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This newsletter describes the research activities and output of the Research Division at Sveriges Riksbank in 2017.

Staff at the Research Division, 2017

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Tobias Broer, visiting scholar
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Tor Jacobson, research economist
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David Vestin, research economist
Mattias Villani, visiting scholar
Erik von Schedvin, research economist
Karl Walentin, research economist
Andreas Westermark, research economist
Xin Zhang, research economist

Reflections by the head of research

It's the end of another year, and time to pass around our exciting outlet Research News! As for little me, I'm back at the Riksbank after an incredibly interesting and rewarding year as resident scholar at the IMF in Washington D.C. My year at the IMF's research department was truly fantastic in many ways. Even so, I will not dwell on that, here it suffices to say that the IMF as an institution studies, implements and makes policy recommendations for a wide variety of issues ranging from fiscal, monetary and financial stability policies to computation of balance of payment statistics. It was very inspiring and valuable for me to follow this work more closely and interact with IMF economists.

Still, it is very inspiring to be back at the Riksbank and Stockholm again, not the least since there are so many interesting economic issues facing Sweden currently. Sweden has over the last 10 years experienced a large runup in household indebtedness and the FI (our Financial Supervisory Authority) is contemplating various policy options to strengthen financial resilience. When it comes to monetary policy, measures of core inflation has been rising since 2014 and this, together with normalization of policy rates abroad, raises interesting discussions about policy normalization in Sweden. When it comes to fiscal policy, the interactions between monetary and fiscal policy deserves to be further studied. In a nutshell, the Swedish economy faces so many challenges that I'm thinking that the IMF could move to Stockholm for a year or two. They would have their hands full here. But as there are so many things happening in the big world outside the Shire (Sweden), the IMF probably won't show up in full force.

So we are left to do our best, and during the year that has passed, the Research Division has made important contributions to these and other important issues. And in case you, Dear Reader, are able to take some time and look through our Research News, I'm sure you will be impressed by the depth and breadth of our work. This year, our featured article is my paper with Mathias Trabandt on fiscal multipliers that has just been accepted for publication in the *Journal of Applied Econometrics*. In addition, the news features an exclusive interview with our visiting scholar Per Krusell focusing on his recent important research on labor supply.

With this, I'm over and out. I wish you a good read of our news, happy holidays and a productive and successful 2018!

Jesper Lindé

Interview with Per Krusell

Professor of Economics, Institute for International Economic Studies, Stockholm University

Q1. Per, you have been an academic advisor to the Riksbank since 2008 – what has led you to serve in such capacity for such a long time?

I really like the environment at the bank! In particular, the research department, where I spend my time, has a very nice and interesting group of people and I find it very stimulating to interact with them.

(continued on page 17)

Changes in the research staff

From August 1, 2017, **Jesper Lindé** is back as head of research for the Research Division. Before August he was a resident scholar at the International Monetary Fund (IMF) in Washington DC. In August 2017, **Marieke Bos** left the Research Division as a part-time research economist to return to her position at the Swedish House of Finance at the Stockholm School of Economics. **Peter Van Santen** left the research division to work in the applied research division in the Financial Stability Department. In May 2017, **Roberto Billi** left the research division to work in the applied research division of the monetary policy department. **Anna Shchekina** joined the division as a research assistant. She received her MS in Financial Mathematics from Uppsala University and had previously worked as a quantitative engineering intern at Itiviti Group.

Summary of featured article

The following is a summary of the article by Jesper Lindé titled “Should We Use Linearized Models to Calculate Fiscal Multipliers?” which is accepted for publication in the *Journal of Applied Econometrics*.

The magnitude of the fiscal spending multiplier is a classic subject in macroeconomics. To calculate the magnitude of the multiplier, economists typically employ a linearized version of their actual nonlinear model. Does linearizing the nonlinear model matter for the conclusions about the multiplier? In a recent paper with Mathias Trabandt, we document that this may be the case, especially in long-lived liquidity traps. When interest rates are expected to be constrained by the zero (or effective) lower bound for a protracted time period, the nonlinear solution suggests a notably smaller multiplier than the linearized solution of the same model.

The financial crisis and “Great Recession” have revived interest in the magnitude of the fiscal spending multiplier. A quickly growing literature suggests that the fiscal spending multiplier can be very large when nominal interest rates are expected to be constrained by the zero (or effective) lower bound (ZLB henceforth) for a prolonged period, see e.g. Eggertsson (2010), Davig and Leeper (2011), Christiano, Eichenbaum and Rebelo (2011), Woodford (2011), Coenen et al. (2012) and Leeper, Traum and Walker (2017). Erceg and Lindé (2014) show that in a long-lived liquidity trap fiscal stimulus can be self-financing. Conversely, the results of the above literature suggest that it is hard to reduce government debt in the short-run through aggressive government spending cuts in long-lived liquidity traps: fiscal consolidation can in fact be self-defeating in such a situation as demonstrated by Erceg and Lindé (2013).

Importantly, the bulk of the existing literature analyses fiscal multipliers in models where all equilibrium equations have been linearized around the steady state, except for the ZLB constraint on the monetary policy rule. Implicit in the linearization procedure is the assumption that the linearized solution is accurate even far away from the steady state. However, recent work by Boneva, Braun, and Waki (2016) suggests that linearization produces severely misleading results at the zero lower bound. Essentially, Boneva et al. argue that extrapolating decision rules far away from the steady state is invalid.

Our paper provides a positive analysis of the effect of spending-based fiscal stimulus on output and government debt using a fully nonlinear model. We compare the fiscal spending multipliers for output and government debt in the nonlinear and linearized solutions as function of the liquidity trap duration. Moreover, our framework allows us to pin down the key features which account for the difference between the multiplier schedule for the nonlinear and linearized solutions of the model.

The New Keynesian model employed in our analysis features monopolistic competition and Calvo sticky prices. The central bank follows a Taylor rule subject to the ZLB constraint on the nominal interest rate. The key difference to existing work is that we introduce real rigidities into the model using the Kimball (1995) aggregator. The Kimball aggregator aggregates intermediate goods into a final good. The Kimball aggregator is commonly used in New Keynesian models, see e.g. Smets and Wouters (2007), as it allows to simultaneously account for the macroeconomic evidence of a low Phillips curve slope and the microeconomic evidence of frequent price changes.

The key finding of our paper is that in a long-lived liquidity trap, the fully nonlinear model implies a much smaller fiscal spending multiplier than the linearized version of the same model. More precisely, when the ZLB binds for 12 quarters, the nonlinear model implies a multiplier of about 0.7 while the linearized version of the same model implies a multiplier in excess of 2.

What accounts for the large difference between the nonlinear and linearized solutions in a prolonged liquidity trap? We document that the difference can almost entirely be accounted for by the nonlinearities in the price setting block of the model – the Phillips curve. Key here is the nonlinearity implied by the Kimball aggregator. The Kimball aggregator implies that the demand elasticity for intermediate goods is state-dependent, i.e. the firms’ demand elasticity is an increasing function of its relative price. While the fully nonlinear model takes this state-dependency explicitly into account, a linear approximation replaces that nonlinearity by a linear function. Put differently, linearization replaces the quasi-kinked demand curve with a linear function. Intuitively, in a deep recession that triggers the ZLB to bind for a long time, the Kimball

aggregator carries the implication that firms do not find it attractive to cut their prices much since that reduces the demand elasticity and thereby does not crowd in more demand. With more fiscal spending in such a situation, firms also find it less attractive to increase their prices. Thus – with policy rates stuck at zero – aggregate inflation increases only little and therefore the real interest rate falls by little: the multiplier does not increase to the same extent with the duration of the ZLB. When the model is linearized, the response of aggregate inflation is notably stronger due to the nature of a linear approximation of a quasi-kinked demand curve at the steady state with no dispersion. Hence, the drop in the real interest rate is elevated following a spending hike and the multiplier is magnified. The bottom line: the linearized version of the model exaggerates the rise in expected and actual inflation due to a sizable approximation error and thereby elevates the magnitude of the fiscal multiplier in long-lived liquidity traps.

