

EPRN funding application:

The Heterogeneous Costs of Exchange Rate Fluctuations

Søren Hove Ravn

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Introduction: Movements in exchange rates between international currencies affect the overall macroeconomic performance of different countries. However, the impact of exchange rate fluctuations is not homogenous across households within a country: Compared to households at the upper end of the income distribution, low-income households generally tend to allocate a larger share of their consumption expenditures to imported goods, such as food or clothing. This leaves these households more exposed to exchange rate fluctuations (Fajgelbaum and Khandelwal, 2016; Cravino and Levchenko, 2017). As a result, the political choice between floating and fixed exchange rates has quite different implications for households at different steps of the income distribution. Yet, this aspect is absent from contemporary macroeconomic models of open economies like the Scandinavian countries. **The current project therefore aims to develop a macroeconomic model of a small open economy, such as Denmark, featuring heterogeneous effects of exchange rate fluctuations across households, and employ this model to investigate the economic implications of the choice of exchange rate regime for households belonging to different income groups.**

Policy relevance: Existing macroeconomic models stipulate that a typical household is better off under a floating than under a fixed exchange rate (see, e.g., Galí and Monacelli, 2005). However, this conclusion may well be different for households at the bottom of the income distribution. Due to their higher vulnerability to fluctuations in exchange rates, these households are likely to gain more from a fixed exchange rate regime. A quantitative investigation of this hypothesis may therefore challenge conventional wisdom about core issues in macroeconomics, and thus potentially obtain a very high scientific impact. It will also be relevant for the design of macroeconomic policies, including the choice of exchange rate regime itself. My findings will be particularly interesting from a Scandinavian perspective, given the differences between Denmark's fixed exchange rate and the floating exchange rates of Norway and Sweden, and given the high importance traditionally attached to distributional issues in these countries. I therefore intend to communicate and disseminate my results through seminars, conferences, and public debate in a Scandinavian context.

Background and related literature: Until recently, macroeconomists tended to disregard income inequality in analyses of monetary policy and exchange rate fluctuations. Correspondingly, the vast majority of models in monetary economics used to feature a single, representative household, thus abstracting from questions related to income inequality by construction. Along with the increasing attention devoted to distributional issues in society in recent years, however, the redistributive effects of monetary policy have become the topic of speeches by economic policymakers (e.g., Bernanke, 2015; Draghi, 2016) and empirical studies by academic economists (e.g., Coibion *et al.*, 2017). An emerging literature has employed models with heterogeneous households in analyses of the effects and transmission mechanisms of monetary policy (e.g., Gornemann *et al.*, 2016; Auclert, 2017; Kaplan *et al.*, 2017; and Luetticke, 2017). These studies have not only found that monetary policy does indeed have important redistributive effects. They have also shown that this redistribution is an inherent part of the way monetary policy affects macroeconomic aggregates such as total employment or Gross Domestic Product. More generally, this class of models is currently establishing itself as the state-of-the-art in modern macroeconomics, offering a more comprehensive picture of the effects of economic policies than previous approaches.

Project description: The first part of this project aims at extending these models along two key dimensions in order to account for heterogeneous exchange rate exposure: *First*, most of these studies focus on the United States, which is typically modeled as a “closed” economy. This leaves no role for exchange rate fluctuations; an inseparable aspect of monetary policy in open economies. *Second*, and more fundamentally, while this class of models allows for household heterogeneity in income and wealth, and by consequence in the *level* of consumption, it features no heterogeneity in the *composition* – and thus the *price* – of consumption baskets across households. By implication, all households face the same inflation rate. However, recent empirical studies have found that the amount of variation and dispersion in inflation rates across households is large (Argente and Lee, 2016; Jaravel, 2016; and Kaplan and Schulhofer-Wohl, 2016). Changes in exchange rates are one important source of such variations.

