Stability and Growth Pact. It serves to quantify the extent to which measurement error interferes with an automatic punishment system, and it compares alternative punishment structures to see which is the most effective.

Forecasting financial stress
Jan Willem Slingenberg and Jakob de Haan

Using a Financial Stress Index (FSI) for 13 OECD countries, we examine which variables can help predicting financial stress. A stress index measures stress in the financial system and summarizes it in a single statistic. We employ three criteria for indicators to be used in constructing a multi-country FSI (the index covers the entire financial system, indicators used are available at a high frequency for many countries for a long period, and are comparable) to come up with our FSI. Our results suggest that financial stress is hard to predict. Only credit growth has predictive power for most countries. Several other variables have predictive power for some countries, but not for others.

Lumpy borrowing and aggregate dynamics
Vincent Sterk

The financial crisis has inspired a wave of research that incorporates financial market imperfections into business cycle models. An important part of this literature builds on the work of Kiyotaki and Moore (1997), who have shown that endogenous collateral constraints on debt can amplify economic fluctuations. In this type of model, loans are typically refinanced in every period. This modelling choice is convenient, because it allows one to use a standard setup with representative agents. However, the setup is also quite unrealistic because in reality borrowing is often “lumpy”. This means that households and firms only refinance their loans infrequently, and only when loans are refinanced there is a renewed collateral requirement. In Sterk (2010), I present a model with a more realistic borrowing constraint, which only imposes a renewed collateral requirement when loans are refinanced.

However, the model still relies on a representative agent framework. The purpose of the project is to build and solve a macro-model with incomplete markets and truly heterogeneous agents, and to investigate to what extent representative agent versions provide a good approximation of this economy. One could expect aggregate debt to move much more sluggishly when borrowers refinance only infrequently. If debt is important for aggregate outcomes (for example, because borrowers are entrepreneurs), the transmission of shocks could become much more persistent.

Strategic loan defaults and coordination: An experimental analysis
Stefan Trautmann (Tilburg University) and Razvan Vlahu

This paper experimentally studies the impact of uncertainty about bank and borrower fundamentals on loan repayment. We find that solvent borrowers are more likely to default strategically when stricter disclosure creates common knowledge about bank weakness. Borrowers are also less likely to repay during phases of higher uncertainty regarding other borrowers' financial health, regardless of disclosure rules. We show that uncertainty about fundamentals changes the risk dominance properties of the coordination problem, and that these changes subsequently explain borrower default. For the individual borrower, loss aversion and negative past experiences reduce repayment, suggesting that bank failure can be contagious in times of distress.

Credit and liquidity risk pricing in interbank markets
Iman van Lelyveld

Banks are inherently fragile institutions making them susceptible to bank runs when liquidity issues emerge, even though the bank might be solvent. Further, banks operate in a network with other banks. The state of this network will influence bank's behaviour and vice versa. Taken together this would mean that market participants would be quite keen to price counterparty risks correctly. We want to study the pricing behaviour of Dutch banks observed in the interbank market. Such pricing information, gleaned from payments streams, would reveal something about banks' view on the riskiness of their counter parties and the risks surrounding scarce liquidity. This can then be compared to both public (credit spreads observed) and private information (collateral banks have available). Understanding market behaviour is crucial for effective supervision and regulation. We would be able to contribute to the literature on risk assessment and price setting. A better understanding in this respect would allow us to develop (early) warning indicators of risks building up in the system. We use data from Heijmans *et al.* (2010). The algorithm developed links payments going out with a return stream consisting of the notional and the associated interest payment. We would then compare the private pricing information with publicly available risk measures and communication signals. Quoted bid-ask spreads (collected from Bloomberg) could, for instance, provide a 'public face' that could be compared with the private information contained in the bilateral prices.

Systematic risk under extremely adverse market conditions (project started in 2010)
Maarten van Oordt and Chen Zhou

Extreme losses are the major concern in risk management. The dependence between financial assets and the market portfolio changes under extremely adverse market conditions. We develop a measure of systematic tail risk, the *tail regression beta*, defined by an asset's sensitivity to large negative market shocks, and establish the estimation methodology. We compare it to regular systematic risk measures: the market beta and the downside beta. Furthermore, the tail regression beta is a useful instrument in both portfolio risk management and systemic risk management. We demonstrate its applications in analyzing Value-at-Risk (VaR) and Conditional Value-at-Risk (CoVaR).