Our results have potentially important implications for the scope of fiscal stimulus to be self-financing, and the extent to which fiscal consolidations can be self-defeating. In the nonlinear model, fiscal stimulus is never a “free lunch” and conversely, fiscal consolidations are never self-defeating. The linearized model arrives at the opposite conclusions: fiscal stimulus can be self-financing in a sufficiently long-lived liquidity trap and fiscal consolidations can be self-defeating. These findings cast doubt on the existing literature on the fiscal implications of fiscal stimulus. It should be noted, however, that we study a model environment in which the fiscal output multiplier is small in normal times (1/3 as mentioned earlier). Had we considered a medium-sized model with Keynesian accelerator effects in which the multiplier is in the mid-range of the empirical evidence when monetary policy is unconstrained to begin with, it is certainly possible that the multiplier could still be magnified sufficiently in a long-lived liquidity trap to obtain a “fiscal free lunch” for a transient spending hike. So, as is often the case, there is ample scope for further research on this important topic!

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Research projects pursued in 2017

CREDIT AND BANKING

Curbing Shocks to Corporate Liquidity: The Role of Trade Credit

Niklas Amberg, Tor Jacobson, Robert Townsend and Erik von Schedvin

This paper quantifies firms' use of trade credit to handle shortfalls in liquidity. We find that firms manage declines in cash flow by increasing the amount of drawn trade credit from suppliers and contracting the amount issued to customers. The compounded adjustments in the amount of drawn and issued trade credit dominate adjustments in cash holdings, which suggest that trade credit positions are economically important sources of reserve liquidity. We tackle fundamental endogeneity concerns arising when relating cash flow to trade credit utilization by studying how losses from a fraudulent scheme initiated by a cash-in-transit firm affected its customers.

(Continuing from previous year)

Evaluating the Loan-to-Value Cap in Sweden

Tor Jacobson, Mats Levander and Kasper Roszbach

In October 2010 the regulatory supervisor in Sweden issued a recommendation to banks to cap their mortgage lending at 85%. Using a recent micro dataset on mortgage loans from a large Swedish retail bank we try to discern the effects of the cap for changes in borrowers' behavior. The richness of the data allows us to control for a wide range of important aspects such as households' uncollateralized borrowing from the incumbent bank, as well as their borrowing in general from other banks.

(Continuing from previous year)

Inter-Firm Lending: An Empirical Analysis of Trade Credit Contracts

Tore Ellingsen, Tor Jacobson and Erik von Schedvin

We study around 52 million trade credit contracts, issued by 50 suppliers over 9 years to 199 000 customers. The data contain information on contract size, due dates, time to payment, and firm characteristics. This data allows us to explore how changing conditions affect contract terms at the level of suppliers-customers pairs. We find that opportunity cost of funds, market power, and information asymmetries impact on the contract terms, where the former dominates, especially for the transacted volume. Financial frictions have little impact on agreed contract duration, but firms with higher liquidity needs draw more credit from suppliers by postponing payments.

(Continuing from previous year)

The Employment Effects of Bank Distress: Firm-, Loan-, and Employee-Level Evidence

Niklas Amberg Tor Jacobson Erik von Schedvin

We study employment effects of bank distress, using a natural experiment and firm-, loan-, and employee-level data for close to the entire population of Swedish firms in the recent global financial crises. We show that an adverse shock to the health of two of Sweden's four major banks, emanating from their exposures to the Baltic countries, led the concerned banks to contract their lending in the Swedish corporate loan market. We then study the implications of contracted lending for employment growth at the firm-level for the customers of the affected banks, and moreover, at the employee-level of said firms.

(New)

The Role of Trust in Online Lending

Christoph Bertsch, Isaiah Hull, Yingjie Qi and Xin Zhang

We study the impact of trust on the expansion of online lending in the U.S. over the 2008–2016 period. Using nearly complete loan and application data from the online lending market, we demonstrate that a misconduct-driven decline of trust in traditional banking is associated with a statistically and economically significant increase in online lending at the state level. To the contrary, increased social trust strengthens in-person, bank-based borrowing and informal borrowing, reducing the demand for impersonal online lending. Both of these effects operate primarily through borrowers. We also use a shock that affects only investors to demonstrate that distrust in traditional finance increases participation in online lending.

(New)

Trade Credit and Price Inflation: An Empirical Evaluation

Niklas Amberg Tor Jacobson Erik von Schedvin

Using a panel data set on transaction prices and firm characteristics, we relate firms' trade credit issuance to price decisions. In a period characterized by tightened credit conditions, we find that inflation rates increase substantially more on products sold by firms issuing relatively more trade credit, reflecting their larger exposure to increased costs-of-capital. The documented effects are primarily present for liquidity-constrained firms. These results are consistent with the presumption that trade credit issuance induces a channel through which credit supply conditions affect prices.

(New)

ECONOMETRICS

Risk endogeneity at the lender-/investor-of-last-resort

Diego Caballero, André Lucas, Bernd Schwaab and Xin Zhang

The riskiness of a central bank's balance sheet depends on the financial health of its counterparties, which may in turn depend on the central bank's liquidity provision and asset purchases. We propose a novel reduced-form framework to study the portfolio credit risks associated with different central bank monetary policy operations. The framework is based on a high-dimensional dependence function that incorporates fat-tails, skewness, and time-varying correlation parameters. We apply the model to the European Central Bank's weekly balance sheet between 2009 and 2015, to study unconventional monetary policy operations and the risk spillovers across policy operations.

(New project)

Score-driven tail shape, with application to bond yields at a high frequency

André Lucas, Bernd Schwaab and Xin Zhang

We propose an observation-driven modeling framework for estimating time series variation in the tail shape parameter of a Generalized Pareto Distribution. We discuss different ways of handling non-tail observations and relate tail shape variation to observed covariates. We then use the model to study the yield, volatility, and tail shape impact of bond purchases by the European Central Bank between 2010 and 2012. Bond purchases lowered the conditional mean of bond yields by about -0.2 to -3.5 bps per 1bn of purchases. The announcement of the program had a significant impact on the tail shape.

(Continuing from previous year, previously named "The tail shape impact of ECB asset purchases")

FINANCIAL MARKETS

Measuring Systemic Downside Risk Component of Asset Prices

Roméo Tédongap and Xin Zhang

We develop a representative agent consumption-based general equilibrium asset pricing model featuring generalized disappointment aversion preferences and multi-frequency long-run volatility risk, and which allows for closed-form bond prices, stock prices, credit derivatives and inflation derivatives. We estimate the model parameters and state dynamics to match moments of the daily stock index return and yield curve, and the default parameters by fitting moments of the daily term-structure of credit default swap spreads. We analytically decompose asset prices into two major components: a regular component and a systemic risk component. Our results point to a significant contribution of systemic risk to asset prices that is more important during crisis times.

(Continuing from previous year)

Pricing default exposure to downside risks

Roméo Tédongap and Xin Zhang

Intertemporal consumption-based equilibrium asset pricing, featuring downside risks through disappointment aversion preferences, implies that investors value assets through their undesirable exposure to two regular (market return and volatility) and three downside risk factors (the disappointment factor, the market downside factor, and the volatility downside factor). We show that these factors have both a predictive and a contemporaneous relationship with credit derivative swap spreads. Our results are robust to including macroeconomic factors, firm characteristics and other tail risk factors in the literature. We measure individual firm credit risk exposure to regular and downside risk factors using the CDS term structure. We find that the exposure information is also incorporated in the cross-section of expected stock returns and CDS spreads.

