

UNIVERSITÄT HAMBURG

DISSERTATION

ZUR ERLANGUNG DES WISSENSCHAFTLICHEN DOKTORGRADES (DR. RER. POL.) AN
DER FAKULTÄT WIRTSCHAFTS- UND SOZIALWISSENSCHAFTEN DER UNIVERSITÄT
HAMBURG

**Essays on Private Household Debt:
Borrowing Behaviour, Insolvency Laws and
Macrodynamics.**

Vorgelegt von

Nadja KÖNIG

Dipl. Oec.

Universität Hohenheim,

Stuttgart

Eingereicht am:

27. Januar 2016

Erstgutachter: Prof. Dr. Ingrid Größl

Zweitgutachter: Prof. Dr. Domenico Delli Gatti

© 2016 Nadja König

Diese Fassung ist ausschließlich für die Zwecke der Prüfungskommission zu verwenden. Die Verbreitung im Internet oder eine anderweitige Veröffentlichung ist in Hinsicht auf Lizenzvereinbarungen mit Dritten bezüglich einzelner Teile der Dissertation untersagt. In Hinblick auf die Veröffentlichungspflicht nach § 12 der Promotionsordnung der Fakultät Wirtschafts- und Sozialwissenschaften der Universität Hamburg vom 24. August 2010 verpflichtet sich der Doktorand, fristgemäß eine geeignete Fassung bei der Graduate School einzureichen.

*"The goal of science is to make the wonderful and the complex understandable and simple
- but not less wonderful."*

Herbert Simon (Sciences of the Artificial, 1996)

Acknowledgements

This dissertation was written when I was working as a research and teaching assistant at the chair of “Money and Credit” of Prof. Dr. Ingrid Größl at the University of Hamburg. Writing this dissertation would not have been possible without the support of many people. I am deeply grateful to my supervisor Prof. Dr. Ingrid Größl for her guidance and encouragement as well as for giving me the opportunity to work in an inspiring, friendly, and strongly research-oriented environment. She attracted my attention to interdisciplinary approaches leading finally to agent-based economics, which is the methodological foundation of this thesis. I also want to thank her for highly valuable feedback and support which improved my work substantially.

Moreover, I want to express my gratitude to Prof. Dr. Domenico Delli Gatti for being my second supervisor, for inspiring me to work on agent-based economics and for the hospitality I experienced during the time I spent at Università Cattolica in Milano.

I am also very indebted to Prof. Dr. Ulrich Fritsche for being my advisor and giving helpful support in every respect throughout the process of working on this thesis.

Furthermore, I would like to thank my colleagues and friends, Eva Arnold, Artur Tarasow, Katharina Glass, Lena Dräger, Martin Sauber, Annemarie Paul, Luise Görge, Roberta Colavecchio, Jan-Oliver Menz, and Philipp Poppitz for being great office mates and for enlightening discussions which led to many good research ideas. I also want to thank Claudia Ranft for having an answer to almost every (administrative) problem. For mental support, I particularly wish to thank Andrea Rentrop, Eva Arnold and Ines Dietrich who were always available to talk over a cup of tea (or a glass of wine). Further, I want to thank Andreana, Augustin, Daniel and Mareike, who were always there when Paris was too far away.

Last but not least, I am truly thankful to my family: To my parents for setting up all preconditions for this dissertation and to my brother Robin for his motivating and optimistic manner. Most of all, I am especially grateful to my boyfriend Marcus for always supporting and encouraging me during the course of this dissertation and for his endless patience when I was distracted from life and had to spend evenings or weekends at the desk.

Hamburg, January 2016

Contents

Acknowledgements	iii
Contents	iii
List of Figures	vii
List of Tables	ix
Summary of the Thesis	x
Zusammenfassung der Dissertation	xii
1 Introduction	1
1.1 Introduction	2
1.2 Relevance of Household Debt	3
1.3 Determinants of Household Debt	5
1.3.1 Intertemporal Explanations	5
Consumption Smoothing:	5
Consumption Tilting:	6
Consumption Stabilising:	6
1.3.2 Social Aspects of Consumption and Borrowing Behaviour	6
1.3.3 Income Distribution	8
1.3.4 Insolvency Regulations	10
1.4 Methodology	11
1.4.1 Agent-based Modelling	12
1.4.2 Empirical Approach	13
1.5 Preview of the Thesis	13
2 Catching up with the Joneses and Borrowing Constraints -An Agent-based Analysis of Household Debt	17
2.1 Introduction	18
2.2 The Joneses Effect	20
2.3 The Model	22
2.3.1 Households	23
2.3.2 The Financial Sector	27
2.3.3 The Government	32