The sensitivity of banks to system shocks
Maarten van Oordt and Chen Zhou

In this paper, we plan to use the methodology from 'Systematic Risk under Extremely Adverse Market Conditions' in order to measure which banks are more sensitive to severe shocks in the banking system. Subsequently, we will try to find the bank characteristics that can explain and/or forecast this sensitivity. The analysis may provide a better understanding and forecasting ability on which banks are more sensitive to severe shocks in the banking system.

Collective strategic defaults: Bailouts and repayment incentives
Razvan Vlahu

This paper shows that under a global games approach banks may be subject to risk of failure even when fundamentals are strong due to a coordination problem among debtors. As a result of collective strategic default a financially sound firm may claim inability to repay if she expects a sufficient number of other firms to do so as well, thus reducing bank's enforcement ability. This occurs in particular when financial environment is characterized by a poor quality of corporate sector. The paper provides a model in which participants take simultaneous actions on the basis of imprecise private signals about the ratio of bad loans in bank portfolio. The model has a unique equilibrium in which an attack against the bank occurs when the fundamentals are above a threshold level. The model also helps us understand the role of the Central Bank as a Lender of Last Resort under opportunistic behaviour from borrowers. While an ex-post bailout policy is often believed to reduce bank incentives, in this case it induces commercial banks to affect loan quality, which indirectly reduces incentives for strategic default. Within this framework we argue that the marginal cost of intervention incurred by Central Bank has a double-edge effect. While a higher cost helps to mitigate the moral hazard problem at the bank level by determining it to exert maximum of effort even when fundamentals are strong, it also increase the probability of bank failure by lowering the threshold that triggers collective strategic default. We also find that high bank expected profitability reduces the likelihood of collective strategic default.

Currency crises linkage: weak or strong? (Continued from the project "Hidden linkages of exchange crises" in 2010)
Chen Zhou

Exchange rates are driven by the relative ratio of macroeconomic fundamentals such as money supply, real income, nominal interest rates and price level between the two underlying countries. This creates potential dependence of exchange rates with respect to one common reference country. Empirical literature documented the tail dependence among exchange rates, i.e. two exchange rates with respect to one common reference country are likely to have extreme co-movements. This could be caused by the either shocks on the macroeconomic fundamentals of the reference country on the linkages between macroeconomic fundamentals of the two considered currency. However, such extreme co-movements are more observed between industrial countries compared to emerging economies. This study intends to provide a theoretical model explaining such phenomenon. Since the macroeconomic fundamentals of emerging economies exhibit heavier tails, i.e. a large shock is more likely, the individual tail events dominate the extreme movements of exchange rates. In that case, an extreme residual dependence is still possible between exchange rates of emerging economies. We define it as the hidden linkages of exchange crises, and show that low level of tail dependence between emerging currencies does not always imply weak currency crises linkage. Empirical analysis verifies the theoretical model.

4. Micro-prudential supervision and conduct of financial institutions

Intra-bank competition and risk taking
Itai Agur, Wilko Bolt and Chen Yeh

This paper investigates the relationship between the hierarchical framework of a bank and its overall risk taking behaviour. A CEO divides funds among self interested division managers. To elicit behaviour from them that is as close as possible to wider bank interests, the CEO designs their contracts. However, he has limited information on the type of investment opportunities that division heads have. Intra-bank competition for funds is shown to exacerbate bank risk taking. The paper proceeds to investigate how bank hierarchies affect optimal bank regulation.

The impact of the financial crisis on the international banking network
Beata Bierut, Julian von Landesberger (European Central Bank) and Tatiana von Landesberger (Technische Universität Darmstadt)

The aim of the project is to analyse the impact of the financial crisis on the structure of the cross-border bank connections within the euro area and with the countries outside the euro area. Network tools and indicators will be used to analyze the development of the properties of the international banking network, most notably those characterizing the stability and resilience of the network. The empirical methodology will be focused on network visualisation and network distribution analysis, extending the two approaches through time, with a particular focus on the financial crisis period and the impact of its mileposts (e.g. the collapse of the Lehman Brothers) on the international banking network structure.