(Continuing from previous year, previously named “Default Exposure to Downside Risks and the Cross-section of Expected Returns”)

FINANCIAL THEORY

A Wake-Up Call Theory of Contagion

Toni Ahnert and Christoph Bertsch

We offer a theory of contagion based on the information choice of investors after observing a financial crisis elsewhere. We study global coordination games of regime change in two regions with an unobserved common macro shock as the only link between regions. A crisis in the first region is a wake-up call to investors in the second region. It induces them to reassess the regional fundamental and acquire information about the macro shock. Contagion can even occur after investors learn that regions are un-related (zero macro shock). Our results rationalize empirical evidence about contagious bank runs and currency crises after wake-up calls. We also derive new implications and discuss how these can be tested.

(Continuing from previous year)

Optimal Bank Capitalization in Crowded Markets

Christoph Bertsch and Mike Mariathasan

We study banks' optimal equity buffer in general equilibrium and their response to under-capitalization. Making progress towards a “pecking order theory” for private recapitalizations, our benchmark model identifies equity issuance as individually and socially optimal, compared to deleveraging, as well as conditions that invert the individually optimal ranking. Imperfectly elastic supply of capital, incomplete insurance markets and costly bankruptcies give rise to inefficiently high leverage ex-ante, and to excessive capital shortfalls and insolvencies ex-post. Abstracting from moral hazard and informational asymmetries, we therefore provide a novel rationale for macroprudential capital regulation and new testable implications about banks' capital structure management.

(Continuing from previous year)

Financial Frictions, Investment, and Tobin's q

Dan Cao, Guido Lorenzoni and Karl Walentin

We develop a model of investment with financial constraints and use it to investigate the relation between investment and Tobin's q . A firm is financed partly by insiders, who control its assets, and partly by outside investors. When insiders' wealth is scarce, they earn a rate of return higher than the market rate of return and thus the firm's value includes a quasi-rent on invested capital. This implies that two forces drive q : changes in the value of invested capital and changes in the value of the insiders' future rents per unit of capital. This weakens the correlation between q and investment, relative to the frictionless benchmark. We present a calibrated version of the model, which, due to this effect, can generate more realistic correlations between investment, q , and cash flow.

(Continuing from previous year)

GROWTH

Fuel for Economic Growth?

Johan Gars and Conny Olovsson

Using data on energy inputs for 134 countries, we document that countries that derive a larger share of their energy from fossil energy sources are richer and grow faster. We then set up an endogenous growth model in which the efficiency of both capital and fossil energy can be improved, whereas that of an alternative energy source is limited. With capital and energy as complements, there exist two steady states: one stagnant where energy is fully derived from the alternative source, and one with balanced growth where energy is fully sourced from fossil fuel. Heterogeneity in initial technology levels can generate the Great Divergence. The demand for fossil fuel in technologically advanced countries drives up its price and makes fossil fuel too costly in less advanced countries that choose the alternative and stagnant energy input.

(Continuing from previous year)

HOUSEHOLD SAVING

Financial Literacy Externalities

Michael Haliassos, Thomas Jansson and Yigitcan Karabulut

This paper uses unique administrative data and a quasi-field experiment of exogenous allocation to apartments in Sweden to estimate medium- and longer-run effects on financial behavior from exposure to financially literate neighbors. It contributes evidence of causal impact of financial literacy and points to a social multiplier of effective programs to enhance it. Exposure promotes saving in private retirement accounts and stockholding, especially when neighbors have economics or business education, but only for educated or male-headed households. Findings point to relevant knowledge transfer through social interactions rather than to labor market or other channels linked to local economic conditions.

(Continuing from previous year)

Households' Housing and Borrowing Decisions

Joao Cocco, Tor Jacobson, Thomas Jansson and Paolo Sodini

In this project we have access to a new unique micro dataset, which includes detailed information not only on a large sample of Swedish households' financial and real assets but also on their liabilities. In the dataset the exact composition of households' asset portfolios and the conditions of their debt (amounts, interest rates, variable or fixed rates, collateral etc.) are reported. We also have detailed income data, which enables us to estimate labor income volatility (separated into transitory and permanent components) at the individual level and at the household level. Hence, our dataset enables us to estimate a household's total exposure to various risk factors. The purpose of a first project is to use micro data to calibrate a lifecycle model. Our focus will be on how households' housing and borrowing decisions are affected by the evolution of house prices, labor incomes and mortgage interest rates. The predictions of the life cycle model will then be confronted with empirical results from estimated on the micro data.

(Continuing from previous year)

House Prices, Home Equity, and Personal Debt Composition

Jieying Li and Xin Zhang

Using a monthly panel dataset of Swedish individuals' debt composition including mortgage and non-mortgage consumer credit, we show that house price changes can explain a significant fraction of personal debt composition dynamics. We exploit the variation in local house price growth as shocks to homeowners' housing wealth to study the consequential adjustment of personal debt composition. To account for local demand shocks and disentangle the housing collateral channel from the wealth effect, we use renters and non-equity-withdrawal homeowners in the same region as control groups. We present direct evidence that homeowners reoptimize their debt structure by using withdrawn home equity to pay down comparatively expensive short-term non-mortgage debt during a housing boom, unsecured consumer loans in particular. We also find that homeowners withdraw home equity to finance their entrepreneurial activities. Our study sheds new light on the dynamics of personal debt composition in response to changes in house prices.

(New project)

How Parents Influence the Wealth Accumulation of their Children

Peter Englund, Thomas Jansson and Todd Sinai

We decompose the channels through which parents and children have correlated net worth using a novel administrative data set from Sweden that follows a panel of parents matched to their grown children. We find that children's initial endowments of net worth and their subsequent net worth accumulations are positively correlated with parents' net worth. There are two main channels of intergenerational wealth correlation. Children of wealthy parents have higher earnings, even conditional on intergenerational correlation in earnings, most of which they consume. The intergenerational correlation in net worth comes largely from housing wealth. We argue that arises from correlated home ownership among high net worth parents and their children, the propensity of home owners to save, and from children of high net worth parents spending more on housing at the time of first purchase. We also consider the impact of bequests, inter vivos transfers, portfolio choice, and savings propensities.

(Continuing from previous year)

The Impact of Social Environment on Entrepreneurial Risk and Its Distributional Effects

Michael Haliassos, Thomas Jansson and Yigitcan Karabulut

Using a rare natural experiment regarding the exogenous spatial allocation of refugee immigrants in Sweden, we focus on the role of social environment in the entrepreneurial process. We analyze whether early

interactions with entrepreneurs have any causal effects on the decision to start a new business, and conditional on being a business owner, on the entrepreneurial income. We find they do. Interestingly, only exposure to successful entrepreneurs has a significant effect, while exposure to unsuccessful entrepreneurs displays no effect on the subsequent entrepreneurial activity. We further analyze the potential mechanisms and find strong suggestive evidence that conforms to transfer of tacit knowledge as the operative channel. Finally, we show that the increased exposure to idiosyncratic entrepreneurial risk leads to a higher rank in the wealth distribution.

(New)

INTERACTION BETWEEN FISCAL AND MONETARY POLICY

Optimal Inflation with Corporate Taxation and Financial Constraints

Daria Finocchiaro, Giovanni Lombardo, Caterina Mendicino, and Philippe Weil

How does inflation affect the investment decisions of financially constrained firms in the presence of corporate taxation? Inflation interacts with corporate taxation through the deductibility of i) capital expenditures and ii) interest payments on debt. Through the first channel, inflation increases firms' taxable profits and further distorts their investment decisions. Through the second, expected inflation affects the effective real interest rate and stimulates investment. When debt must be collateralized, the second effect dominates. Therefore, when there is a tax-advantage to debt financing, positive long-run inflation enhances welfare by mitigating or even eliminating the investment distortion.

(Continuing from previous year)

Should We Use Linearized Models to Calculate Fiscal Multipliers?

