DNB Research Program 2024

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July 2024

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Theme 1. Conventional and unconventional monetary policy

New projects

1. Monetary Policy, Unemployment and Employment Concentration.
Guido Ascari (DNB, University of Pavia), Andrea Colciago (DNB, University of Milano Bicocca), Marco Membretti (University of Pavia)

We provide evidence showing that a tightening in monetary policy leads to an increase in job destruction, a rise in unemployment, and a sustained increase in employment concentration within large firms. To rationalize these empirical findings, we propose a model that integrates the theory of firm boundaries, through diminishing marginal returns, within a framework that encompasses search and matching frictions in the labor market and nominal price rigidities.

Continued projects

1. Quantitative tightening in a HANK model
Guido Ascari (DNB, University of Pavia), Timo Haber (DNB) and Kostas Mavromatis (DNB, University of Amsterdam)

Who bears the burden of quantitative tightening and how does it affect macroeconomic outcomes? In order to answer this question we build a model where households face uninsurable idiosyncratic income risk and can save in two assets; a short and a long government bond. The long government bond is subject to adjustment costs and modelled like a perpetuity that declines geometrically. We model QT (and QE) as a change in the relative aggregate supply of the long- versus the short bond. We then investigate the following questions through the model's perspective: How does a change in the maturity structure of outstanding debt affect aggregate variables? How does fiscal policy affect these conclusions? Are there any asymmetries?

2. Monetary policy transmission during sovereign stress
Tilman Bletzinger (European Central Bank) and Gavin Goy (DNB)

A key justification of several asset purchase programs of the European Central Bank has been the safeguarding of the monetary transmission, i.e. the control of euro area interest rates and ultimately inflation. Using a Bayesian threshold model and daily data on key macro-financial variables, we provide evidence that the monetary policy transmission in the euro area may indeed break down at times of heightened sovereign stress. Our results thus provide an important empirical justification for instruments such as the Transmission Protection Instrument.

3. Efficient estimation of models with occasionally binding constraints
Paolo Bonomolo (DNB) and Sophocles Mavroeidis (University of Oxford)

We propose two methods to estimate models with occasionally binding constraints: a maximum likelihood strategy and a Bayesian approach. With respect to existing methods, we improve the efficiency of the estimators through the analytical derivations of the likelihood and of the posterior distributions of the parameters and latent processes. Our methods are simpler to implement and faster. We apply our estimation strategy to the CKSVAR model of Mavroeidis (2021) and use it to measure the contribution of conventional and unconventional monetary policies in the Euro Area and US.

4. Estimating DSGE models with finite horizons
Kostas Mavromatis (DNB), Joep Lustenhouwer (University of Heidelberg), Mike Tsionas (Lancaster University) and Giorgio Motta (Lancaster University)

We augment the Smets-Wouters (2007) model to account for households' and firms'

bounded rationality. In particular, we assume that both form decisions up to a finite number of periods to the future. We estimate the model using a novel estimator. Our estimates show that the planning horizon of agents varies from 20 to 25 quarters ahead. Moreover, given the finite horizon in agents' decisions, we show that the responses of output, inflation and investment in the U.S. are more pronounced following fundamental shocks.

Theme 2. Inflation

New projects

1. Do markets see risks of fiscal dominance in the euro area?
Dennis Bonam (DNB, University of Amsterdam), Gabriele Galati (DNB), Tolga Ozden (Bank of Canada) and Steven Poelhekke (VU Amsterdam)

The sovereign debt crisis of 2010-12 and the Covid-19 crisis have witnessed a combination of a strong monetary response and a sharp increase in sovereign debt in Europe. This policy mix in principle could raise some concerns of entering a regime of fiscal dominance in the future. In turn, these concerns could lead to higher and de-anchored inflation expectations when agents expect fiscal sustainability issues to be resolved through higher inflation, which could threaten long-run price and economic stability. We estimate the impact of changes in financial markets' perceptions of fiscal sustainability on long-term inflation expectations in the euro area. We find that perceptions of elevated fiscal sustainability risks have generally not been associated with significantly higher long-term inflation expectations, neither during the sovereign debt crisis nor the pandemic crisis. These results suggest that financial markets do not expect the euro area to enter a regime of fiscal dominance.

2. Expectations formation and the Phillips curve
Emmanuel De Veirman (DNB)

Standard theory implies that in the Phillips curve, inflation depends on short-run inflation expectations which are formed rationally on the basis of full information. At the same time, empirical researchers use a variety of measures for inflation expectations, ranging from rational over survey-based to adaptive expectations, with survey expectations being either short- or long-run. This paper tests the relative performance of various types of inflation expectations in the data, so as to get a better understanding about how inflation expectations are formed and how these feed into the inflation process. One way in which this matters for monetary policy is that the types of inflation expectations differ in terms of their persistence, which influences the speed with which monetary policy affects inflation expectations and inflation.

3. Understanding inflation effects on bond markets allocations
Martijn Boermans (DNB) and Laurens Swinkels (Erasmus University Rotterdam)

Inflation in the euro area has been relatively stable over the past decades, until 2021. We analyze how inflation dynamics has impacted portfolio holdings of European investors before and after the inflation spikes. In particular, using the ECB Securities Holdings Statistics Sectoral database over the period 2013-2023 we unravel which investors were impacted the most by the rise of inflation. Important heterogeneity in asset and liability management in terms of real versus nominal pricing may affect investors differently, which could drive buying and selling of certain bonds with greater inflation exposures.

4. Inflationary relative demand shocks
Dennis Bonam (DNB, VU Amsterdam), Bart Hobijn (Federal Reserve Bank of Chicago)

During the pandemic crisis, as economies were under lockdown, a noticeable shift emerged in the spending behavior of consumers, from consumption on services to consumption on (durable) goods. In a frictionless world with flexible prices, such relative demand shocks would trigger an increase in the price of goods and a decline in the price of services, thereby leaving the aggregate price level more or less unchanged. In this paper, we investigate the implications of downward nominal price rigidity for the impact of relative demand shocks on inflation. When prices are downwardly rigid, a shift in demand requires a stronger increase in the price of the product that is in high demand compared to the prices of other products, as the latter are too slow to adjust to restore equilibrium. Such inflationary relative demand shocks could partially explain the pandemic era inflation surge.