Developments in competition and efficiency in the Dutch insurance industry
Jaap Bikker and Jalal Mrabti (University of Utrecht)

The Dutch insurance industry has recently been hit by various crises: the commotion around investment-linked insurance policies, popularly known as ‘robber policies’ (woekerpolissen), the introduction of ‘banksparen’ which increased the competition with banks, and the credit crisis. Earlier research of Bikker en Van Leuvensteijn (2005, 2008) over 1995–2003 has revealed that life-insurance firms are cost inefficient and that their market is not competitive. Lack of competition and inefficiency may contribute to instability, while on the other hand cutthroat competition may also threaten stability. This paper aims at assessing how these insurance market features have developed over time, particularly, over 2004-2009. Further, this paper extends the analyses to the Dutch non-life insurance market (including disaggregation into the various lines of business), where competition has not been estimated before. Finally, in order to establish the optimal structure of the market, special attention is paid to difference between large and small firms. Measurement approaches with respect to competition and efficiency are restricted by data availability, e.g. lack of input and output prices and detailed cost figures. This paper measures efficiency by unused scale economies and competition by the Boone indicator. Competition and efficiency complement each other as heavy competition forces insurers to increase efficiency. The estimation of scale economies allows comparisons with other countries. Both approaches enable measurement of developments over time, particular the Boone indicator allows annual estimates.

Dynamic adjustment of stock prices to the fundamental value: An error correction approach
Jaap Bikker, Pauline Broertjes (University of Utrecht) and Laura Spierdijk (University of Groningen)

In the public discussion on the future of the Dutch pension system, people suggest that the current funding shortages will disappear as stock prices are expected to recover. Pension funds’ investment policies in the Netherlands (including rebalancing strategies) are explicitly based on (long-run) mean reversion of stock prices. The existence or absence of mean reversion has great implications for the FTK continuity test and, the required buffers of pension funds. Spierdijk *et al.* (2010) found very small and volatile mean reversion in line with various other papers. Spierdijk *et al.* (2010) assume international mean reversion to a world-wide average. However, theoretically, one may expect a strong link between the financial stock price and real-economic developments. Employing such kind of a long-run relationship is expected to result in a more informative mean reversion model. Spierdijk *et al.* (2010) apply panel data models for equity returns in several countries, in order to obtain more reliable estimates, using long data series from the Dimson database. As those data do not contain macro-economic series needed for the fundamental price model, we will collect other data series for several countries over very long periods. Further, we will use bootstrap and simulation methods to determine reliable standard errors in models that employ overlapping samples. Finally, we will investigate the consequences of our results for the FTK continuity test.

Measuring competition across US banks (project started in 2010)
Wilko Bolt and Dave Humphrey (Florida State University)

Adequate banking competition benefits consumers by reducing costs, lowering prices, and improving offered services. While the reverse may occur if competition is too weak, if it is too strong banks may seek greater risks in an effort to replace profits lost by lowering prices more than costs can be reduced. Unfortunately, standard indicators of bank competition may yield conflicting results. We propose an alternative measure that takes different bank activities (spread, non-interest income) into account. Should antitrust authorities or banking regulators be concerned? Our competition measure borrows from the cost/profit efficient frontier literature and is applied to US banks to assess banking competition between larger versus smaller banks, between commercial versus savings banks, and to determine whether competition has changed over time.

Solvency regulation of contingent pension benefits
Dirk Broeders and David Rijsbergen

Pension contracts around the world increasingly contain conditional elements. The key characteristic of these contingencies is that the pension benefit can be adjusted upward or downward with the performance of the pension fund’s assets or with changes in longevity expectations. Regulatory regimes, however, for contingent liabilities are less clear. We develop a mechanism that allocates the pension assets to the different age cohorts of the pension fund using innovative option contracts known as "super shares". These super shares allow for a distinction to be made between the claims of young and old according to life cycle theories. Furthermore we suggest a regulatory solvency framework, in which account is taken for the potential adjustments in pension benefits. This paper is relevant for the contemporary discussion in the Netherlands on new pension contracts, the "green book" issued by the European Commission and other regulatory frameworks, like Solvency II for insurance companies.

Trends in foreign banking: A database on foreign bank ownership
Stijn Claessens (International Monetary Fund) and Neeltje van Horen

This paper describes an extensive data collection effort on foreign bank entry and documents important trends and patterns in foreign bank presence. The data collected cover the period 1995-2009 and include ownership information and changes therein of banks active in 138 countries. Furthermore, it includes a full bilateral matrix of bank source and host countries, and the mode of entry. We document that there has been a sharp increase in foreign bank presence in most regions between 1995 and 2009, with especially developing countries observing much new entry. However, over the sample period mode of entry has shifted from Greenfield investment to the merger and acquisition of domestic (and foreign) banks. We also show that integration through foreign bank ownership is mostly regional and this has become more important over time. The crisis had a dramatic effect on the number of new entries, while exits were very limited over the crisis period.