Jesper Lindé and Mathias Trabandt

We calculate the magnitude of the government consumption multiplier in linearized and nonlinear solutions of a New Keynesian model at the zero lower bound. Importantly, the model is amended with real rigidities to simultaneously account for the macroeconomic evidence of a low Phillips curve slope and the microeconomic evidence of frequent price changes. We show that the nonlinear solution is associated with a much smaller multiplier than the linearized solution in long-lived liquidity traps, and pin down the key features in the model which account for the difference. Our results caution against the common practice of using linearized models to calculate fiscal multipliers in long-lived liquidity traps.

(Accepted for publication in *Journal of Applied Econometrics*.)

INTERNATIONAL ECONOMICS

International business cycles: quantifying the effects of a world market for oil

Johan Gars and Conny Olovsson

To what extent is the international business cycle affected by the fact that an essential input (oil) is traded on the world market? We quantify the contribution of oil by setting up a model with separate shocks to efficiencies of capital/labor and oil, and global shocks to the oil supply. The oil related shocks both contribute to positive comovements. The wealth effect associated with these shocks is typically smaller than the substitution effect, which induces high responses in output and low responses in consumption. Consequently, the model can resolve both the consumption correlation puzzle and the international comovement puzzle.

(Continuing from previous year)

The impact of foreign shocks on the Swedish economy

Jesper Lindé, Conny Olovsson, and Spyridon Sichelmiris

We aim to explain the positive cross-country comovement observed in the data among the main macroeconomic variables both nominal and real ones. We address the comovement problem by introducing international trade in durables. Durables trade in OECD represents roughly 2/3 of the total imports and the total exports. Based on the work of Engel and Wang (2011), incorporating durables trade into a standard international business cycle model improves substantially the volatility of imports and exports and induces positive correlation of these variables with respect to GDP. However, the issue of comovement has not been addressed because prices are flexible. We intend to build a two country New-Keynesian model with price and wage stickiness. Given the price stickiness, there has to be a strong adjustment through quantities that can potentially induce positive comovement among the main macroeconomic variables across the two countries.

(New)

The Macroeconomic Effects of Trade Tariffs: Revisiting the Lerner Symmetry Result *Jesper Lindé and Andrea Pescatori*

We study the robustness of the Lerner symmetry result in an open economy New Keynesian model with price rigidities. While the Lerner symmetry result of no real effects of a combined import tariff and export subsidy holds up approximately for a number of alternative assumptions, we obtain quantitatively important long-term deviations under complete international asset markets. Direct pass-through of tariffs and subsidies to prices and slow exchange rate adjustment can also generate significant short-term deviations from Lerner. Finally, we quantify the macroeconomic costs of a trade war and find that they can be substantial, with permanently lower income and trade volumes. However, a fully symmetric retaliation to a unilaterally imposed border adjustment tax can prevent any real or nominal effects.

(Continuing from previous year)

LABOR MARKETS

Endogenous Separations, Wage Rigidities and Employment Volatility

Mikael Carlsson and Andreas Westermark

We show that in micro data, as well as in a search and matching model with endogenous separations and rigid wages, separations and hence employment volatility are non-neutral to wage rigidities of incumbent workers. In contrast to when all wages are flexible, the standard deviation of unemployment in a model with rigid wages for incumbent workers (only) matches the standard deviation in the data. Thus, the degree of wage rigidity for newly hired workers is not a sufficient statistic for determining the effect of wage rigidities on macroeconomic outcomes in this class of models.

(Continuing from previous year)

Involuntary Unemployment and the Business Cycle

Lawrence Christiano, Mathias Trabandt and Karl Walentin

We propose a monetary model in which the unemployed satisfy the official US definition of unemployment: they are people without jobs who are (i) currently making concrete efforts to find work and (ii) willing and able to work. In addition, our model has the property that people searching for jobs are better off if they find a job than if they do not (i.e., unemployment is “involuntary”). We integrate our model of involuntary unemployment into the simple New Keynesian framework with no capital and use the resulting model to discuss the concept of the “non-accelerating inflation rate of unemployment”. We then integrate the model into a medium sized DSGE model with capital and show that the resulting model does as well as existing models at accounting for the response of standard macroeconomic variables to monetary policy shocks and two technology shocks. In addition, the model does well at accounting for the response of the labor force and unemployment rate to the three shocks.

(Continuing from last year)

Learning on the Job and the Cost of Business Cycles

Karl Walentin and Andreas Westermark

We show that business cycles reduce welfare through a decrease in the average level of employment and output in a labor market search model with learning on-the-job. A negative correlation between unemployment and vacancies (i.e. a Beveridge curve) combined with a matching function implies that business cycles tend to reduce the average number of new jobs and, in turn, employment. Then, since learning on-the-job implies that aggregate human capital is increasing in employment, it follows that aggregate volatility reduces human capital. This, in turn, reduces the incentives to post vacancies, further reducing employment and human capital. We quantify this mechanism using a carefully calibrated model and find the output and welfare cost of business cycles to be fairly large.

(Continuing from last year)

The Optimal Inflation Target under Downward Nominal Wage Rigidity

Mikael Carlsson and Andreas Westermark

We study the implications for optimal average inflation when there is both a role for money as a medium of exchange and when nominal wages are downwardly rigid. The model also features transaction costs, as in Dotsey, King and Wolman (1999), and a non-Walrasian labor market with search frictions as in Trigari (2009). The introduction of downward nominal wage rigidities into a model with flexible wages can be decomposed into two effects; first, introducing (symmetric) wage adjustment frictions and, second making them asymmetric.

Productivity growth is important for the level of inflation and also affects the size of the effect of the asymmetric wage friction. Without productivity growth, symmetric wage adjustment frictions leads to a yearly inflation rate of approximately 1.0%, while introducing an asymmetry on top of this increases the inflation rate by an additional 0.7%. With productivity growth, inflation is almost a percent lower and the effect of adding asymmetric wage frictions is also somewhat smaller – about 0.5%. Overall, we find an optimal inflation rate of about 0–2 percent.

(Continuing from previous year)

MACROECONOMICS

Energy-saving technical change

John Hassler, Per Krusell, and Conny Olovsson

How do markets economize on scarce natural resources? In this paper we emphasize technological change aimed at saving on the scarce resource. We develop a neoclassical macroeconomic theory that is quantitatively oriented and that views technical change as directed: it can be used to save on different inputs. At a point in time, the elasticity between inputs – in our application a capital-labor composite and fossil energy – is given by a production function with fixed parameters, but because the future values of these parameters can be changed with R&D efforts today, the long-run elasticity between the inputs is higher than it is in the short run. We demonstrate how the theory can be used to robustly derive predictions for the long-run cost share accruing to the scarce resource as well as for its rate of depletion. In an application, we look at postwar U.S. data, estimate the short-run elasticity between inputs using an aggregate CES production function, and also estimate the implied input-saving technology series. From these technology series, we can gauge what the historical tradeoff has been in the choice between allocating R&D to save on one or the other input. The implied parameter estimates are then used in our aggregate model to make long-run predictions, which indicate a marked increase in the share of costs going to fossil energy.

(Continuing from previous year)

Integrated Assessment in a Multi-region World with Multiple Energy Sources and Endogenous Technical Change

John Hassler, Per Krusell, and Conny Olovsson

We construct an integrated assessment model with multiple energy sources – including fossil fuels and “green energy” – and multiple world regions. The energy sources are imperfect substitutes and their production involve structures that are endogenous. In particular, firms can decide to lower the marginal cost of producing one form of energy at the expense of the marginal costs of other energy sources: there is directed technical change. In the lowering of these marginal costs, there are also spillovers, which are international. We analyze how (potentially region-specific) taxes affect output and the climate with and without the endogeneity of technology. We emphasize the second-best nature of taxation when optimal world-wide technology subsidies are not implemented.