5.Turning point indicator of inflation
Jan Willem van den End (DNB), Marco Hoeberichts (DNB)

Based on a non-parametric method we construct a leading indicator for turning points in the inflation cycle. We follow De Bondt et al. (2021), but differ in several ways. We extract the cycle by a band pass filter. To identify the turning points we use the Bry Boschan algorithm. The selection of variables included in the leading indicator is based on turning point matching and dynamic correlation. We apply the method to core inflation in the Netherlands and the euro area.

Continued projects

1. Global supply chain pressures, inflation and implications for monetary policy
Dennis Bonam (DNB, VU Amsterdam), Andra Smadu (DNB, University of Groningen) and Guido Ascari (DNB, University of Pavia)

How should policymakers respond to the recent surge in inflation? This paper quantifies empirically how much global supply chain pressures contribute to euro area inflation, and examines theoretically what they imply for monetary policy. We first document that global supply chain pressures contribute positively and significantly to inflation in the euro area, based on a Phillips curve analysis. We then show that shocks to global supply chain pressures play an important role in the recent surge in euro area inflation, using a Bayesian structural vector autoregressive model. These shocks are found to have a highly persistent effect on inflation. Finally, we study what these shocks imply for optimal monetary policy using a New Keynesian model with trade in intermediate goods.

2. Nonlinear Phillips curve and inflation risk
Hanno Kase (University of Minnesota), Sebastian Rast (DNB), Matthias Rottner (Deutsche Bundesbank) and Leonardo Melosi (University of Warwick, Federal Reserve Bank of Chicago)

How does a nonlinear Phillips curve affect inflation risk? Using a strategic surveys approach and micro price data, we establish that the price setting behaviour of firms depends nonlinearly on the inflation environment. In a high inflation environment, the share of firms that adjust their prices in response to expected inflation increases. We rationalize these dynamics using a quantitative macroeconomic model with a nonlinear Phillips curve. The model features a tractable heterogeneous firm setup with endogenous varying degrees of price flexibility. Solving the model with a machine learning approach, we demonstrate that firms price setting decision implies a substantial inflation and growth risk on the upside. Contractionary monetary policy becomes less effective in a high inflation environment, which provides a new motive to act pre-emptively for monetary policy once inflation risk increases.

3. Inflation trends and cycles

Marco Hoeberichts (DNB)

We investigate trends and cycles for inflation using trend-cycle decomposition based on a Beveridge-Nelson filter. We also the relationship between cyclical inflation and a business cycle indicator. By applying this approach to data from the euro area and from the Netherlands, we investigate whether the results help in understanding the inflation process and whether the trends as analyzed in Hindrayanto, Samarina and Stanga (2019) still apply. We also intend to use the result for forecasting inflation in real time.

4. Estimating the slope of the Phillips curve
Emmanuel De Veirman (DNB) and Anton Nakov (European Central Bank).

This paper examines the performance of different ways of estimating the Phillips curve. We

do so by running Phillips curve regressions on simulated data from a New Keynesian model in which we know the true Phillips curve parameters. We check which estimation method yields estimates that are closest to the truth. We check how this depends on the mix of demand and supply shocks that hit the economy.

5. Inflation and commercial real estate: a happy marriage?
Dorinth van Dijk (DNB), Simon Camillo Buechler (MIT) and Alex van de Minne (UCONN)

Real estate is usually seen as a relatively good inflation hedge compared to stocks or bonds. The main reason is that rents tend to be indexed. At the same time, real estate pricing is relatively sensitive to interest rate swings. In this study we examine the effect of several inflation shocks on commercial real estate returns at a regional level. We include cities from multiple countries in our sample. We will allow for nonlinear effects to distinguish between periods of low and (unexpected) high inflation.

6. The relation between idiosyncratic volatility and price setting
Emmanuel De Veirman (DNB) and Raphael Schoenle (Brandeis University)

Firm-specific shocks play a crucial role in price setting models. For instance, they are in line with the fact that one observes a substantial share of price declines even with positive inflation. In this paper, we test the implication from price-setting models that firm-specific volatility relates positively to the frequency of price adjustment. This relation is important for monetary policy given that theoretically, more frequent price adjustment implies a steeper Phillips curve.

7. Consumers' inflation expectations: insights from a monthly survey
Richhild Moessner (BIS), Gabriele Galati (DNB) and Maarten van Rooij (DNB)

There is an increasing interest among policy makers and academics in the formation of inflation expectations of consumers. This project aims to better understand inflation expectations using results from an ongoing consumer survey. Topics include the level and probability of inflation expectations, anchoring of long-term inflation expectations, developments during a period of regime changes and increasing inflation realizations, and the role of information provision.

8. Forecasting Dutch inflation using machine-learning methods
Robert-Paul Berben (DNB) and Jasper de Winter (DNB)

Despite the benefits of forecasting inflation accurately, improving simple models has proved challenging. This research explores advances in machine learning (ML) methods to forecast Dutch inflation. We investigate whether ML models with a large number of covariates are systematically more accurate than simple benchmark models. Amongst other we will investigate (polynomial) shrinkage methods, (targeted/boosted) factor models, ensemble methods, random forests and neural networks.

9. Bounded rationality, noisy signals and monetary policy assessment
Kostas Mavromatis (DNB), Tolga Ozden (Bank of Canada) and Joep Lustenhouwer (University of Heidelberg)

We introduce household bounded rationality in a closed economy where firms have noise signals as regards the demand for their products. We assume that households use simple heuristics to forecast inflation, output, consumption and the future monetary policy stance. Firms operate in a monopolistically competitive environment and set the price of their goods infrequently. Firms are uncertain about the demand conditions in their sector. In particular, we assume that when setting the price, firms observe the demand for their product with some noise. This channel introduces an additional layer of uncertainty in our model. We assess the performance of simple monetary policy rules, namely inflation targeting, average inflation targeting and price level targeting. Subsequently, we compare our results to those from the rational expectations benchmark where households and firms share the same information set.