To construct a model encompassing these aspects, I envisage an open-economy model in which domestic households consume both imported and domestically-produced goods. The share of expenditures allocated to imported products will differ across households. In particular, the share of imported goods in a given household’s consumption basket will depend on this household’s place in the income distribution, with poorer households devoting a larger share of their total expenditures to imports. In developed countries, low-income households primarily consume tradeable *goods* (e.g.,

food and clothing), which are often imported from abroad, whereas high-income households are more likely to spend their money on non-tradeable *services* produced domestically (e.g., restaurant visits and domestic help). This has been documented in a number of empirical studies (e.g., Fajgelbaum and Khandelwal, 2016; Cravino and Levchenko, 2017). A crucial step is to estimate the expenditure share of imported goods in the consumption baskets of households in different income groups in Denmark (and the other Nordic countries). This share will determine the relative exposure to exchange rate movements of different households. To this end, I combine data from four different sources: sectoral trade flows from the World Input-Output Database covering 56 sectors in 43 countries; quality-adjusted prices of goods from 185 countries estimated by Feenstra and Romalis (2014); income levels across countries from the Penn World Tables; and Gini coefficients for the Nordic countries, available from the World Income Inequality Database.

A model living up to these requirements will push the research frontier both conceptually and methodologically. No previous studies have developed models allowing for the effects of exchange rate fluctuations to vary systematically across the income distribution. Thus, the quantitative significance of these variations remains unexplored. From a methodological viewpoint, existing models with heterogeneous households allow for heterogeneity in *quantities* (e.g., consumption), but not in *prices*, and thus inflation rates. This is convenient when solving the model. However, given the recent empirical focus on heterogeneities in inflation rates, extending theoretical models to account also for this aspect of inequality is an important next push.

Once the model is developed, the second part of my project aims at using the model to revisit a long-standing debate in macroeconomics. Standard macroeconomic theory holds that a typical household is better off in a country with a flexible exchange rate, such as Sweden, than in one with a fixed rate, such as Denmark. This result emerges from the canonical model of monetary policy in a small open economy developed by Galí and Monacelli (2005). Their finding echoes the classical view of Friedman (1953), who argued that exchange rates should be allowed to adjust freely in response to country-specific shocks. If so, they may act as “shock absorbers” and reduce fluctuations in economic activity. The model developed in the first part of this project allows me to add a novel and important dimension to this classical discussion: While the typical household may be better off under a flexible exchange rate, I will analyze whether the same is true for households in different income groups. As mentioned above, there are good reasons to believe that a flexible exchange rate may be particularly harmful to low-income households: By adopting a fixed exchange rate policy, a country effectively surrenders its monetary policy as a stabilization tool in exchange for eliminating fluctuations in its exchange rate. To a typical household, the costs associated with the former outweigh the benefits

arising from the latter. However, these costs and benefits are not evenly distributed across households. Due to their higher exposure to changes in exchange rates, low-income households suffer larger fluctuations in their household-specific inflation rates, and therefore tend to bear a disproportionate share of the costs associated with a flexible exchange rate. All else equal, low-income households are therefore likely to be better off under a fixed exchange rate, while the opposite is true for high-income households. If this hypothesis turns out to have merit, it will challenge conventional macroeconomic wisdom, as well as the policy prescriptions emerging from it.

Timeline and budget: I plan to start working on the project in February 2018. The initial focus will be on designing and solving the macroeconomic model, which is particularly challenging due to the presence of a large number of heterogeneous households. During this crucial phase of the project, I have been invited to visit Professor Wouter Den Haan at the London School of Economics (LSE) for a period of three months. Professor Den Haan is a world-leading expert within a range of macroeconomic topics, including the solution of models with heterogeneous agents. As described in his official invitation letter (attached), he is enthusiastic about the project. Having access to discuss my work with him (and other faculty members at the LSE) on a regular basis during this period is of key importance for the project, and will undoubtedly have a huge impact on the quality of the final product. I therefore apply for funding to cover the costs and research time associated with this visit (see attached budget). Upon solving the model, the next step is to estimate the import shares of households in different income groups. I expect this process to last throughout the summer of 2018. I will carry out the theoretical analysis for the second subproject in the fall of 2018, after which I can start writing up the two working papers. I expect to have first drafts of these in the spring of 2019.