(New)

Measuring U.S. Time Series Volatility during the Great Moderation: A Big Data Approach

Isaiah Hull

We identify conditional variance breaks in all testable series in the FRED database over the 1957–2013 period. This yields 17 681 breaks, which we categorize using text analysis. We show that 70.5% of series categories experienced a decline in conditional variance over the 1984–1999 period, suggesting that the Great Moderation was far broader in scope than the literature has documented. We also show that this decline reversed in 2000, leading to a sharp increase in volatility for most time series categories; however, this did not fully materialize in GDP volatility until the Great Recession. Finally, we identify labor markets, demographics, finance, and government debt as potential drivers of low-frequency shifts in volatility over the 1957–2013 period.

(Continuing from previous year)

Microeconomic Drivers of House Price Risk

Isaiah Hull, Conny Olovsson, Karl Walentin and Andreas Westermark

Recent work has shown that microeconomic shocks at the firm and sector level account for a substantial share of output volatility. We examine whether this observation also holds for house price risk, which experienced a similar decline after 1983 and increase after 2001. Using a novel dataset of all property transactions in Sweden, we demonstrate that the following are associated with increases in house price risk: 1) an increase

in the volatile sector share at the county level; 2) an increase in employment volatility at the county level; and 3) an increase in firm concentration at the parish level.
(New)

Oil prices in a real-business-cycle model with precautionary demand for oil *Conny Olovsson*

This paper analyses the interaction between oil prices and macroeconomic outcomes by incorporating oil as an input in production alongside a precautionary motive for holding oil in a general equilibrium model. The driving forces are factor-specific technology shocks, oil supply shocks, and future oil supply news shocks. These shocks account for a large part of the U.S. business cycle and the empirical distribution of oil prices. Oil prices are mainly driven by increasing precautionary/smoothing demand, but supply shocks contribute to both the oil-price volatility and the magnitude of oil-price changes, mainly through their effect on oil reserves.
(Continuing from previous year)

The Consequences of Uncertainty: Climate Sensitivity and Economic Sensitivity to the Climate *John Hassler, Per Krusell, and Conny Olovsson*

We construct an integrated assessment model with multiple energy sources – two fossil fuels and “green energy” – and use it to evaluate ranges of plausible estimates for the climate sensitivity as well as for the sensitivity of the economy to climate change. Rather than focusing on uncertainty explicitly, we look at extreme scenarios defined by the upper and lower limits given in available studies in the literature. We compare optimal policy with laissez faire and we point to the possible policy errors that could arise. By far the largest policy error arises when the climate policy is “overly passive”; “overly zealous” climate policy (i.e., a high carbon tax applied when climate change and its negative on the economy are very limited) does not hurt the economy much as there is considerable substitutability between fossil and non-fossil energy sources.
(New)

The Timing of Uncertainty Shocks in a Small Open Economy *Hanna Armelius, Isaiah Hull, Hanna Stenbacka Köhler*

Foreign measures of uncertainty, such as the US EPU index, are often used as a proxies for domestic uncertainty in small open economies. We construct an EPU index for Sweden and demonstrate that shocks to the domestic index yield different impulse response functions for GDP growth than shocks to the US index. In particular, a one standard deviation shock to the Swedish index delivers its maximum impact in the same quarter, lowering GDP growth by slightly less than 0.2 percentage points. In contrast, a shock to the US index delivers its maximum impact with a one-quarter delay. Other foreign proxies, such as the European and German indices, also generate effects that peak with a one-quarter delay.
(Accepted for publication at Economics Letters)

MONETARY POLICY AND THEORY

Balance-sheet implications of QE in a small open economy *David Vestin*

We estimate a global term-structure model and use this to simulate future risks to the balance-sheet of a small open economy central bank. We discuss the importance of future developments in seigniorage revenue and equity for the central bank’s ability to fund its operations.
(New)

Designing a Simple Loss Function for Central Banks: Does a Dual Mandate Make Sense? *Davide Debortoli, Jinill Kim, Jesper Lindé and Ricardo Nunes*

Yes, it makes a lot of sense. This paper studies how to design simple loss functions for central banks, as parsimonious approximations to social welfare. We show, both analytically and quantitatively, that simple loss functions should feature a high weight on measures of economic activity, sometimes even larger than the weight on inflation. Two main factors drive our result. First, stabilizing economic activity also stabilizes other welfare-relevant variables. Second, the estimated model features mitigated inflation distortions due to a low elasticity of substitution between monopolistic goods and a low interest rate sensitivity of demand. The result holds up in the presence of measurement errors, with large shocks that generate a trade-off between

stabilizing inflation and resource utilization, and also when imposing a moderate degree of interest rate volatility.

(Continuing from previous year)

Long-run perspectives on the forward guidance puzzle” (continuing from last year

David Vestin

In this paper I examine the forward-guidance puzzle i.e. that pre-announced monetary policy actions yield very large real and inflationary effects in the standard NK-model. I argue that of the proposed solutions to the puzzle, only the Mankiw-Reis “sticky-information” really solves the puzzle, whereas other proposals work to attenuate the short-run implications. In the flex-price equilibrium, inflation moves opposite to pre-announced interest rates shocks, contrary to the long-run Fisher equation, and there are no real effects of anticipated shocks. I show that in the Mankiw-Reis model, the sticky price-plan/information converges exactly to this outcome as the horizon of the pre-announced shocks grows to infinity, in contrast to the standard NK-model which has a discontinuity emphasized recently by Cochrane.

(Continuing from previous year)

Modelling disagreement between the central bank and the private sector

Oreste Tristani and David Vestin

We model an imperfect information environment where the central bank and the private sector learns from each other, but agrees to disagree about the expected future path of the policy interest rate. Our first contribution is to generate differences in interest rate forecasts that can match some features of observed differences between published central bank forecasts and market based measures. Second, we discuss implications for forecasts and the conduct of optimal monetary policy in the presence of informational friction.

(Continuing from previous year)

Monetary Normalizations and Consumer Credit: Evidence from Fed Liftoff and Online Lending

Christoph Bertsch, Isaiah Hull and Xin Zhang

On December 16th of 2015, the Fed initiated “liftoff”, a critical step in the monetary normalization process. We use a unique panel dataset of 640,000 loan-hour observations to measure the impact of liftoff on interest rates, demand, and supply in the online primary market for uncollateralized consumer credit. We find that credit supply increased, reducing the spread by 16% and lowering the average interest rate by 16.9–22.6 basis points. Our findings are consistent with an investor-perceived reduction in default probabilities; and suggest that liftoff provided a strong, positive signal about the future solvency of borrowers.

(Continuing from previous year)

Money, Credit and Banking and the Cost of Financial Activity (with G. Camera)

Paola Boel and Gabriele Camera

We extend the study of banking equilibrium in Berentsen, Camera and Waller (2007) by introducing an explicit production function for banks. Banks employ labor resources, hired on a competitive market, to run their operations. In equilibrium this generates a spread between interest rates on loans and on deposits, which naturally reflects the efficiency of financial intermediation and underlying monetary policy. In this augmented model, equilibrium deposits yield zero return in a deflation or very low inflation. Hence, if monetary policy is sufficiently tight then banks end up reducing aggregate efficiency, soaking up labor resources while offering deposits that do not outperform idle balances.

(Continuing from previous year)

On the Theoretical Efficacy of Quantitative Easing at the Zero Lower Bound

Paola Boel and Christopher Waller

We construct a monetary economy with aggregate demand shocks and heterogeneous idiosyncratic preference shocks. At the ZLB, patient agents are unconstrained in their money holdings, but impatient ones are constrained since they face a positive shadow nominal rate. If agents have access to banks taking deposits and making loans, a zero interest-rate policy may be the best the central bank can implement. Specifically, if the banking sector has ample liquidity for lending, then zero interest rates generate the first-best outcome. If the banking sector faces a liquidity shortage, instead, there is scope for central bank policies of liquidity provision.

(Continuing from previous year)

Output Gaps and Robust Monetary Policy Rules

Roberto Billi

Policy makers often use the output gap to guide monetary policy, even though nominal gross domestic product (GDP) and prices are measured in real time more accurately than the output gap. Employing a small New Keynesian model with a lower bound on nominal interest rates, this article compares the performance of monetary-policy rules that are robust to errors in measuring the output gap, nominal GDP level, or price level. It shows that a robust policy rule that focuses on stabilizing the price level improves the trade-offs faced by the central bank, especially when the analysis accounts for persistent measurement errors as faced in practice.