Theme 3. Monetary policy, financial markets and credit

New projects

1. Quantitative easing and global commercial real estate price spillovers
Bing Zhu (Technical University Munich), Dorinth van Dijk (DNB), Dennis Bonam (DNB, VU Amsterdam), Gavin Goy (DNB)

The effectiveness of unconventional monetary policies (UMPs) and their international spillovers to global asset prices and capital flows have dominated policy discussions. This paper is the first to document the effect of UMP on global commercial real estate (CRE) markets. Even though the size of CRE as asset class is substantial, the subject has received very limited interest in research studying the effect of monetary policy. We empirically find that a domestic UMP significantly impacts US CRE pricing through credit supply. We additionally document persistent price effects on foreign non-US CRE markets. This effect largely stems from global CRE market spillovers. In fact, global CRE market spillovers are found to amplify the original domestic UMP effect on US CRE prices. We aim to enrich our empirical findings with a two-country DSGE-model that includes CRE pricing.

2. Beyond financing: Effects of changes in bank relationships on client-firms
Steven Poelhekke (VU Amsterdam), Vadym Volosovych (Erasmus University Rotterdam), and Razvan Vlahu (DNB)

Using an extensive dataset of firm-bank relationships and ownership information for 23 European countries over 2008-2015, we explore firm and bank heterogeneity and study the effects of changing banks on firm outcomes. Our paper points to the information provision service and other synergies offered by banks, extending beyond the traditional effects on investment and financing. Importantly, these effects are particularly pronounced for financially-constrained firms.

Continued projects

1. Pass-through of banks' lending and deposit rates in a changing interest rate environment
Jan Kakes (DNB), Andra Smadu (DNB, University of Groningen) and Anna Samarina (DNB)

We study the pass-through of monetary policy rates – and market interest rates more generally – to banks' deposit and lending rates in the euro area. Particularly for retail deposits, this pass-through was limited in the negative interest rate environment because of the zero lower bound (ZLB). We aim to identify and date changes in banks' rate setting policies, using panel threshold and time-varying regressions. In addition, we investigate to what extent banks have passed on the costs of the ZLB for deposits by boosting their lending rates. Finally, a relevant question is to examine if banks reversed their rate setting behavior when policy interest rates moved back into positive territory in 2022.

2. Macroeconomic implications of price and liability dollarization
Daniela Hauser (Bank of Canada) and Kostas Mavromatis (DNB, University of Amsterdam)

Dollarization is a key feature of many emerging market economies, affecting their vulnerability to currency fluctuations as well as to foreign shocks. This paper develops a small open economy with endogenous dollarization in goods and financial markets.
Domestic firms can price their goods in both the domestic currency as well as in dollars. At the same time, local governments can issue debt in both currencies. Our model suggests that dollarization affects the economy's dynamics to relevant shocks and gives rise to an additional trade-off between stabilization and the degree of dollarization.

3. Local supply effects and the impact of QE: the Eurosystem's corporate sector purchase programme
Casper de Haes (University of Amsterdam), Tom Hudepohl (European Central Bank) and Jan Kakes (DNB)

We study the impact of the corporate sector purchase programme (CSPP) on market prices through the lens of a preferred habitat investor. Using individual bond data, we investigate the presence of a so-called local supply effect, which means that yields of bonds that are eligible under the CSPP, or have characteristics that are similar to eligible bonds, respond more to the Eurosystem's asset purchases than other securities. Establishing a local supply effect helps to understand how asset purchase programmes affect financial markets. Moreover, the presence of a local supply effect provides insight into the scope for tilting asset purchases towards issuers with specific characteristics, such as green (climate-friendly) relative to brown firms.

4. Cross-country evidence of the natural yield curve
Gavin Goy (DNB) and Yuto Iwasaki (Bank of Japan)

The asset pricing literature usually describes yield curve dynamics by a small set of factors. Using data for the Euro area, Japan, the United Kingdom and the United States we provide country-level analysis evidence for treating the first two factors, namely level and slope, as non-stationary factors, thus supporting the existence of a time-varying natural yield curve. We then estimate the natural yield curves of these models by modelling the global component using a VAR with common trends.

5. Integration of funding and market liquidity in real estate
Dorinth van Dijk (DNB), Yumei Wang (University of Amsterdam) and Marc Francke (University of Amsterdam)

In commercial real estate markets, market liquidity tends to commove stronger than returns. As trading requires capital, we hypothesize that part of the strong co-movements in market liquidity are determined by changes in capital markets, i.e. funding liquidity.
Because capital markets, as opposed to space markets, are mostly nationally or even internationally integrated, this provides a reasonable explanation why commercial real estate market liquidity is so strongly integrated across markets. By using and constructing several measures for funding liquidity, we provide robust evidence that changes in funding liquidity drive common changes in market liquidity.

6. Managing the transition to central bank digital currency
Maria Sole Pagliari (DNB), Katrin Assenmacher (European Central Bank), Massimo Ferrari Minesso (European Central Bank) and Arnaud Mehl (European Central Bank)

We develop a two-country DSGE model with financial frictions to study the transition from a steady-state without CBDC to one in which the home country issues a CBDC. The CBDC provides households with a liquid, convenient and storage-cost-free means of payments which reduces the market power of banks on deposits. In the steady-states CBDC unambiguously improves welfare without disintermediating the banking sector. But macroeconomic volatility in the transition period to the new steady-state increases for plausible values of the latter. Demand for CBDC and money overshoot, thereby crowding out bank deposits and leading to initial declines in investment, consumption and output. We use non-linear solution methods with occasionally binding constraints to explore how alternative policies reduce volatility in the transition, contrasting the effects of restrictions on non-residents, binding caps, tiered remuneration and central bank asset purchases. Binding caps reduce disintermediation and output losses in the transition most effectively, with an optimal level of around 40% of steady-state CBDC demand.

Theme 4. Financial stability and financial regulation

New projects

1. Choosing pension fund investment consultants
Aleksandar Andonov (University of Amsterdam), Matteo Bonetti (DNB), Irina Stefanescu (Board of Governors of the Federal Reserve System)

Pension funds rely on consultants for asset allocation, manager selection, and benchmarking decisions, and have expanded their consultant base by hiring more specialized consultants in alternative assets. We examine the selection and termination of investment consultants. The replacement of general consultants stems from prior relative underperformance, while target asset allocation gaps and board composition influence the hiring of specialized consultants. Replacing general consultants is followed by changes in asset allocation but no significant improvements in pension fund performance. Specialized consultants enable pension funds to scale up the number of investments in private markets as pension funds are more likely to invest in private funds from the consultants' networks. However, specialized consultants do not provide access to rationed private funds, and relying on their services also does not improve performance. The growing concentration of consultants and their influence on asset manager selection by their clients may increase pension fund flow correlations.