Conduct and cultural risks: a survey
Jakob de Haan, Rosa Maljaars, Kirsten Spahr van der Hoek

This paper summarizes findings in the academic literature of behaviour and culture in organizations, with a special emphasis on factors that may lead to suboptimal (risky) decisions by financial institutions. The purpose of the research is to summarize what may be learned from academic research for supervision of culture and behaviour of financial institutions. This literature review is aiming to facilitate the execution of the DNB Supervisory Strategy 2010-2014 regarding enhancing supervision on the culture of financial institutions. Given the broadness of the topic, additional in-depth analyses on subtopics or specific risks are advisable. The main subjects in this literature review are: 1) individual and group decision-making, 2) leadership, 3) corporate culture, and 4) measurability of behaviour and culture.

Foreign bank subsidiaries during the crisis: facing the perfect storm
Ralph de Haas (European Bank for Reconstruction and Development) and Iman van Lelyveld

In this paper we will extend earlier analysis of internal capital market across national boundaries (De Haas and Van Lelyveld, 2010). Using panel data on the intra-group ownership structure and balance sheets of 45 of the largest multinational banks, we showed evidence of the existence of internal capital markets through which multinational banks manage the credit growth of their subsidiaries. The recent crisis, however, might shed a different light on the functioning of internal capital markets. First, as crises now have occurred not only in host but also in home countries, the positive, credit stabilising effect of internal markets might be affected. Second, some of the parent banks in our sample have received significant state support and these support packages have had implicit and explicit conditions on credit extension attached. Thus, credit extension in non-home regions might be affected. This research will shed light on the question whether further internationalisation of banking firms is a desirable trend. We use a panel model to test whether a subsidiary's credit and deposit growth is affected by conglomerate factors using accounting data running from 1992 to 2009. Similar to our earlier paper we will apply several sensitivity tests to establish the robustness of our results; these include the random assignment of the subsidiaries studied to foster parents as well as the random linking of domestic banks to the parent companies in our sample.

The economics of bank bankruptcy law
Matej Marinc (University of Ljubljana) and Razvan Vlahu

This paper shows that a special bank bankruptcy regime is desirable for an efficient restructuring and/or liquidation of distressed banks. We first explore in detail the principal features of corporate bankruptcy law. Subsequently we examine specific characteristics of banks including public confidence, negative externalities of bank failures, opaqueness and related asset substitution problem and liquidity provision. These features distinguish banks from other corporations and are largely neglected in corporate bankruptcy law. Other implications arise from the pressure of multiple regulators. Finally, we make recommendations for the necessary changes in both prudential regulation and reorganization policies which should allow regulators and banking authorities to better mitigate disruptions in the financial system and minimize the social costs associated with bank failures. We confront the recommendations with the examples of bank failures from the 2007-2009 financial crises.

Global financial contagion, foreign bank ownership and credit availability
Steven Ongena (Tilburg University), Jose Luis Peydro Alcalde (ECB) and Neeltje van Horen

This paper studies the transmission of the current financial crisis through foreign bank ownership. Specifically, we examine the impact of foreign bank ownership on firm credit availability and the implications for the real economy. Matching data from three different data sources, Bankscope, Kompass and Amadeus, we study the differential impact of the crisis on lending by foreign versus domestic banks in twenty Eastern European countries. Our paper differs from previous studies on crisis transmission through foreign bank ownership, as we can exploit both bank heterogeneity and firm heterogeneity while accounting for differences in type of borrowers serviced by domestic and foreign banks. In addition, our dataset allows us to study the (differential) impact of the credit crunch on the profitability of firms. To our knowledge this is the first paper studying the real effects of the global financial contagion.