Output and publication potential: The goal is to write and publish two single-authored academic papers targeted towards top-ranked international scientific journals. In particular, the analysis of whether low-income households are generally better off under a fixed exchange rate should have a good chance at a top-5 economics journal such as the *American Economic Review* or the *Review of Economic Studies*. Existing studies on the heterogeneous effects of monetary policy have recently been published in (or are currently at the revise-and-resubmit stage at) the very best and most prestigious journals in economics (e.g. Gornemann *et al.*, 2016; Cravino and Levchenko, 2017; Kaplan *et al.*, 2017). Given that this project pushes the research frontier along both the theoretical and methodological dimensions, it seems realistic to publish the results in similar top-ranked journals.

References:

- Argente, D., and M. Lee, 2016, Cost of Living Inequality during the Great Recession, *Journal of the European Economic Association*, revise and resubmit.
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- Coibion, O., Gorodnichenko, Y., Kueng, L., and J. Silvia, 2017, Innocent Bystanders? Monetary Policy and Inequality in the U.S., *Journal of Monetary Economics*, 88, p. 70-88.
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- Galí, J., and T. Monacelli, 2005, Monetary Policy and Exchange Rate Volatility in a Small Open Economy, *Review of Economic Studies*, 72, p. 707-734.
- Gornemann, N., K. Kuester, and M. Nakajima, 2016, Doves for the Rich, Hawks for the Poor? Distributional Consequences of Monetary Policy, *Econometrica*, revise and resubmit.
- Jaravel, X., 2016, The Unequal Gains from Product Innovations: Evidence from the US Retail Sector, *Quarterly Journal of Economics*, revise and resubmit.
- Kaplan, G., B. Moll, and G. Violante, 2017, Monetary Policy According to HANK, *American Economic Review*, forthcoming.
- Kaplan, G., and S. Schulhofer-Wohl, 2016, Inflation at the Household Level, *Journal of Monetary Economics*, forthcoming.
- Lueticke, R., 2017, Transmission of Monetary Policy with Heterogeneity in Household Portfolios, working paper, University College London.



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To the Economic Policy Research Network, Copenhagen, Denmark.

Dear Madam/Sir,

I hereby confirm my invitation and commitment to host Soren Hove Ravn in the Department of Economics at the London School of Economics and Political Science (LSE) for a period of 3 months in the spring of 2018.

Soren Hove Ravn is an Assistant Professor of economics at the University of Copenhagen since 2014. His research interests are in the field of macroeconomics, more specifically in modeling the interactions between financial markets and the real economy, and in studying the implications for economic policy thereof. He has a strong publication record, as well as some very promising projects in the pipeline. I have seen him present some of his more recent work in conferences, and have found it both interesting and innovative.

In his next project, Soren plans to study the diverse effects of exchange rate fluctuations across households in a heterogeneous-agents model. I find Soren's project description highly promising, and I am convinced that he has identified a novel and important contribution to the literature. While a representative-agent model implies that a flexible exchange rate generates higher welfare than a fixed-rate regime, Soren will investigate to what extent this conclusion changes for households at different places of the income distribution. In particular, low-income households rely predominantly on imported goods, and are therefore disproportionately exposed to exchange rate fluctuations. It thus seems likely that these households would gain from a fixed exchange rate, whereas high-income households are more likely to be better off under a floating rate. This offers an intriguing perspective on a long-standing debate in macroeconomics. Furthermore, I believe that the type of model Soren has in mind represents an important contribution also from a methodological viewpoint, in

particular in allowing for household-specific inflation rates. I find Soren's project particularly interesting in light of my own work on heterogeneous-agents models, and I am looking forward to discussing the project with him throughout his stay at the LSE.

During his visit, Soren will have access to research facilities of the LSE, and he will be able to benefit from our extensive seminars and workshops in his field of interest. Our department is one of the leading institutions in the world in the field of economics, and I am confident that his visit and the collaborations he will form over this period will be very rewarding. Soren will also be able to participate in and contribute to the activities of the Centre for Macroeconomics, a research centre encompassing economists from a range of UK-based universities and the Bank of England.

To conclude, I strongly support Soren Hove Ravn's application, and I will be happy to host him at the LSE in the spring of 2018.