2. Pension fund equity performance: Herding does not payoff
Matteo Bonetti (DNB)

I use proprietary data on equity holdings to show that Dutch pension funds herd in individual securities. I introduce a pension fund-level measure of herding that identifies the extent to which a pension fund follows other pension funds into and out of the same securities over time. I show that pension funds that herd underperform pension funds that do not herd by 1.32% on an annual basis that indicates herding has a negative impact on performance. Small pension funds and pension funds that trade less frequently are more likely to herd. These pension funds herd consistently over time, hence they appear to make this decision strategically out of reputational concerns.

3. Risk management policies of central clearing counterparties
Branka Matyska (DNB)

There is considerable debate over the systemic benefits and costs risk-management policies of clearinghouses (CCP). This paper explores the effect of mandatory central clearing on counterparty risk and risk-shifting and risk-mitigating incentives of clearing members. To examine the effect of central clearing on counterparty default risk, our model features a CCP that interposes between protection buyers and sellers. First, does the introduction of a CCP in a derivative market which was previously bilaterally cleared reduce counterparty default risk? Second, do initial margins and default fund contributions mitigate or amplify counterparty risk? We aim to answer these questions theoretically and empirically. We empirically test risk-shifting or risk-mitigating incentives of CCPs and clearing members by studying the relation between protection bought and sold and idiosyncratic risk.

4. How big banks evaluate risk? Evidence from the capital purchase program
Branka Matyska (DNB)

In the 2008 financial crisis aftermath there have been policy debate how to evaluate market risk on bank balance sheet. To help answer this question, we present a model where banks use subjective expectation and probability weighting to compute balance sheet losses. Then, we estimate the probability weighting function from the asset pricing equation of the largest banks that were recapitalized under the Capital Purchase Program. When facing rare events, do banks demonstrate the coexistence of overweighting and underweighting of tail losses? We further test if overweighting and underweighting is linked to funding liquidity, prior gains and losses, market risk, investor sentiment, default probabilities, and policy uncertainty.

5. The impact of pandemic-driven remote work on house prices
Lu Zhang (DNB), Cindy Biesenbeek (DNB) and Dorinth van Dijk (DNB)

The Covid-19 pandemic has had a profound impact on housing preferences. The '*dash for space*' as a result of remote work first induced housing demand and has subsequently supported prices since summer 2022. A handful of recent studies show that the shift in preferences accounts for a significant share of house price growth during the pandemic. In this study, we examine to what extent pandemic-induced remote work has affected house prices using both the DNB Household Survey and administrative data on transactions in the Dutch housing market. To the best of our knowledge, this is the first study to explore homebuyers' occupations to measure the extent of remote work and its impact on transaction prices.

6. Extreme weather events and insurance costs
Stefany Burbano (DNB, Maastricht University), Rogier Holtermans (University of Guelph) and Nils Kok (Maastricht University)

Extreme weather events pose a significant concern for the real estate sector shaping property prices but also a myriad of costs associated with this market, with insurance playing a pivotal role. Insurance premiums have been increasing, a trend that appears to be correlated with the increasing frequency and severity of climate shocks. The behavior of insurance pricing significantly impacts property expenses and the accessibility of mortgages and commercial loans for households and investors. This paper aims to study the extent to which natural disasters shocks influence the behavior of insurance premium, and how these changes in insurance costs contribute to fluctuations in property prices.

Continued projects

1. Cross-border banking, intragroup exposures and bank risk-taking
Eric Cuijpers (DNB, University of Amsterdam) and Razvan Vlahu (DNB)

European banking groups face significant restrictions when moving funds across borders, most notably in intragroup exposure limits that impair the ability to transfer funds from entities in one jurisdiction to those in another. Regulators intend to loosen (or abolish entirely) restrictions on the cross-border flow of funds within banking groups. We study banking groups' risk-taking behavior under alternative intragroup exposure limits. Specifically, we focus on the behavior of banking groups with a large parent in the home country and a small(er) subsidiary in the host country when the banking group falls under supranational supervision but complies with national regulations of intragroup exposures. We show that banks have incentives to onshore risky investments to the home country due to the structure of intragroup support required under supranational supervision. This effect is more pronounced when foreign subsidiaries are larger.

2. The preferential treatment of sovereign debt
Eric Cuijpers (DNB), Maurice Bun (DNB, University of Amsterdam) and Massimo Giuliodori (University of Amsterdam)

Large holdings of (home) sovereign debt by banks have negative effects on real output and financial stability. The literature has found risk shifting, carry trade behavior and moral suasion as causes of these large (home) holdings. This paper contributes by investigating to what extent the preferential regulatory treatment, i.e. zero risk weight, is a contributing factor in the emergence of large (home) sovereign portfolios. Using a novel dataset of EU bank's sovereign portfolios broken down by member state and regulatory approach (SA versus IRB), we identify to what extent the zero risk weight facilitates the mechanisms identified by the literature. If zero risk weights facilitate banks' large holdings of (home) sovereign debt, the policy implication is that risk shifting, moral suasion and carry trade behavior can be eliminated by adjusting the preferential treatment of sovereign debt.

3. Central bank digital currencies and financial stability: Market discipline in the era of digital money
Razvan Vlahu (DNB)

Central Bank Digital Currency (CBDC) is a highly debated topic. Various central banks are currently considering whether and how to introduce this new type of fiat money. The introduction of a CBDC raises questions relating to, among others, the optimal design and potential consequences for financial stability. Some argue that under stress conditions, the presence of CBDC can increase the likelihood of bank runs. Concerns about a bank's health might encourage depositors to convert their money into CBDCs (since this digital money is backed up by sovereign credibility and thus risk-free). The financial stability implications of a CBDC would depend on depositors' behavior, which also depends on the specific attributes of the CBDC. This research project's main goal is to gain insights into the implications of the adoption of CBDC on financial stability. We answer the following questions: (1) How does the presence of CBDCs alter the nature of bank runs?, and (2) To what extent does the impact on bank deposits depend on the design features of a CBDC (such as interest rates and limits on convertibility)?