(Continuing from previous year)

Price Level Targeting and Risk Management

Roberto Billi

Many argue that, because the outlook for the economy is uncertain, monetary policy should apply a risk management approach by raising the policy interest rate gradually from its lower bound. Using a small New Keynesian model, I study the impact of outlook uncertainty on the economic performance of a central bank with a target for the price level or the level of nominal gross domestic product. I show that, in the presence of persistent supply and demand shocks, a price-level target is more effective at mitigating outlook uncertainty because it induces greater policy inertia and improves the trade-offs faced by the central bank.

(Continuing from previous year)

Seigniorage, Gesell Taxes and Monetary Policy in the middle Ages

Roger Svensson and Andreas Westermarck

Gesell taxes on money holdings have received attention in recent decades as a way of alleviating the zero lower bound on interest rates. Less known is that such a tax was the predominant method used to generate seigniorage in large parts of medieval Europe for around two centuries. When the Gesell tax was levied, current coins ceased to be legal tender and had to be exchanged into new coins for a fee – an institution known as *renovatio monetarum* or periodic re-coinage. This could occur as often as twice a year. Using a cash-in-advance model, prices increase over time during an issue period and falls immediately after the re-coinage date. Agents re-mint coins and the system generates tax revenues if the tax is sufficiently low, if the time period between re-coinages is sufficiently long, and if the probability of being penalized for using illegal coins is sufficiently high.

(Continuing from previous year)

Understanding the Gains from Wage Flexibility: The Lower Bound Constraint

Roberto Billi and Jordi Galí

This project examines the welfare implications from increased wage flexibility using a model with staggered price and wage setting, in which nominal interest rates are subject to a binding lower bound. When nominal interest rates hit a lower bound, a wage cut may have contractionary effects on aggregate demand and employment if it triggers expectations of lower inflation and leads to higher real interest rates. The project, thus, provides an assessment of the role of a binding lower bound on nominal interest rates and of increased wage flexibility in the determination of employment and welfare.

(New)

The Redistributive Effects of Inflation and the Shape of Money Demand

Paola Boel

I quantify the distributional effects of expected inflation in a sample of OECD countries using a microfounded model of money where agents differ in their consumption risk, against which they can insure using money and government bonds. The model is calibrated using harmonized wealth microdata from the Luxembourg Wealth Study. I find that the inflation tax is progressive for low inflation, but it becomes regressive as inflation increases. Cut-off points vary across countries and depend on discount factors and heterogeneity in consumption risk across agents. Moreover, I find that the magnitude of inflation's distributional impact depends not only on wealth distribution but also, and importantly, on the curvature and height of the money demand curve. Indeed, a higher and less elastic money demand leads to more regressive effects of inflation, thus implying such effects are not necessarily stronger in a country with a more unequal wealth distribution.

(Continuing from previous year)

Publications accepted in 2017

Armeliu, Hanna, Isaiah Hull, and Hanna Stenbacka Köhler, "The Timing of Uncertainty Shocks in a Small Open Economy", Forthcoming in *Economics Letters*.

Bos, Marieke, Emily Breza and Anders Liberman, "The Labor Market Effects of Credit Market Information", Forthcoming in *Review of Financial Studies*.

Carlsson, Mikael, "Microdata Evidence on the Empirical Importance of Selection Effects in Menu-Cost Models", *Journal of Money, Credit and Banking* Vol. 49, No. 8, pp. 1803-1830.

Lindé, Jesper and Mathias Trabandt, "Should We Use Linearized Models to Calculate Fiscal Multipliers?", Forthcoming in *Journal of Applied Econometrics*.

Lindé, Jesper, "DSGE Models: Still Useful in Policy Analysis", Forthcoming in *Oxford Review of Economic Policy*.

Quiros, Mathias, Robert Kohn, Mattias Villani and, Tran Minh-Ngoc, "Speeding up MCMC by Delayed Acceptance and Data Subsampling", Forthcoming in *Journal of Computational and Graphical Statistics*.

Working papers

No. 347, Anna Grodecka, "On the Effectiveness of Loan-to-Value Regulation in a Multiconstraint Framework"

No. 346, Christoph Bertsch, Isaiah Hull, Yingjie Qi and Xin Zhang, "The Role of Trust in Online Lending"

No. 345, Paola Di Casola and Spyridon Sichlimiris, "Domestic and External Sovereign Debt"

No. 344, Daniel Buncic, "Identification and Estimation issues in Exponential Smooth Transition Autoregressive Models"

No. 343, Jieying Li and Xin Zhang, "House Prices, Home Equity, and Personal Debt Composition"

No. 342, Martin Flodén, Matilda Kilström, Jósef Sigurdsson and Roine Vestman, "Household Debt and Monetary Policy: Revealing the Cash-Flow Channel"

No. 341, Stefan Laséen, Andrea Pescatori and Jarkko Turunen, "Systemic Risk: A New Trade-Off for Monetary Policy?"

No. 340, Johan Gars and Conny Olovsson, "International Business Cycles: Quantifying the Effects of a World Market for Oil"

No. 339, Magnus Åhl, "How Big is the Toolbox of a Central Banker? Managing Expectations with Policy-Rate Forecasts: Evidence from Sweden"

No. 338, Burton Hollifield, Patrik Sandås and Andrew Todd, "Latency Arbitrage when Markets Become Faster"

No. 337, Kristina Bluwstein, "Asymmetric Macro-Financial Spillovers"

No. 336, Antje Berndt, Burton Hollifield and Patrik Sandås, "What Broker Charges Reveal about Mortgage Credit Risk"

No. 335, Marien Ferdinandusse, Maximilian Freier and Annukka Ristiniemi, "Quantitative Easing and the Price-Liquidity Trade-Off"

Non-refereed publications in 2017

Do Swedish Forecasters Properly account for Sweden's International Dependence?

Jesper Lindé and André Reslow

Riksbank Economic Review

Sweden is a small, open economy that is affected to a large extent by developments abroad. An important question is whether Swedish forecasters take sufficient account of Sweden's international dependence in their forecasts of domestic developments. In this study, we analyze this for forecasts made during the period 2007–2017 for GDP growth and inflation. We compare the Riksbank's forecasts with those of a number of major Swedish forecasters, including the National Institute of Economic Research (NIER). The analysis shows that several forecasters, including the Riksbank and NIER, take too little account of other countries in their long-term GDP and inflation forecasts. In the short term, however, the influence of foreign inflation is in line with the correlation in the data, while the influence of foreign GDP growth is still slightly lower than the correlation in actual outcomes even in the short term. Finally, we show that the weaker influence from other countries in the forecasts cannot be explained by monetary policy is more aggressive in the forecasts compared with how the repo rate de facto has been set in relation to policy rates abroad.

DSGE Models: Still Useful in Policy Analysis?

Jesper Lindé

Oxford Review of Economic Policy special issue "Rebuilding Macroeconomic Theory" (eds. David Vines and Samuel Willis).

This paper discusses the usefulness of DSGE models in monetary and fiscal policy analysis. While the recent crisis has exposed some weaknesses in these models, I argue that DSGE models currently have few contenders to replace them as core models in the policy process. The prominent role for forward-looking behaviour and their simplicity make DSGE models very suitable for policy analysis. In addition, DSGE models are flexible enough to be used for many purposes, while other models are often more limited in terms of the questions they can address. As a result, I argue that improved DSGE models – modified to take the lessons of the recent crisis into account – will remain as a workhorse tool in many policy institutions for a long time to come.

