Sudden stops, social security, and lumpy investment with variable utilization

Three essays in macroeconomics

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Die Fakultät hat diese Arbeit am 15. Oktober 2015 auf Antrag der beiden Gutachter Prof. Dr. Klaus Neusser und Prof. Dr. Pierpaolo Benigno als Dissertation angenommen, ohne damit zu den darin ausgesprochenen Auffassungen Stellung nehmen zu wollen.

Preface

This thesis is a collection of three separate papers. Although all essays consider current macroeconomic topics, they differ considerably in both content and methodology. The motivation for this variety was mostly educational. One of my personal goals of doing a PhD was to learn and apply various tools that are nowadays used at the research frontier in macroeconomics. Only by doing both empirical and theoretical research, I had the chance to achieve this goal. Moreover, while specialization in a field is undoubtedly important, the PhD appears to be a too early point in a researcher's career to focus only on a very narrow topic. For these reasons, I decided to write three chapters in different areas of macroeconomics and apply various current methods, including Bayesian estimation, Markov switching models, the sufficient statistics approach (in the sense of Chetty, 2009), heterogeneous agents models, and dynamic programming.

This thesis has greatly benefited from the support of several people. I am very grateful for their assistance in many respects. I would like to express my deepest gratitude to my advisor Klaus Neusser for his support, guidance and encouragement during my thesis. I would also like to thank my co-advisor, Pierpaolo Benigno, who has kindly agreed to take part in the thesis committee. Parts of this thesis have been written with co-authors. I would like to thank Stefan Leist and Kaspar Wüthrich for their excellent, fruitful collaboration in Chapter 2 and 3, respectively. I greatly enjoyed working and discussing with them. I am also grateful to the faculty at the Department of Economics of the University of Bern. In particular, I would like to thank Fabrice Collard, Harris Dellas, Klaus Neusser and Dirk Niepelt for helpful

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Chapter 1

Introduction

Current knowledge on macroeconomic issues results from both theoretical and empirical research. These methodological approaches complement each other: Empirical studies have established facts giving rise to new theories, and hypotheses from theoretical models have been validated empirically. Both approaches have their assets and drawbacks. Large-scale theoretical models allow for an analysis of various research questions, including the economic impact of shocks, the role of frictions for economic behavior, or welfare evaluations of policy changes. However, these models require assumptions on functional forms and deep parameters characterizing technology and preferences, which are often hard to justify and to test in an empirically compelling manner. Empirical research, on the other hand, is useful to estimate statistical relationships, identify economic regularities, or test theoretical implications. However, the results may be of limited applicability because the estimates are usually inherently local (i.e., the effects are identified for certain countries or sets of policy variables only) and not policy-invariant. Moreover, welfare evaluation in general necessitates the use of a model. In the light of these advantages and disadvantages, economic questions are preferably analyzed both theoretically and empirically.

Acknowledging the value of both theoretical and empirical research, this thesis aims at enhancing consistency between the two. It relaxes critical assumptions and analyzes whether existing knowledge withstands the test of

using a more flexible approach. Different strategies are applied to improve on
consistency between theory and empirics: Chapter 2 proposes an econometric
framework that is in line with theoretical knowledge while Chapter 4 extends
a theoretical model to be more consistent with empirical facts. Chapter 3 uses
an approach that inherently links theoretical structural models and reduced-
form estimation. The key idea of this *sufficient statistic approach* is to derive
a model-based formula for a quantity of interest under few assumptions and
to estimate the ingredients of this formula empirically.[1] A full specification
and parameterization of the structural model can be avoided because the
quantity of interest does in general not depend on all functions or parameters
of the model.

While the chapters of this thesis all make an effort in enhancing
consistency between theoretical and empirical research, they considerably
differ with respect to the research field. The chapters contribute to three
current, important areas of macroeconomics: Chapter 2 estimates the impact
of sudden stops in capital flows on GDP, an issue that has recently received
increasing attention in international economics. The chapter proposes an
estimation strategy that is multivariate, non-linear and uses a novel way to
identify sudden stops. The econometric framework is chosen consistently
with theoretical work on sudden stops. In particular, the non-linear nature
of sudden stops is accounted for. Chapter 3 proposes a method for welfare
analysis of pay-as-you-go social security systems. In the light of the rising
ratio of retirees to workers, reforms of the pension systems are an important
and urgent domestic policy issue in many advanced economies. The chapter
analyzes both the generation-specific and the overall welfare consequences of
permanent changes in payroll taxes used to finance transfers in pay-as-you-
go systems. The proposed method follows the sufficient statistic approach,
which combines theory and empirics: A formula for the welfare effect is
derived based on an overlapping generations model under few parametric
assumptions. The formula is implemented empirically using impulse response
functions and predicted growth rates. Chapter 4 analyzes firms' investment

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[1]See for example Chetty (2009) for a review.

behavior and its macroeconomic implications when capital adjustment is subject to fixed costs and utilization is variable. The macroeconomic relevance of capital adjustment frictions and the resulting microeconomic lumpy investment behavior has been subject to debate. The chapter extends a lumpy investment model by variable utilization. This extension substantially augments firms' incentives for lumpy investment due to reserve capacity building. The chapter numerically derives firms' optimal decision rules and analyzes the macroeconomic effects of the enhanced lumpiness. Allowing for variable utilization renders the theoretical model more consistent with empirical facts: Chapter 4 also presents empirical evidence for the importance of capacity utilization for firms' investment decisions.