4. The volatility of capital flows in emerging markets: measures and determinants
Maria Sole Pagliari (DNB) and Swarnali Ahmed Hannan (IMF)

Capital flow volatility is a concern for macroeconomic and financial stability. Nonetheless, literature is scarce in this topic. Our paper sheds light on this issue along two dimensions. First, using quarterly data for 33 emerging markets and developing economies, we introduce new estimates of volatility for total capital flows and key categories, based on the residuals of ARIMA models. We show that, compared to the commonly used standard deviation and the - less common - GARCH measures, our proposed approach fares at least as good as and, in some cases, better than the others in picking up sharp rises during episodes of heightened global risk aversion. Second, we perform panel regressions to understand the determinants of volatility using both ARIMA and standard deviation measures of volatility. While there are variations across different categories of capital flows, generally speaking we identify three main drivers: the US interest rates, global risk aversion, and domestic real GDP. Overall, our findings call for a richer set of volatility estimates, beyond standard deviation, and also show that the determinants of capital flow volatility could vary depending on the measurement approach and the category of flow under analysis.

Theme 5. Trust

New projects

1. Central bank capital and shareholder relationship
Matteo Bonetti (DNB), Dirk Broeders (European Central Bank), Damiaan Chen (DNB) and Daniel Dimitrov(DNB)

In pursuing its mandated objectives, a central bank accepts financial risks through its monetary policy operations. These risks can in some cases deplete its buffers and require capital transfers from the shareholder. At the same time, independence and credibility are essential for ensuring effective implementation of monetary policy. We thus examine the concept of central bank equity as a form of risk-sharing arrangement with the shareholder, typically the government. We take an option pricing perspective in which the central bank holds a recapitalization option underwritten by the shareholder and to be exercised in bad states of the world. In return, the central bank is obliged to pay out dividends in good states of the world. We examine the trade-offs that the two options offer and look for the optimal recapitalization and dividend arrangement between the two counterparties.

Continued projects

1. The effect of online news articles on trust in the payment system
Marie-Claire Broekhoff (DNB)

While there is a growing literature on the effect of news articles in finance, research on the effect of news articles on trust in payment systems is yet to develop. Digitalisation increases people's access to information and news. Therefore we examine the effects of online news articles on consumers' trust in the payment system in the Netherlands. The articles can entail numerous topics related to, for example, (central) banks or political news, that could have either a positive or negative effect on trust. We use a machine-learning based text mining technique and a sentiment indicator and combine this with a daily payment diary data set, that includes data on trust. This could create new insights into what affects consumers' trust in the payment system.

2. Trust in financial institutions and central banks
Anna Samarina (DNB) and Carin van der Cruijsen (DNB)

Trust in financial institutions is key because low trust may undermine financial stability and damage the financial services industry, which is detrimental for the well-functioning of the economy. Trust in central banks is also important. High trust comes with better-anchored consumer inflation expectations around the central bank's price stability objective, which makes it easier to reach this objective. We discuss trust in financial institutions and trust in central banks and summarize research on their drivers and impact.

Theme 6. Sustainability

New projects

1. The regulation of entry and the labor Market
Andrea Colciago (DNB, University of Milano Bicocca) and Marco Membretti (University of Pavia)

We provide evidence showing that a tightening in entry regulation depresses the job creation of new firms and boosts that of incumbents, resulting in a persistent rise in employment concentration at large firms. In the short run, the reallocation process is expansionary. In the long run, missing job creation from new firms leads to a higher unemployment rate. To rationalize these empirical findings, we propose a model that integrates the theory of firm boundaries, through diminishing marginal returns, into a framework with search and matching frictions in the labor market.

2. Competition, returns, and inequality
Andrea Colciago (DNB, University of Milano Bicocca), Timo Haber (DNB) and Rajssa Mechelli (UK Competition Authority)

In the last few decades, the US economy suffered a surge in income inequality. Additionally, several indicators suggest it is no longer as competitive as it used to be. Indeed, since the 80s, estimated price markups and the profit share of income displayed upward trends, while the labour share and the firm entry rate decreased. We develop a general equilibrium model with household heterogeneity and endogenous markups consistent with these facts. We quantify the contribution of lower competition and higher markups on the evolution of wealth returns and income and wealth inequality since the 80s.

3. Keeping up with the Jansens: Causal peer effects on household spending, beliefs and happiness
Bernardo Candia (University of California Berkeley), Dimitris Georgarakos (European Central Bank), Yuriy Gorodnichenko (University of California Berkeley), Olivier Coibion (University of Texas Austin) and Maarten van Rooij (DNB)

This project aims to better understand the role of the financial situation of peers for household decisions. Specifically, we investigate the role of perceived relative income and debt standings for views on inequality, for support of redistribution policies, for the participation in social activities and for happiness. Also, we investigate keeping up with the Jones behavior in that we look into the role of peer income for spending decisions (which inter alia provides information on the empirical support of macro models of external habit formation).

4. Face-to-face interview versus web survey mode effects for personal and general financial information
Wändi Bruine de Bruin (University of Southern California), Wilbert van

der Klaauw (Federal Reserve Bank of New York), Maarten van Rooij (DNB), Federica Teppa (DNB) and Klaas de Vos (Centerdata)

There is a lack of systematic comparative studies on the effect of interview mode on responses to economic and, in particular, financial questions involving web surveys. We study the impact of interview mode on responses to survey questions on general financial information as well as about the personal financial situation for three dimensions of data quality (item non-responses, rounding, and accuracy). This investigation aims to provide information on the comparative advantages and disadvantages of using face-to-face interviews vis-à-vis web surveys.

5. The welfare of the elderly in the Netherlands: An empirical assessment of their financial conditions
Federica Teppa (DNB and Netspar)

This projects aims to shed light on the heterogeneity observed among the elderly population in The Netherlands, particularly when it comes to their financial conditions and needs. Using administrative data from the CBS, we answer two main research questions. First, we study whether the wealth of the elderly is uniformly distributed along the age dimension. Second, we investigate whether the wealth of the elderly is composed by an adequate mix of liquid and illiquid assets, or rather whether some fraction of the elderly is facing an illiquidity trap in their wealth composition which will reduce their ability to cope with (un)expected adverse shocks that require cash on hand. The answers to those questions will help identify the presence of (potentially) vulnerable groups among the elderly with respect to their financial situation. They will also provide some unique insights to the policy makers into the finances of the elderly population to better understand their needs and formulate more tailored-made social measures.