Capital regulation and tail risks
Enrico Perotti (University of Amsterdam, Lev Ratnovski (International Monetary Fund) and Razvan Vlahu

The paper revisits the relationship between bank capital and risk taking. The traditional view is that higher capital reduces excess risk-taking driven by limited liability. We argue that this effect is diminished when banks can choose projects with high tail risk. Moreover there is an important opposing effect, associated with the costs of compliance with capital regulation. A poorly capitalized bank may act risk-averse to avoid breaching the minimal capital ratio. Higher capital reduces the probability of breaching the ratio, allowing a bank to take more risk. Overall, when banks have access to high tail risk projects, this can lead to excess risk-taking by highly capitalized banks in equilibrium. The results are consistent with stylized facts about pre-crisis bank behaviour, and have implications for the optimal design of capital regulation.

Multinationals and the benefits of banking FDI
Steven Poelhekke

Research on the internationalization of banks and financial sector foreign direct investment (FDI) has primarily focused on the host country implications of foreign banks. This paper instead investigates the benefits of banking FDI for non-financial multinationals who invest in the same host countries. Using a new dataset of non-stationary sector level outward FDI the paper finds that the volume of FDI by home market banks boosts FDI by non-financial firms from the same home market. The sale of a major international bank to foreign parties during the recent crisis may thus result in lower permanent volumes of outward FDI from the bank's home market. Third country foreign banks provide an imperfect substitute, which is consistent with a model of FDI in which home market banks solve agency problems in unfamiliar foreign markets.

The impact of bank regulation and supervision on bank soundness (project started in 2010)
Choudhry Tanveer Shehzad (RUG) and Jakob de Haan

We examine the effect of different dimensions of bank regulation and supervision on financial soundness analyzing around 400 banks for the period 2005-2008. We find that various dimensions of bank regulation and supervision have different effects on our proxies for financial soundness as suggested by the IMF. Better supervisory control tends to improve bank asset quality, liquidity, banking stability, and profitability, but has no effect on capital adequacy. Moreover, regulations restricting bank activities and increased private sector monitoring of banks do not improve financial soundness.

The crisis as a wake-up call. Do banks tighten monitoring and screening during a financial crisis?
Neeltje van Horen (project started in 2010)

We examine whether the global financial crisis has prompted banks to screen and monitor borrowers more carefully. By analyzing a large set of syndicated loans to private borrowers over the period 2005-2009 we find significant changes in syndicate structure that point to an increased focus on screening and monitoring during the crisis. In particular, we document a considerable increase in retention rates among syndicate arrangers. These higher retention rates (‘more skin in the game’) are only partially caused by increased borrower risk. They mainly reflect that banks re-evaluated the importance of strict screening and monitoring when the crisis erupted: a wake-up call effect.

Contextual determinants of banks’ liquid buffers (project started in 2010)
Iman van Lelyveld, Robert Zymek (Bank of England, Pompeu Fabra).

Banks’ role in maturity transformation combined with a first-come, first save constraint imply that banks are susceptible to bank runs and thus can suffer from – temporary – illiquidity. The supervisory community has realised this and is working hard in coming to a joint framework for liquidity regulation and supervision (see WGL (2009) for an overview of the state of play in the literature). Objections to such a common framework have been raised as ‘contextual factors’ would make it impossible to achieve a level playing field; The depth of the financial market, the quality of regulation and competition have for instance been mentioned as such factors (BCBS, 2008). This paper will examine the economic importance of many of the factors mentioned in the debate. We will provide the first formal analysis of the determinants of banks’ liquid asset holdings across countries. Using balance-sheet data for nearly 7,000 banks from 30 OECD countries over a ten-year period, we will assess the relevance of a number of country-specific institutional and policy variables in explaining the size of banks liquid asset buffers. Our setup will be similar to Aspachs, Nier and Tiesset (2009) but we will use a worldwide dataset. Using several measures of bank’s liquidity as dependent, we intend to explain these by firm specific controls, macro economic controls, and variables that measure contextual factors as mentioned in the literature.

Exploring the relationship between factional groups, conflict management, and pension fund board effectiveness
Dennis Veltrop (University of Groningen), Niels Hermes (University of Groningen), Theo Postma (University of Groningen) and Jakob de Haan

We investigate the effects of faction distance between two naturally occurring factions within Dutch pension fund boards on conflict management within boards as well as on board effectiveness. We demonstrate that faction distance can either be beneficial or detrimental for board effectiveness, depending on the strength of the faction faultline, that is, how cleanly the two factions can be separated. We show that faction distance leads to forcing behaviour when there is a strong faultline between the factions. Conversely, for boards with a weak faultline, faction distance leads to problem solving behaviour. Faction distance has conditional indirect effects on board effectiveness through forcing behaviour and problem solving behaviour, depending on the strength of the faction faultline.