Price Information Collected Online and Short-Term Inflation Forecasts

Isaiah Hull, Mårten Löf, and Markus Tibblin

Economic Commentary

Forecasting short-term inflation developments (e.g. inflation over the coming months) is important for a central bank. There are certain elements within the published inflation figures that are volatile and inherently hard to forecast even in the short-run. Fruit and vegetable prices, energy prices, and air travel prices are examples of product groups within the inflation measure that historically have held a high degree of volatility in Sweden. An automatic internet data collection process was developed to collect sales prices daily for selected fruits and vegetables from a number of Swedish online retailers. The results indicate that the information from the daily data could increase the precision in short-term inflation forecasts in Sweden.

Other research activities

Conferences

On April 6 and 7, the Research Division organized a conference entitled "Sveriges Riksbank 350 years: a central bank in a world of central banks". The background for this event is that Sveriges Riksbank will celebrate its 350-years anniversary in 2018. The Riksbank has therefore undertaken a book project aiming at presenting the Riksbank's historical development, along with those of a selection of important and dominating central banks world-wide. To this end, a large number of authors have been invited to contribute towards the volume, presenting chapters on the central banks of Sweden, England, the United States, France, the Netherlands, Norway, Spain, Japan, Italy, Germany, China, and the European central bank. An additional chapter discusses historical perspectives on the overall evolution of central banking. The conference in April provided an opportunity to discuss the volume's various chapters at length, and not least, with the help of external discussants. The organizing committee consisted of Tor Jacobson and Lena Sundvall.

Roberto Billi helped organize the conference "The Future of Forward Guidance". The program can be found at: www.riksbank.se/en/The-Riksbank/Research/Conferences/2017/The-Future-of-Forward-Guidance/

Courses

During 2017, the Research Division organized a second-year PhD course on monetary economics. The course was held at the bank, and was taught by faculty from Stockholm University and by Riksbank researchers. The purpose of the course was to introduce students to modern New & Keynesian models for monetary policy and business cycle-analysis.

Greater Stockholm Macro Group

Together with Per Krusell (IIES, Stockholm University), the Research Division continued to organize a monthly internal seminar series for macro researchers from all major institutions in Stockholm and Uppsala. The series is known as "Greater Stockholm Macro Group" and aims at fostering exchange of ideas and cooperation among macro researchers in the Stockholm area.

Internship Program

As customary, the Research Division hosted four PhD interns in 2016. This year's interns were Kasper Kragh-Sorensen (Institute for International Economic Studies), Adam Altmejd (Stockholm School of Economics), Melinda Süveg (Uppsala University), and Tamás Kiss (Göteborg University).

Research Seminars

The Research Division organizes weekly research seminars, mainly by invited international speakers. The seminars usually take place on Tuesdays at 1 pm and attendance is open to Riksbank employees as well as to academics. A complete list of both upcoming and past seminars is available on the homepage of the Riksbank's Research Division: www.riksbank.se/en/The-Riksbank/Research/Seminars/

Sabbaticals

Tor Jacobson is on a sabbatical visit to the Reserve Bank of Australia from November 1, 2017 to March 31, 2018.

Erik von Schedvin is on a sabbatical visit to the Federal Reserve Bank of San Francisco from November 1, 2017 to March 31, 2018.

Teaching and Advising

Daria Finocchiaro taught half of the first-year graduate Macro course at Uppsala University in the fall of 2017. Her lectures dealt with classical consumption theory, asset prices and overlapping generation models, while also touching upon fiscal and monetary policy issues.

Karl Walentin taught half of the second first-year Macro course for PhD students at Stockholm University (Macro II). The course covered inequality facts, macroeconomic modelling of inequality and heterogeneity as well as labor markets.

David Vestin taught half of the Macro II course for PhD students at Uppsala University. Andreas Westermark taught part of the second-year PhD course on monetary economics held at the Riksbank.

Conny Olovsson taught part of the master course "The Climate and the Economy" during the spring of 2017 at Stockholm University. The course explained how economic tools can be used to analyze environmental issues and, in particular, climate change: its causes and effects and the role for economic policy in influencing our future. The focus was on economic methods in theory and practice but the course also covered the basic aspects of the natural sciences involved.

Jesper Lindé and David Vestin taught a master course "Monetary Policy" at the Stockholm School of Economics. The course was intended to provide a thorough understanding of some basic theoretical and empirical models for analyzing business cycles and monetary policy, with a main focus on small-scale models with nominal rigidities.

Andreas Westermark has together with Magnus Jonsson and Magnus Åhl at the monetary policy department, as part of the Riksbank's technical assistance activities, taught a course in DSGE-modelling at the central banks of Ukraine and Kenya. The purpose of the course is to introduce the staff at the central banks to DSGE modelling and estimation. The course is divided into two parts, where the first part builds the theoretical foundations for DSGE models and presents a simple open-economy DSGE model that could be used by the central banks. The first part starts by describing key mechanism, e.g. the consumption savings decision, investment, in dynamic models in a simple neoclassical closed economy model. Then sticky prices is introduced in a simple new Keynesian framework. Moreover, in order to match the empirical evidence better,

habit formation and price indexation is added to the model. Finally, since both Ukraine and Kenya are small open economies, a small open economy model is described. The second part is focused on estimating DSGE models. We first look at methods for estimating such models and then continue to estimate a model using Kenyan and Ukrainian data, respectively. The estimated models are intended to be used by the central banks of Kenya and Ukraine for policy analysis and forecasting. In the fall 2016, we taught the first part of the course and the second part was given in the spring of 2017. The course was in general well received and both in Ukraine and Kenya the central bank staff attending the course showed a lot of interest in DSGE modelling.

Isaiah Hull taught the course “Data collection and processing in Python” at the National Bank of Ukraine. The course covered topics such as web scraping, automation, text analysis, and data visualization.

Miscellanea

Christoph Bertsch was a member of the Committee on the Global Financial System (CGFS) Working Group on Policy Challenges and Open Issues in Liquidity Assistance, which produced a report on “Designing frameworks for central bank liquidity assistance: addressing new challenges”, CGFS Papers No. 58, April 2017: www.bis.org/publ/cgfs58.htm

Jesper Lindé discussed the paper “The Folk Theorem of Decreasing Effectiveness of Monetary Policy: What Do the Data Say?” by Ugo Panizza and Charles Wyplosz at the IMF 17th Jaques Polak conference “Macroeconomics after the Great Recession” in honor of Olivier Blanchard.

Thomas Jansson participated at the ECB Household Finance and Consumption Network (HFCN) meetings.

Upcoming events in 2018

On September 13th–14th 2018 the research division will organize a conference on “Housing, Credit and Heterogeneity: New Challenges for Stabilization Policies” at the Riksbank. The aim of the conference is to bring together researchers focusing on heterogeneity in households and firms and the interplay of that heterogeneity with macroeconomic policy and aggregate fluctuations.

In the spring, a second year PhD course on monetary economics will be given at the bank. The course is taught by faculty from Stockholm University and the Riksbank. The purpose of the course is to introduce students to modern New Keynesian models for monetary policy and business cycle analysis. These models are dynamic stochastic general equilibrium models based on optimizing behaviour and rational expectations. At the same time, they incorporate price and wage rigidity, permitting an important role for aggregate demand shocks and monetary policy to affect activity. They have become a standard tool for central banks and they are used as a framework for much modern research in macroeconomics.

The course will cover the basic New Keynesian model, optimal policy, labor market frictions, open economy, and also introduce methods for solution and simulation. Throughout, we will emphasize the microeconomic foundations of these models. We hope that, after finishing this course, participants will feel comfortable working with these models.