6. Climate stress testing with ambiguity
Daniel Dimitrov (DNB) and Sweder van Wijnbergen (DNB, University of Amsterdam)

Climate change without a doubt presents the most significant long term risk to financial markets. Its proper quantification is thus of key importance for policymakers. Yet, the exact relation between financial shocks and climate change are notoriously difficult to pinpoint. First of all, by design climate models are not probabilistic, and cannot inform us of the chances with which different physical scenarios are likely to materialize. Second, there is wide uncertainty in how policymakers globally will react to each potential scenario. Third, there is still significant lack of understanding of the extent to which potential climate shocks (physical and policy related) are currently priced into asset risk premia. As a result, climate risk in asset pricing is characterized by ambiguity, in which the relevant probability distributions of asset returns are not known with certainty, or in a more extreme sense by deep (Knightian) uncertainty, in which probabilities

are unknowable. We thus offer to extend current climate stress testing approaches by embedding asset pricing ambiguity. Ambiguity will work both through the asset pricing kernel, affecting the estimation of risk premia; and through the risk preferences and ambiguity aversion of a policymaker who needs to regulate the optimal risk absorption capacity of the risk holder.

7. Measuring retirement savings adequacy: Towards a comprehensive measure

Cindy Biesenbeek (DNB), Jim Been (Leiden University), Marike Knoef (Tilburg University) and Koen Caminada (Leiden University)

Although the Dutch pension system is highly ranked on adequacy, there is an increasing concern that vulnerable groups face a substantial income loss after retirement. We use a methodology developed by Knoef and coauthors to measure expected retirement savings. Our contribution to the literature is that we use administrative data for the full Dutch population, while previous studies rely on survey data. This allows us to zoom in to specific groups, such as employees with a demanding job or divorced individuals. Moreover, we exploit new data on voluntarily retirement savings, occupational pension funds and savings within firms to get a more comprehensive measure of retirement savings adequacy.

Continued projects

1. Questioning the causality of green bonds
Martijn Boermans (DNB) and Eline Jacobs (Stockholm House of Finance)

To facilitate the low-carbon transition, firms borrow on financial markets to invest in sustainability projects. This study analyses the impact of green bonds on environmental performance. A key question concerns the additionality of the issuance green bond as the causal link between green bonds and environmental performance has not decisively established. Our results suggest there is no direct (causal) relationship between green bonds issuances and corporate environmental performance, including carbon emission reductions. However, our findings highlight important moderating factors that may enable green financing to affect firm outcomes to deliver on their green bond promises.

2. Corporate climate related disclosures and green bond home bias
Anouk Levels (DNB) and Claudia Lambert (European Central Bank)

The benefits of international portfolio diversification have been widely recognized in finance theory. Yet, compared to what is deemed optimal, investors tend to allocate a disproportionally large share of their wealth to domestic financial assets. This empirical phenomenon,

called home bias, has been extensively researched but remains an important empirical puzzle in financial markets to date. A steadily growing literature has proposed several partly competing and partly complementary explanations for investors' home bias, including information asymmetries. Interestingly, the integration of the nascent but fast growing European green bond market and its drivers remain largely unexplored, despite its potential relevance for financing the EU's transition to a green economy. We exploit the nascent state of the euro area green bond market to assess how euro area companies' climate related disclosures affect the level of home bias of the green bonds that they issue. Our findings may inform EU policy development geared towards green capital market integration.

3. Climate risk disclosure quality and costs of debt
Anouk Levels (DNB) and Rex Wang Renjie (VU Amsterdam, Tinbergen Institute)

In response to the increasing demand for climate-related financial disclosures, many countries start to mandate listed or large firms to explicitly report their climate risks and initiatives. Yet, despite some evidence in the equity markets, there is little evidence on how climate risk disclosure quality affects firms' cost of debt. Our study aims to fill this gap by studying the credit market effects of EU firms' climate disclosures. Specifically, we test whether high-quality climate disclosure reduce firms' financing costs for both green and conventional bonds. We further study whether the change in costs of debt is driven by reduced home-bias.

4. Carbon taxation, reallocation and productivity
Boris Chafwehe (European Commission), Andrea Colciago (DNB, University of Milano Bicocca) and Romanos Priftis (European Central Bank)

We develop a New Keynesian, multisector, industry dynamics model. Electricity is produced with both a fossil resource and a renewable. Goods and services are produced with technologies characterized by different labor intensity. In the latter two sectors firms are heterogeneous in terms of productivity and there are endogenous entry and exit dynamics. Nominal wages are sticky, such that monetary policy has real effects. We use carbon taxation to model a transition aimed at meeting the emission targets set by the European commission, and evaluate productivity and reallocation effects.

5. Modelling macroeconomic time series with multivariate Bayesian forests *Aishameriane Schmidt (DNB, Erasmus University Rotterdam, Tinbergen Institute), Andreas Pick (Erasmus University Rotterdam, Tinbergen Institute) and Andrea Naghi (Erasmus University Rotterdam, Tinbergen Institute)*

We develop a new non-parametric model that accommodates non-linearities that can be present in the joint dynamics of macroeconomic time series. Specifically, we propose a multivariate heteroskedastic Bayesian regression tree (BART) model. Our new model is flexible and

scalable as the traditional BART model without the restriction of a constant parametric variance specification. Moreover, the multivariate framework allows to capture correlations among the time series as well as dependencies in the error structure.

6. The effect of labour market participation and education in credit access and approval during the covid-19 pandemic in Europe
Evangelos Charalambakis (Bank of Greece), Federica Teppa (DNB, Netspar) and Athanasios Tsiortas (European Central Bank)

We adopt the decomposition methodology à la Oaxaca (1973) and Blinder (1973) to identify and estimate the separate contributions of differences in parameters of (and in) individual demographic characteristics when accounting for mean differences in access to credit markets and credit approval between the employed and the unemployed, as well as between the high educated and the low educated. The empirical analysis is based on novel microdata from the new ECB's Consumer Expectations Survey, a fully harmonized online survey measuring consumer expectations and behavior, covering the period April 2020 to December 2021.

7. Consumption inequality and the green transition
Guido Ascari (DNB, University of Pavia), Andrea Colciago (DNB, University of Milano Bicocca), Timo Haber (DNB) and Stefan Wöhrmüller (DNB)

We study consumption inequality dynamics induced by the green transition. We assess the impact of either green technological change, carbon taxes, or both through the lens of a heterogeneous-agent incomplete-markets model. The model features a realistic production structure of brown and green energy as well as non-homothetic preferences over energy and non-energy goods.