5. Financial literacy and behaviour of households and companies

Financial behaviour of self-employed
Robert Paul Berben and Federica Teppa

In the Netherlands an increasing number of individuals start their own business, possibly as a response to adverse labour market shocks. In addition, during the financial crisis private consumption in the Netherlands fell sharply, also from an international perspective. These two facts may be related. For instance, the self-employed may react to (negative) income shocks differently than employees. This project uses data from the DNB Household Survey to investigate empirically to what extent self-employed handle shocks to their income and finances differently than employees.

Knowledge and opinions about financial supervision: effects on trust and behaviour
Jakob de Haan, David-Jan Jansen, Robert Mosch and Carin van der Cruijsen

This paper extends the analysis in '*Knowledge and opinions about banking supervision*' (DNB WP, 2010). We relate knowledge and opinions to the households' financial decisions, such as the decision to spread savings over accounts at different banks, or the degree to which information about banks is gathered, before a savings account is opened. We will also study whether trust is higher for individuals who have more realistic expectations and/or knowledge.

Compensating insurance agents: commissions versus fees
Janko Gorter

Due to both competitive and regulatory concerns, the compensation of insurance agents has come under increasing scrutiny, both from policy makers and from the public at large. Particular concern exists about the effects of commission payments on unethical sales practices. It has been suggested that it would be better if consumers would pay a direct fee for advice about financial products rather than having the agent receive a commission from the insurers if a sale is made. This paper models the insurance market. There are consumers, insurers and agents. Agents have a financial incentive to exaggerate the benefits of insurance to consumers if compensated by sales commissions. Consequently, the quality of advice is greater when agents are compensated under a fee-based system. However, consumer will not become informed under a fee-for-advice system, unless they first pay the fee. So, whether a fee-based system is actually preferable from a welfare perspective largely depends on the market position of agents and consumers, respectively. Therefore welfare comparisons are made between commission-based and fee-based compensation regimes.

Household financial market expectations and investment choices in a financial crisis ethnicity (project started in 2010)
Michael Hurd (RAND and NBER), Maarten van Rooij, Joachim Winter (University of Munich)

Despite its importance for the analysis of life-cycle behaviour and, in particular, retirement planning, stock ownership by private households is poorly understood. For instance, in contrast to the predictions of standard models of life-cycle behaviour and portfolio choice, relatively few households hold stocks while those who do hold stocks often trade too much or not at all. The current study uses repeated observations of private households' financial market expectations collected at relatively high frequency in the CentERpanel to investigate the effect of the autumn 2008 financial crisis, i.e. a crash on the stock market, a high volatility of stock returns and an increased uncertainty on future economic developments, on the level and volatility of stock market expectations and its effect portfolio investment choices (i.e. buying or selling stocks, bonds and mutual funds). The hypotheses we test include (i) the stability of expectations over time; (ii) the reaction of expectations to new information on stock markets, e.g. the emergence of a stock market crash; and (iii) the relationship between expected returns and actual trades.

Choice of payments instruments and ethnicity (project started in 2010)
David-Jan Jansen and Anneke Kosse

The role of demographic factors in choice of payments instruments has been well researched. However, little attention has been paid in the literature to the specific role of ethnicity. In August 2009 a survey was conducted to gather information on payments by ethnic groups in the Netherlands. Using regression analysis, we will investigate whether ethnicity plays a significant role while controlling for various covariates, such as income, education, gender, type of transaction, and transaction volume.

Card acceptance and surcharging: the role of costs and competition (project started in 2010)
Nicole Jonker

Several cost studies reveal that debit card payments are very often more cost efficient than cash or credit card payments. Previous research shows that a higher acceptance rate among merchants will encourage consumers to use their debit card more frequently, as will less debit card surcharging. The aim of this study is to gain insight into the factors influencing merchants' acceptance and surcharging decisions. We summarise the main behavioural relationships found in the theoretical literature and we evaluate these relationships empirically, using survey data collected by DNB among 1,008 Dutch merchants in 2007. The survey results reveal that both the costs associated with card acceptance for merchants as well as the competitiveness of the market influences merchants' acceptance and surcharging decisions. The results confirm the predictions from the theoretical literature.