The subsequent paragraphs summarize each chapter's motivation, research question, methodology and main findings.

Chapter 2.[2] Sudden stops in capital flows and their negative effects on GDP have recently received renewed attention because quantitative easing has led to considerable capital flows to emerging markets. These capital flows could suddenly stop or even reverse, for example when US monetary policy becomes more restrictive. Besides for emerging markets, the impact of sudden stops in capital flows is also relevant for other countries. Greece or Russia provide recent examples. Chapter 2 estimates the impact of sudden stops on GDP. We propose a multivariate, non-linear econometric framework and a novel strategy to identify sudden stops, thereby addressing potential shortcomings of previous, related empirical studies. Specifically, we employ a Markov switching vector autoregression with a latent variable indicating whether the economy is in a sudden stop regime. In addition, we identify a structural net capital inflows shock using the maximum fraction of forecast error variance approach. This framework allows to estimate both the impact of rare switches to the sudden stop regime and regime-dependent responses to net capital inflows shocks. We provide results for Mexico and Indonesia. The findings show that (i) sudden stops are associated with regime switches and have significantly negative and permanent effects on GDP, (ii) impulse

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[2]This chapter was co-authored by Stefan Leist.

responses to net capital inflow shocks are regime-dependent with economies being more vulnerable to shocks during the sudden stop regime, and (iii) there were different main drivers of the output decline in historical sudden stop episodes.

Chapter 3.[3] Many developed countries rely on pay-as-you-go systems for old-age provision. Because of demographic changes such as the growing fraction of retirees, reforms of these social security systems are increasingly discussed. Previous studies have typically analyzed the welfare effects of different policies using structural overlapping generations models. While this approach provides a flexible framework for welfare analysis, it requires parameterizing and calibrating the structure of the model, which involves many assumptions on functional forms and deep model parameters. Chapter 3 introduces a complementary method for welfare analysis of pay-as-you-go systems. Using an overlapping generations model, we derive a simple formula for the welfare consequences of a permanent marginal change in the payroll tax rate used to finance transfers to retirees. The formula is valid under weak assumptions about the deep structure of the economy. In particular, our approach requires neither a full specification of preferences and technology, nor knowledge of the individual savings behavior. We show that the formula can be implemented using reduced form estimates of a vector autoregression model and predictions for key quantities of the model. We apply our method to evaluate the current pay-as-you-go social security system in the United States. The results suggest that an increase in the payroll tax rate along with higher pension benefits leads to an overall welfare increase due to welfare gains of today's retirees, but it also induces a distributional conflict as today's workers and future generations are negatively affected. A decomposition reveals the predominant channels through which welfare is influenced: Besides the direct channel through different taxes and benefits, induced changes in factor prices (i.e., wage and interest rates) are important determinants of the welfare effect. In contrast, only minor welfare consequences result from adjustments in labor.

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[3]This chapter was co-authored by Kaspar Wüthrich.

Chapter 4. The impact of microeconomic investment frictions and firm heterogeneity on macroeconomic dynamics are subject to ongoing research. Fixed capital adjustment costs incentivize firms to invest in a lumpy fashion, i.e., to reduce the frequency of capital adjustments and to increase their size. While there is extensive evidence for lumpy investment at the microeconomic level, its macroeconomic consequences are not evident: Some studies suggest that lumpy investment is basically irrelevant for macroeconomics while others find that it substantially alters the response of aggregate investment to aggregate technology shocks. These previous studies, however, have underestimated investment lumpiness. Their assumption of constant capital utilization reduces firms' incentives to undertake large investments as it prevents reserve capacity building. Chapter 4 considers an environment with variable utilization and fixed capital adjustment costs and analyzes firms' optimal decisions and the macroeconomic implications thereof. Specifically, I use a dynamic stochastic general equilibrium model with heterogeneous firms and aggregate technology shocks and I numerically compute firms' optimal decisions on investment, utilization and labor demand. Subsequently, I simulate the economy and analyze the resulting moments of macroeconomic aggregates and impulse response functions to technology shocks. The results show that if capacity utilization is allowed to vary, firms optimally undertake larger investments and leave parts of the new capital stock idle for some periods, thereby reducing the frequency of investment activities. Thus, there is reserve capacity building and additional investment lumpiness. Moreover, variability of utilization alters the cyclical properties of firms' optimal decisions. However, all these findings appear to be of minor macroeconomic relevance: Moments and impulse responses of macroeconomic quantities change similarly when variable utilization is introduced in a lumpy or in a frictionless model. Some of the theoretical findings are confirmed by new empirical evidence presented in Chapter 4. Using firm-level panel data, I estimate the impact of capacity utilization on firms' investment decisions. The findings show that higher utilization rates increase (decrease) the probability of positive (negative) capital adjustments. In addition, the results reveal significant interaction effects with GDP growth.

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Selbständigkeitserklärung

Ich erkläre hiermit, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Koautorenschaften sowie alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe o des Gesetzes vom 5. September 1996 über die Universität zum Entzug des aufgrund dieser Arbeit verliehenen Titels berechtigt ist.

Bern, 23. September 2015

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