8. Funding the fittest? The pricing of climate transition risk in the corporate bond market
Martijn Boermans (DNB), Maurice Bun (DNB, University of Amsterdam), Yasmine van der Straten (University of Amsterdam, Tinbergen Institute)

We study whether climate transition risk is priced in corporate bond markets. We assess whether corporate bond investors value companies' efforts to mitigate climate change, by innovating in the green space. By combining global firm-level data on greenhouse emissions and green patents with bond-level holdings data, we provide evidence of a positive transition risk premium, which is significantly lower for emission intensive companies that engage in green innovation. The combined effect of emission intensity and green innovation on yield spreads is driven by European investors, specifically institutional investors. Overall, our results indicate that

investors care about whether companies are `fit' for the green transition.

9. The CO2 content of TLTRO III and its greening

Maria Sole Pagliari (DNB), Chiara Colesanti Senni (University of Zurich & CEPS) and Jens van 't Klooster (University of Amsterdam)

This paper investigates the climate impact of central bank refinancing operations, with a focus the ECB's TLTRO III program. We find that the emissions content of bank loans granted over the TLTRO III reference period amount to 8% of overall Euro Area 2019 emissions and that more than 80% of total cumulated loans issued in the reference period was directed towards polluting companies. We then investigate the effectiveness of a green credit easing scheme via a general equilibrium model. Our findings are twofold: first, the central bank policy can increase the costs for lending to polluting companies, thus re-directing loans to less-polluting firms; second, the financial stability implications of such a policy should be carefully considered. Finally, we address legal and operational challenges to such a policy by outlining three alternative ways of implementing a "green" TLTRO programme.

10. A green TLTRO in the euro area

Maria Sole Pagliari (DNB) and Chiara Colesanti Senni (University of Zurich & CEPS)

We develop a closed economy NK DSGE model with financial frictions to assess the impact of a green credit easing scheme implemented by the central bank.

Theme 7. Payments and market infrastructures

New projects

1. The stability of stablecoins: Are these coins stable or is the stability just a flip   of the coin?
Segun Bewaji (Payments Canada), Ajit Desai (Bank of Canada), Aayush Gugnani (Payments Canada), Tarush Gupta (Payments Canada), Ronald Heijmans (DNB), Anneke Kosse (BIS), Anita Smirnova (Payments Canada) and Ellen van der Woerd (DNB)

This paper identifies and investigates the features, like calendar effects, trading activity or central bank interest rate changes, that contribute to the volatility of asset-backed stablecoins. Given the availability of high-frequency stablecoin price and trading data, we employ advanced machine learning (ML) models. First, our objective is to assess whether advanced ML models can identify relevant features that may not be easily obtained using traditional methods. Next, we compare the volatility of stablecoins with that of established crypto-assets to explore differences. Lastly, we treat stablecoins like a "deposit-taking bank" and subject their underlying assets to stress tests through Monte Carlo simulations, in accordance with the Basel III requirements. With these stress tests we investigate extreme but plausible "black swan" events that could cause the stablecoin to deviate from its peg to the fiat currency like we saw with Terra USD. To perform these studies, we use granular price time series data (minute-by-minute) of 15 stablecoins and 6 crypto-assets obtained from Crypto Compare, ranging from 2019-2023.

2. Predatory pricing in payment markets
Vera Lubbersen (DNB)

The two largest card schemes of the world are also the most profitable companies in the world. Despite increasing regulatory effort, they both still have a net profit margin between 40-55 percent. Past models on payment card scheme competition focused largely on the interchange fee, which is now regulated in many jurisdictions. However, this paper argues that a form of predatory pricing, with a fixed subsidy to issuing banks could also play an important role which has been largely neglected. In fact, 'client incentives' constitute almost 70 percent of net income from operating activities in their consolidated statement of cashflow. The model shows that by such a form of predatory pricing, payment card networks can successfully deny competitors to enter the market. It shows the conditions under which a card scheme uses such a form of predatory pricing and how it affects social welfare.

3. Gender gaps in the digital payment world
Marie-Claire Broekhoff (DNB) and Carin van der Cruijsen (DNB)

Access to payment services is essential for everyone to fully participate in society. Unfortunately, the increasing digitization of the payment world is accompanied by a decrease in accessibility for certain groups of people. Our research focuses on answering the question of whether there are gender gaps in the use of the digital payment world. We examine payment behaviour, the use of online and mobile banking and knowledge and experience with different types of frauds. We also investigate whether gender gaps vary between generations. Then, we attempt to explain the gender gaps. We consider a wide range of potential influencing factors, such as differences in financial literacy, risk aversion, and trust in banks. Last, we identify areas of future research to learn more about the gender gap in payments.

4. The effect of online news articles on trust in the payment system
Marie-Claire Broekhoff (DNB)

While there is a growing literature on the effect of news articles in finance, research on the effect of news articles on trust in payment systems is yet to develop. Digitalisation increases people's access to information and news. Therefore, we examine the effects of online news articles on consumers' trust in the payment system in the Netherlands. The articles can entail numerous topics related to, for example, (central) banks or political news, that could have either a positive or negative effect on trust. We use a machine-learning based text mining technique and a sentiment indicator and combine this with a daily payment diary data set, that includes data on trust. This could create new insights into what affects consumers' trust in the payment system.

5. The relation between decreasing number of ATMs and bank branches, trust in the payment system and consumer payment behaviour
Marie-Claire Broekhoff (DNB) and Carin van der Cruijsen (DNB)

In this paper, we examine whether a decreasing number of ATMs and bank locations affect trust and payment behaviour in different regions/municipalities. Every year data are collected on the locations of ATMs and bank branches in the Netherlands. Using this location data, combined with data from the Dutch Survey on Consumer Payments (SCP), we estimate a spatial regression model. We assume that there is spatial dependence between the level of trust (dependent variable)

and the observations that include information on the number of ATMs and bank location, and the average distance to the location within a region. Additionally, we examine payment behaviour in each region, to understand what effects the number of bank branches and ATMs have, with a focus on cash usage.

6. Liquidity around the world part 2
Payment system liquidity analysis group under CPMI including Ellen van der Woerd (DNB)

This paper investigates how banks manage their liquidity during the day across different Large Value Payments Systems (LVPS). It focusses on the behaviour of participants and tries to identify drivers of heterogenous behaviour in payment systems. More specifically we calculate the so-called reaction function, which is defined as the value of outgoing payments at a specific time interval as a function of incoming payments, daily net payments, available liquidity and other participant and system specific control variables, such as the overnight rate. This paper is a worldwide collaboration, which leads to a unique dataset of participants in different LVPS around the world. This enables us to compare different characteristics of these systems.