Do newspaper articles on debit card fraud affect debit card usage? (project started in 2010)
Anneke Kosse

Skimming fraud is one of the main forms of payment fraud at points of sale and automated teller machines in the Netherlands and it has increased materially over the past few years. Although the size of this fraud is relatively small in comparison with total retail payments, these incidents receive a fair amount of attention from the media and might therefore affect consumers' payment behaviour and in the end the overall efficiency of the payment system. Using time series and panel data analyses, I will analyse, after having corrected for calendar and seasonal effects, to what extent daily debit card usage is affected by publications of newspaper articles about skimming. To this end, daily debit card transaction data (split up by region) have been collected from 2005 – 2008, as well as all skimming articles published during this period in national and regional newspapers (also split up by region). This study will provide insight into the extent to which overall consumer payment behaviour is affected by media announcements and into the sensitivity of consumers' confidence with respect to paying.

What is a clean Euro banknote? The Dutch public responds
Martijn Meeter, Frank van der Horst and Marcel van der Woude (VU University)

In the Netherlands, a total of around 2 billion banknotes are sorted each year. Banknotes that are still fit for circulation are re-used, while the remaining unfit notes are destroyed by DNB. The sorting threshold for this selection is determined by experts of DNB. This study will measure the opinion of the Dutch public on fitness or unfitness of different used banknotes. Pre-defined sets of banknotes with single and multiple defects will be used in qualitative experiments. Although opinion polls on the general quality of banknotes in a country have been conducted before by DNB and other central banks, this is the first time that a relation will be established between individual or combined defects of a banknote (tears, dog ears etcetera) and the opinion of the public on fitness or unfitness. The results of this study will allow us to compare the public opinion with the current sorting practices at DNB, and can result in recommendations to improve sorting efficiency while meeting the public's expectation.

Subjective survival probabilities and the preference for annuities.
Federika Teppa and Maarten van Rooij

An annuity is the only contract that guarantees income right up to the point of death. Nonetheless, international empirical evidence show that only a small minority of individuals voluntarily purchases an annuity. This paper provides additional evidence on individual preferences over annuities and lump sum payments based on a number of hypothetical questions posed in the DNB Household Survey in 2005. Contrary to the majority of papers in the annuitization puzzle literature, this study allows to control for the subjective survival probability, a key driver of the decision about whether to annuitize or not as a perceived measure of longevity risk. The finding that people expecting to live longer do claim to prefer the annuity is an important empirical result that is still not directly tested in the existing literature.

Labelling, magnitude, ordering and choice set effects in individual preferences
Federika Teppa and Maarten van Rooij

A large literature has documented behavioural biases in a wide range of activities that are important steps in the process of planning for retirement, including whether to participate in employer sponsored pension plans, how much to save, and how to allocate one's portfolio. With the gradual shift from defined benefit to defined contribution pension plans workers' investment decisions play an increasingly important role in determining their retirement income, because the investment risk is shifted from employers to workers. While traditional defined benefit plans are generally managed professionally, workers have responsibility for managing the investments in their defined contribution pension arrangements. This paper aims at contributing to this literature by analysing labelling, magnitude, ordering and choice set effects in individual preferences with respect to retirement savings (namely, pension premium contributions) and asset allocation of pension wealth. The study makes use of survey data collected in 2006 both in NL (via the DNB Household Survey) and in US (via the RAND American Life Panel). The finding that individual choices are affected by any of these effects is fundamentally important for a central bank in its role of policy maker.

Other projects

Employment protection, technology choice, and worker allocation (project started in 2010)
Eric J. Bartelsman (VU University Amsterdam, TI), Joris de Wind and Pieter A. Gautier (VU University Amsterdam, TI)

Using country-industry panel data from the EUKLEMS, we find that countries with stricter employment protection legislation (EPL) have smaller and less productive high-risk innovative sectors. We develop a two-sector matching model with endogenous technology choice, i.e. firms can choose between a safe sector with stable productivity and a risky sector with productivity subject to sizeable shocks. In the absence of EPL, the risky sector is relatively attractive because firms have the option to fire workers which bounds the downward risk. Recent evidence from Brynjolfsson, McAfee, and Zhu (2009) shows that the adoption of new information and communication technologies (ICT) since the mid-nineties is associated with an increase in the variance of firm performance. We argue that this increased variance has boosted average productivity because the option to fire workers gives firms opportunities to exploit the good projects and exit the bad ones. As EPL makes it more costly to exit, countries with stricter EPL have been less able to exploit the new ICT. The described mechanism can explain a considerable portion of the slowdown in productivity in the EU relative to the US since the mid-nineties.