Kind regards,

A handwritten signature in black ink, appearing to read 'Wouter J. Den Haan', enclosed within a large, loopy, oval-shaped flourish.

Wouter J. Den Haan
Professor of Economics

The Heterogeneous Costs of Exchange Rate Fluctuations

Budget for the project

All amounts in Danish Kroner

Type	Price	Number	Total expenses
Buy-off, Søren Hove Ravn, 1 month	44.255	3	132.765
Rent, 1-bedroom apartment, London, 1 month ¹	16.000	3	48.000
Return ticket, Copenhagen-London, economy class	2.500	1	2.500
Total expenses			183.265
Overhead (20 pct. of the above)			36.653
Total amount applied for			219.918

1: For short-term rentals, a 1-bedroom apartment in London costs around £ 1.800 per month.

SØREN HOVE RAVN

Personal

Born: October 22, 1984

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Website: <https://sites.google.com/site/sorenhoveravn/>

Current Employment

Since 2014: Assistant Professor, Department of Economics, University of Copenhagen.

Other Current Positions

Since 2016: Consultant and visiting scholar, Danmarks Nationalbank.

Previous Employment

2013 – 2014: Economist, Research Division, Danmarks Nationalbank.

Education

2013: **PhD in Economics**, University of Copenhagen.
Adviser: Henrik Jensen.
Committee: Ulf Michael Bergman, Ester Faia, Francesco Furlanetto.
Visiting PhD student, Bocconi University, Italy (Spring 2010) and Oxford University, UK (Fall 2010).

2011: **M.Sc. in Economics** (Cand. polit.), University of Copenhagen.
Visiting Graduate Student, Northwestern University, USA (2007-08).

2007: **B.Sc. in Economics**, University of Copenhagen.

International Peer-reviewed Publications:

Endogenous Credit Standards and Aggregate Fluctuations, *Journal of Economic Dynamics and Control*, 2016, vol. 69, p. 89-111.

Asymmetric Monetary Policy Towards the Stock Market: A DSGE Approach, *Journal of Macroeconomics*, 2014, vol. 39(A), p. 24-41.

The Effects of Fiscal Policy in a Small Open Economy with Fixed Exchange Rates, *Open Economies Review*, 2014, vol. 25(3), p. 451-476 (with Morten Spange, Danmarks Nationalbank).

Has the Fed Reacted Asymmetrically to Stock Prices?, *The B.E. Journal of Macroeconomics*, 2012, vol. 12:1 (Topics), article 14.

Other Publications:

Essays on the Interactions between Financial Markets, the Macroeconomy, and Economic Policy. PhD dissertation, 2013, *PhD series*, no. 158, Dept. of Economics, University of Copenhagen.

Rules versus Dictation: A Taylor Rule for Denmark, *Danish Journal of Economics* (Nationaløkonomisk Tidsskrift), 2012, vol. 150(1), p. 22-42.

Macroeconomic Effects of Fiscal Policy, *Danmarks Nationalbank Quarterly Review*, 2012, 3rd Quarter.

What Drives the Business Cycle in a Small Open Economy? Evidence from an Estimated DSGE Model of the Danish Economy, *Danmarks Nationalbank Working Papers*, No. 88, 2013 (with Jesper Pedersen, Danmarks Nationalbank).

A Taylor Rule for Fiscal Policy in a Fixed Exchange Rate Regime, *Danmarks Nationalbank Working Papers*, No. 90, 2014 (with Jesper Pedersen).

Working Papers:

Changing Credit Limits, Changing Business Cycles (with Henrik Jensen and Emiliano Santoro), *CEPR Discussion Papers 10462*. Revise and resubmit, *European Economic Review*.

Leverage and Deepening Business Cycle Skewness (with Henrik Jensen, Ivan Petrella, and Emiliano Santoro), *CEPR Discussion Papers 12239*. Submitted.