7. From cash to contactless: financial and digital literacy in the field of payments
Carin van der Cruijsen (DNB) and Maarten van Rooij (DNB)

The world of payments is becoming increasingly digital, presenting new challenges for various demographic groups. While extensive research has been conducted on financial literacy, there is a distinct lack of focus on the act of payment itself. Our initiative seeks to establish standards for knowledge related to payment methods and digital payment skills. Through a comprehensive consumer survey, we aim to assess this knowledge and these digital skills, examining their relationships with a wide array of personal characteristics. Our research aims to pinpoint areas where knowledge and skills can be enhanced, providing valuable insights for policymakers that want to enhance financial inclusion.

8. Generational and gender differences in expectations of financial firms: what really matters for whom and should regulators care?
Nicole Jonker (DNB) and Hans Brits (DNB)

According to empirical research, consumers have a wide range of expectations from financial firms. However, it is not always immediately clear why certain incidents or firm policies affect their interests and lead to discontent, whereas others do not

or to a much smaller extent. In this study we will make an attempt to gain more insight to what really matters for consumers, and how this differs from one generation to the other. We will distinguish between consumers' personal financial interests (e.g. fees paid for payment packages or insurance policies, interests on savings, interest on loans, coverage insurance policy, etc.), consumers' personal non-financial interests (e.g. accessibility, location branches, customer care service, digitalisation, privacy, security, transparency etc.), and the importance they attach to financial firms' contribution to social goals (e.g. financial stability, financial inclusion, digital inclusion, national and/or European sovereignty, AML-CFT, facilitating the green transition, etc.). In the study, we will pay special attention to differences across generations and gender, as they may have different needs or give priorities to different social goals.

Continued projects

1. A liquidity 'black hole' in a large value payment system: what is the impact of a failing participant on its environment and does time matter?
Ronald Heijmans (DNB) and Ellen van der Woerd (DNB)

This paper identifies the impact of a failing participant in a large value payment system (TARGET2). First, we determine, at individual bank level, the time interval between two payments to be considered exceptionally long (an outage or an outlier). To capture the intraday pattern we identify this interval at each hour during the daylight opening hours of TARGET2. Second, we measure the impact over time of this potential outage to other participants in terms of the number of participants hit and the amount of payments not send in line with Heijmans and Wendt (2019). In order to assess the impact we link the liquidity impact of participants to a measure of the size of the bank (e.g. the reserve requirement).

2. Paper or polymer? A fungal examination on banknotes
Katja Coeleveld (DNB), Wieske Ebben (DNB), Michel Justus (DNB), Simon Mastbergen (UMC Utrecht) and Schimmel onderzoekslaboratorium (UMC Utrecht).

Banknotes are exchanged by people in almost all communities on a daily basis, due to a variety in a person's health and hygienic standards microorganisms can spread on the surfaces of banknotes. The spread of microorganisms can also occur in the storage of banknotes under varying environmental conditions. One of the microorganisms are Fungi. Not only are fungi capable of destroying the paper currency they are also a threat to human health. In this study we are going to examine

the transmission, survival and toxicity of fungi on banknotes. We are also going to look into if there is a difference in the transmission, survival and toxicity of fungi on paper or polymer based banknotes.

3. Attitudes and preferences of merchants with respect to CBDC
Nicole Jonker (DNB), Ria Roerink (DNB) and Igo Boerrigter (DNB)

Cash usage is declining and policymakers are discussing the introduction of a digital alternative: Central Bank Digital Currency (CBDC). They want to know the factors that will contribute to the adoption of CBDC and how CBDC can be designed best to meet the preferences and needs of consumers and merchants. Thus far, little attention has been paid to merchants and businesses. Goal of this research is to fill this gap, and to learn about merchant attitudes towards CBDC, and the factors influencing potential adoption. The study will gain deeper insights into the perceived and possible consequences of design features for different types of businesses, depending on their size (small, large), their scope (national, international) and type (online, physical), possible concerns and foreseen bottlenecks by merchants.

4.Cross-selling bank products via the payment account
Wilko Bolt (DNB, VU Amsterdam) and Nicole Jonker (DNB)

Dutch banks were not able to cover the cost of offering retail payment services in the Netherlands in 2021. It used to be the case that other bank segments cross-subsidized payments, because of the cross-selling possibilities. However, due to increased competition in the market for bank products, cross-selling may become harder for banks. In this study, we will examine the importance of the payment account as a cross-selling channel for banks overtime, and the factors affecting it. We will pay special attention to the impact of the interest rate on consumers' balances on payment accounts and savings accounts and trust in the providers of financial services. Among other things, we will use information from DNB Household Survey (DHS). Our study will contribute to the understanding of the role of payments account for banks for cross-selling other bank products.

5. Competition between private and public payment platforms
Vera Lubbersen (DNB)

One of the key issues in balancing public and private interests in money and payments concerns competition between

payment service providers. Two-sided market structures, network effects, consumer habits and economies of scale and scope may lead to 'winner- takes-most' type of dynamics. The decline in cash usage poses the question what happens to payment pricing and social welfare when there is no longer a public alternative. This paper analyses welfare effects that arise when a public payment platform competes with a private payment platform compared to a monopolistic market structure. Specifically, under what conditions would it be more efficient to offer a public platform? Under these conditions, what role is left for private parties and what type of optimal fee structure will be implemented?

6. Privacy in payments
Wilko Bolt (DNB, VU Amsterdam) and Maarten van Oordt (VU Amsterdam)

The issue of privacy is attracting more and more attention in payments. Preserving one's privacy in payments is increasingly difficult in a rapidly digitalizing world. Privacy in payments is a feature inherent to the use of cash, but transactional usage of cash is in decline. Garratt and Van Oordt (2021) provide a theoretic model unveiling the potential adverse economic consequences of foregoing privacy in payments. Their analysis stresses a public good aspect of privacy: my own information and own choices may also reveal something about the behaviour of other individuals. Others have highlighted the role of personal privacy attitudes (Kahn, 2018). The idea of this paper is to test empirically the role of privacy attitudes for payment behaviour by combining recent survey datasets.