Interview with Per Krusell (continuing from page 1)

My main task at the bank is to provide the researchers with feedback on their work and to collaborate on projects with them and, if anything, my appreciation for this activity has increased over the years. I hope it is also rewarding to the bank’s research department. One of the fruitful activities we have been organizing together for several years now is a workshop, taking place once a month at the bank, where macroeconomic researchers from the “greater Stockholm area” (which includes Uppsala!) present their research projects at early stages and get friendly feedback in group format. The meeting is very often over-booked and this is a reflection of the vibrant, and advanced, macroeconomic research taking place in our local area. I would even argue that, within Europe, the agglomeration of researchers in macroeconomics in Stockholm stands out as one of the very best, surpassed only by London at this point. The initial focus of the workshop was on attracting people from the bank and from local universities only. However, as the meetings have more broadly known we have also drawn in people from the Ministry of Finance and other government agencies. There, just like at the bank, the connection to the research world is an increasingly important input into policy discussions, especially in the light of the recent crises and the many discussions about how our understanding of the macroeconomy needs to be improved. The other side of the coin is that the connection to the policy world is an equally crucial input into the research of the university-based macroeconomists. For example, most of the work I am doing jointly with people at the bank is fundamentally policy-motivated.

Q2. You have written a recent paper with your IIES colleague Timo Boppart the paper “Labor Supply in the Past, Present, and Future: a Balanced-Growth Perspective” which challenges the conventional view in economics that hours worked per worker is constant.¹ Can you tell us a little more about this research?

Whether we should work more or less is one of the most hotly debated issues right now. You know, the main political parties in Sweden just agreed on a retirement reform that seems to mean that we will end up working more. In thinking about this topic, especially about how much people want to, and should, be working, it is important to take a historical perspective. Yes, as you indicated, the modern macroeconomic literature is based on the view that, fundamentally, how many hours people want to work has not changed over time, even though wages have grown tremendously, especially if you look back a hundred years or more. This conventional position might at first sound surprising: shouldn't higher wages make people want to work more? In other words, isn't this what basic economic incentives tell us? Well, yes, economic incentives indicate that, but there is also another equally relevant effect. This effect is that by making more money per hour you are, effectively, richer, so that you can afford not to work so much. Put this way, the conventional view is that this latter effect – the so-called *income effect* – exactly offsets the former effect – the *substitution effect* – leaving the desired amount of working time constant as the economy grows over time. What Timo Boppart and I have done is to look back at the historical data and noticed that the amount of working hours per year and person has actually instead fallen rather significantly. A hundred years ago, we worked almost 50% more than we do today, and this fact holds true across developed countries. The changes are small if you measure them per year – a little over 1/3 of a percent – but accumulated they make for a drastic drop in hours worked. Timo and I simply interpret this as a reflection of human preferences: as our economy has grown richer, we have preferred to cut down on hour working time, slowly but surely. When we look at poor countries today, we also see that their populations work many more hours than we do. In fact, they work about as much as we did in Sweden when we were on a similar level of development.

For everyday business, and maybe for the central banks around the world whose main objectives are to make sure that our economies develop smoothly and do not run off into highly inflationary (or deflationary!) periods, the small and smooth downward trend in hours worked does perhaps not look very exciting. But for us, how much we should work is a fundamental question and our historical perspective has taught us that people do prefer working less, not more, when their wages grow and they get richer, and that the value of leisure – time off work – is underappreciated when we examine the performance of our economies. Leisure is not included in GDP but it is one of our most valuable activities. And working more is no goal in itself. Coming back to the pension reform, my view is actually that different groups really have different needs and that a common retirement age – regardless of whether you are a construction worker or an office worker – is an increasingly unattractive proposition. It is ok that people can keep working longer (those who are healthy and want to) – and have certain rights to do so – but imposing too much one-size-fits-all in the system is bound to be a problem.

Q3. Interesting. Can I get back to the “conventional” view and ask you how macroeconomists ended up believing in that? Don't they look at historical data?

Well, they do. However, the further back you go in time, the lower is the quality of the data. A common practice in studying macroeconomic variables like GDP, investment, inflation, employment, hours worked and so on is to go back no further than to the second world war, because the war was a major disruption and so was the Great Depression which just preceded it, and before this period the data was of significantly lower quality. As importantly, though, for a long time macroeconomics has been very U.S.-centered: the world's best researchers in the area work at American universities. Therefore, they have focused mostly on studying U.S. data and it so turns out that, for hours worked, the postwar period in the U.S. is an exception, both historically and compared to similar countries: hours worked per person have been stable in the U.S. over this rather long period! In a second paper, with our PhD student Jonna Olsson, Timo and I are trying to understand the exceptional behavior of hours worked during the U.S. postwar period. This is research in motion and our preliminary findings are quite interesting. Actually, the hours worked of U.S. men have kept falling, roughly at the pace predicted by the theory and the past. However, there is a major counteracting force: the rather drastic increased labor-force participation of women. What explains the increasing labor-force participation of women therefore is of major importance for understanding postwar U.S. macroeconomic data. I think researchers should spend much more time on this question. In our paper, we do not provide an answer but we quantify how much more women must “like” working today compared to in 1960, and we find a huge number. One cannot avoid thinking about how this may reflect a “#metoo effect” – that used to be very large but that is going down over time – but there are certainly a number of other potential explanations too.

¹ The NBER working paper “Labor supply in the past, present, and future: a balanced-growth perspective” is available at www.nber.org/papers/w22215

Q4. *Per*, we also know that you are working on models of climate change and the global economy too. What do you believe are the key pressing questions for policy in that area today?

Fortunately, I can give a short answer to that one! It is to tax carbon dioxide emissions, and to do it worldwide. We are doing the right thing already in Sweden, though we can harmonize our taxes and improve on the margin here and there. But our most important task is to convince other countries to follow our lead. I don't believe in the many quantity-oriented and regulatory proposals that keep coming from our politicians. I believe that these proposals are mostly designed to attract uninformed voters, who may find aggressive-looking policies more salient and appealing. In reality, though, they are inefficient and, often, even have no effect at all on the climate. Again, we should just tax carbon!

Thank you very much!

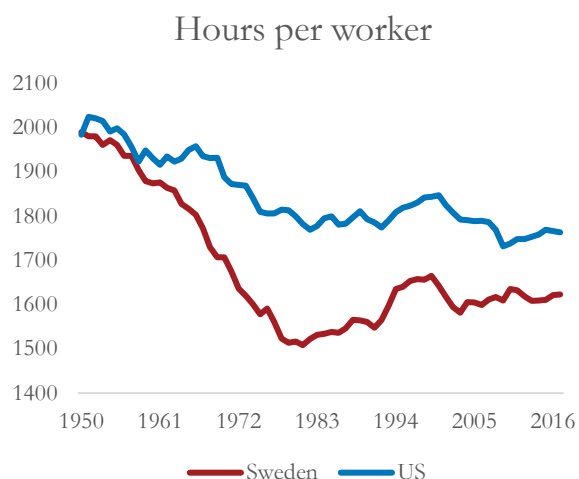


Figure 1: Sweden and U.S. average annual hours per worker, 1950–2016

Notes: Source: GGDC Total Economy Database for total hours worked per worker in nonfarm establishments

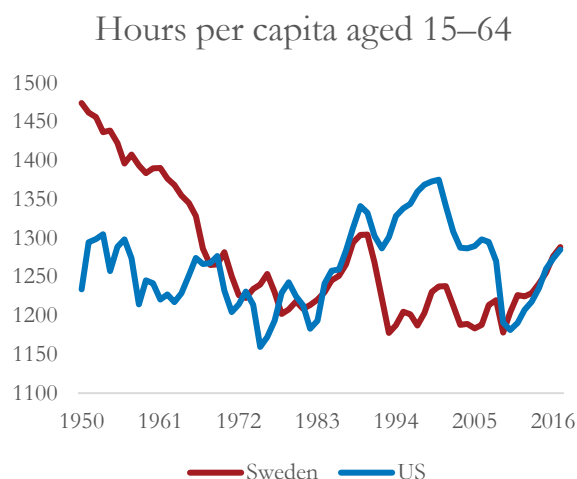


Figure 2: Sweden and U.S. average annual hours per capita aged 15–64, 1950–2016

Notes: Source: GGDC Total Economy Database for total hours worked and OECD for the data on population aged 15–64

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