Key subjects in banknote design: banknote identity
Hans de Heij

Commissions to design a new banknote are typically unclear, hiding many implicit aspects. This study aims to make these key subjects more explicit in order to make them more manageable. These key subjects of banknote design falls apart in two separate groups, subjects related to a) the product, i.e. the banknote; b) the process, i.e. the design management. Both product and process are divided into six subjects and each subject is subdivided in several items. The study is done with an eye on the design of future euro banknotes (Euro Series 3). The 'fieldwork' of the study covers 3 of the 12 identified key subjects: 1) Value recognition of banknotes, 2) Security features for retailers and public and 3) Banknote identity (planned for 2011). Additional research to banknote identity has been ordered by DNB at TNS NIPO and will be done in 2011. The Dutch will be asked about their opinions on the European identity reflected in the euro coins and banknotes. Once this fieldwork is finished the thesis will be written (planned for 2012). An important part of the thesis is the Annex (*yellow pages*), which will be a template of a complete Programme of Requirements for a new banknote. This study also covers the methods developed and used by DNB at the time of the successful Dutch guilder banknotes.

Nonlinear and stable perturbation-based approximations
Wouter J. den Haan (UvA, TI) and Joris de Wind

Users of regular higher-order perturbation approximations can face two problems: policy functions with odd undesirable shapes and simulated data that explode. The solution proposed by Kim, Kim, Schaumburg, and Sims (2008), i.e., pruned perturbation approximations avoid the instability problem, but – as is documented in this paper – have some important drawbacks. We propose an alternative perturbation-based approximation that (i) does not have odd shapes, (ii) generates stable time paths, and (iii) avoids the drawbacks that hamper pruning. We consider models for which the highlighted problems of regular higher-order perturbation are relevant. We find that our alternative and pruned perturbation approximations give a good qualitative insight in the nonlinear aspects of the true solution, but – with a few exceptions – differ from the true solution in some quantitative aspects, especially during severe peaks and troughs.

R*educed rank time-varying Vector Autoregressions* (project started in 2010)
Joris de Wind and Luca Gambetti (UAB, RECent)

The time-varying Vector Autoregressions of for example Primiceri (2005) and Cogley and Sargent (2005) seem to be over-parameterized. They assume that the vector of time-varying coefficients follows a random walk with full rank covariance matrix. Principal component analysis, however, suggests that only a few factors are important in driving the coefficients. Therefore, we reduce the rank of the covariance matrix of the random walk. We rewrite the reduced rank model using an underlying factor structure which we can estimate much faster than the full rank model. Because the reduced rank model is not subject to over-parameterization as much as the full rank model, we can include more variables and/or more lags.

A heterogeneous agent approach to explaining dispersion in the foreign exchange market

Ron Jongen, Willem Verschoor (Erasmus University Rotterdam), Christian Wolff (Luxembourg School of Finance) and Remco Zwinkels (Erasmus University Rotterdam)

In this project we try to combine survey expectations with a heterogeneous agent model to examine the dispersion of beliefs of market participants in the foreign exchange market. It is a well-known fact that market participants have heterogeneous beliefs about the future, but little is known about why dispersion is bigger in some periods than in others, nor about what the drivers of such shifts in beliefs are. We will therefore build a heterogeneous agent models that allows switching between various forecasting techniques, so as to learn why market participants rely more on some forecasting techniques in certain periods than in other. We initially apply this technique on foreign exchange forecasts, but the methodology we develop can and will be used in future research to also have meaningful investigations of macroeconomic forecasts, such as inflation rates, GDP and interest rate forecasts. We believe that more insights in the dynamics of market participants' beliefs is important in understanding the actual behaviour of market participants and the market in general.

Forecasting in the presence of structural breaks
Andreas Pick

The quality of forecasts can be detrimentally affected by structural breaks in the estimation period. Pesaran and Timmermann (2005) consider optimal estimation windows when structural breaks are present. Pesaran and Pick (forthcoming) considered forecast averaging when the same model is used but estimation is carried out over different estimation windows. This project will investigate further methods that deliver forecasts that are robust against structural breaks.