Work in Progress:

Luxury Goods Inflation over the Business Cycle (with Martín Gonzalez-Eiras)

Fiscal Policy and House Prices (with Peter Lihn-Jørgensen)

Kinks and Credit-Cycle Gains (with Henrik Jensen and Emiliano Santoro)

Grants and Awards

- 2015: EPRN research grant: *Credit Demand, Credit Supply, and the Business Cycle* (with Henrik Jensen and Emiliano Santoro), approx. EUR 40,000.
- 2010: Winner of the *Nordic Council of Ministers'* prize for economic policy papers.
- 2010: Winner of the *Best Paper Award*, 3rd Ruhr Graduate School of Economics Doctoral Conference, Bochum, Germany.
- 2009: Recipient of the *Mikael Kristiansen Prize* for studies at Oxford University.

Teaching Experience

- Fall 2017: Lecturer, *Advanced Macroeconomics*, M.Sc. course, Dept. of Economics, University of Copenhagen.
- Summer 2013, 2014, 2015, 2016: Lecturer, *Theoretical and Empirical Foundations of DSGE Modeling*, M.Sc. course, Dept. of Economics, University of Copenhagen.
- Spring 2015, 2016, Fall 2016, 2017: Lecturer, *Macroeconomics B* (undergraduate), Dept. of Economics, University of Copenhagen.
- Fall 2014, 2015: Lecturer, *Macroeconomics 3*, M.Sc. course, Dept. of Mathematical Sciences, University of Copenhagen.
- Fall 2013: Lecturer, *Advanced Macroeconomics: Business Cycle Fluctuations* (seminar for M.Sc. students), Dept. of Economics, University of Copenhagen.
- Fall 2008, Spring 2009: Teaching Assistant, *Macroeconomics 3* (advanced undergraduate course), Dept. of Economics, University of Copenhagen.

Supervision of Students

- PhD level: Peter Lihn-Jørgensen (in progress, expected graduation 2017, co-supervisor), Marcus Mølbak Ingholt (in progress, expected graduation 2018, co-supervisor).
- M.Sc. and B.Sc. level: Supervisor for more than 50 students since 2014.

- Refereeing Activity** American Economic Journal: *Macroeconomics*, *Macroeconomic Dynamics*, *Journal of Macroeconomics*, *Open Economies Review*, *Sustainability*, *Danish Journal of Economics* (*Nationaløkonomisk Tidsskrift*).

Communication I serve as an occasional expert on macroeconomic topics in Danish newspapers (e.g., Berlingske Tidende, Information) or Danish national television (e.g., DR Detektor). I am active on Twitter, primarily about economic issues (twitter.com/S_HoveRavn).

Languages Danish (native), English (fluent), German, Italian (proficient), French, Swedish (basic).

Invited Seminars and Conferences

2017: 23rd International Conference on Computing in Economics and Finance, New York; Lund University.

2016: Danmarks Nationalbank; 3rd Annual BCAM Workshop on Macroeconomics, Birkbeck University, London; 7th IIBEO Workshop, Università degli Studi di Sassari; 10th Nordic Summer Symposium in Macroeconomics, Ebeltoft; 12th Dynare Conference, Banca d'Italia.

2015: Bank of Finland.

2014: Danish Economic Society; DIW Berlin; Danmarks Nationalbank; Danish Econometric Society; 20th International Conference on Computing in Economics and Finance, Oslo; 8th Nordic Summer Symposium in Macroeconomics, Laugarvatn; Copenhagen Business School.

2013: Danmarks Nationalbank; Workshop on Macroeconomics, Financial Frictions and Asset Prices, Università degli Studi di Pavia; University of Oxford; University of Copenhagen.

2012: Danish Economic Society; University of Copenhagen; Danmarks Nationalbank.

2011: Danmarks Nationalbank; University of Copenhagen; 5th Nordic Summer Symposium in Macroeconomics, Smögen; EDGE Doctoral Workshop, Bocconi University, Milan; DGPE Doctoral Workshop, Sandbjerg.

2010: 3rd Ruhr Graduate School of Economics Doctoral Conference, Bochum; Zeuthen Workshop on Macroeconomics, Copenhagen; Bocconi University, Milan; EcoMod conference, Istanbul; 16th International Conference on Computing in Economics and Finance, London; Oxford University.

2009: DGPE Doctoral Workshop, Ebeltoft.

(Updated November 2017)