2.3.4	Macroeconomics	32
2.4	Simulation	33
2.4.1	Computational experiments	33
2.4.2	Parameter settings	34
2.4.3	Results	35
2.4.3.1	The model economy without credit constraints	35
	Absence of the Joneses effect (scenario 1.1 =2.1 =3.1):	35
	Accounting for a Joneses effect (scenario 1.2 and 1.3):	36
2.4.3.2	The model economy with loose credit constraints	37
	Accounting for a weak Joneses effect (scenario 2.2):	37
	Accounting for a strong Joneses effect (scenario 2.3):	38
2.4.3.3	The model economy with tight credit constraints	39
	Accounting for a weak Joneses effect (scenario 3.2):	39
	Accounting for a strong Joneses effect (scenario 3.3):	40
2.5	Summary and Conclusion	41
3	Household Debt and Macrodynamics - How do Income Distribution and Insolvency Regulations interact?	43
3.1	Introduction	44
3.2	Literature Review	46
3.3	The Model	50
3.3.1	Overview	50
3.3.2	Income Distribution	52
3.3.3	Insolvency Regulations	54
3.3.4	Consumption Dynamics of Insolvent Households	55
3.3.5	Banks	56
3.3.6	Aggregation	57
3.4	Simulation	58
3.4.1	Calibration and Computational experiments	58
3.4.2	Results	59
	3.4.2.1 The Role of Income Distribution in a Creditor Friendly Economy	59
	3.4.2.2 The Role of Income Distribution in a Debtor Friendly Economy	62
	3.4.2.3 Debtor versus Creditor Friendly Economies	66
3.5	Summary and Conclusion	66
4	Personal Insolvency Dynamics in Germany and the UK - A SUR-TAR Approach	68
4.1	Introduction	69
4.2	Literature on Personal Insolvencies	70
4.3	On the Link between Financial Systems, Insolvency Laws and Household Debt	73
4.4	Background on Personal Insolvency Regulations	75
4.4.1	Personal Insolvency Laws in Germany	76
4.4.2	Personal Insolvency Laws in the UK	77
4.4.3	German versus UK Personal Insolvency Procedures	79
4.5	Data and Descriptive Statistics	79

4.6	Empirical Analysis	85
4.6.1	Factor Analysis	85
4.6.2	Dynamics of Personal Insolvencies	88
	Results for Insolvency Petitions:	89
	Results for Actual Insolvencies:	94
4.6.3	Interpretation of Results	94
	Persistence of Insolvencies:	94
	Reaction to Business Cycle Developments:	96
4.7	Conclusion	97
A	Appendix to Chapter 2	99
B	Appendix to Chapter 2	101
C	Appendix to Chapter 2	104
D	Appendix to Chapter 3	106
E	Appendix to Chapter 3	115
F	Appendix to Chapter 4	124
G	Appendix to Chapter 4	130
	Selbstdeklaration	147
	Eidesstattliche Versicherung	148

List of Figures

2.1	GDP times series without Joneses effect	35
2.2	Lending Variables, without credit constraints, $\gamma_2 = 0.15$ and $\gamma_2 = 0.8$. . .	35
2.3	GDP for Varying Joneses effects (scen. 1.2 and 1.3), without credit lines .	37
2.4	Lending variables and deposits, loose credit constraints	38
2.5	Lending Variables and Deposits, strict credit constraints	39
2.6	GDP for varying Joneses effects (scen. 2.2 and 2.3), loose credit lines . .	40
2.7	GDP for varying Joneses effects (scen. 3.2 and 3.3), strict credit lines . . .	40
3.1	Income at t=1, Cumulative Generalised Pareto Distribution	60
3.2	Kernel density of the distribution variable η	61
3.3	GDP - Creditor friendly regime (Moving averages), Generalised Pareto Distribution, $\gamma_2 = 0, 3$	63
3.4	GDP - Debtor friendly regime with moral hazard (Moving averages), Gen- eralised Pareto Distribution, $\gamma_2 = 0, 4$	65
4.1	Screeplot after factor loading of eigenvalues for (a) DE and (b) UK	85
4.2	Loadingplots for (a) DE and (b) UK	87
A.1	Model overview	100
A.2	Transmission Channels of the Model	100
B.1	Consumption Heterogeneity	102
C.1	Changing Income Distribution (Uniform), without credit constraints . . .	105
E.1	Income distribution across countries	120
E.2	Wealth distribution across countries	121
E.3	Income distribution across countries	121
E.4	Wealth Distribution across countries, Lorenz curve	122
E.5	Household finance 1	122
E.6	Household finance 2	123
F.1	Real GDP	125
F.2	Unemployment Rate	125
F.3	Inflation Rate	126
F.4	HP Index (Pre-owned dwellings), quarterly differences.	126
F.5	Total Individual Insolvencies in the UK by Regions	127
F.6	Insolvency Petitions, Actual Insolvencies	127
F.7	Debt-to-Income Ratio	128
F.8	Long-term-to-short-term Debt Ratio	128

F.9 Interest Rates	129
F.10 Interest Rate related Ratios	129

List of Tables

2.1	Initial Parameter Values for the Simulation of the Model	34
2.2	Parameter Variation for different Scenarios	34
2.3	Aggregate Household Debt	36
2.4	Model Output: Macroeconomic Time Series	36
2.5	Average Number of Household Insolvencies in the Different Scenarios (median values)	36
3.1	Initial parameter Values for the Two Model Economies	60
3.2	Simulation Results: Creditor Friendly, Debt relief after 8 years ($\gamma_2 = 0.3$)	63
3.3	Simulation Results: Debtor Friendly, Debt relief after 3 years ($\gamma_2 = 0.4$) .	65
4.1	Features of consumer insolvency laws across countries	78
4.2	Descriptive Statistics, Germany and the UK	83
4.3	Rotated Factor Loadings	87
4.4	Model SUR TAR (Insolvency Petitions)	91
4.5	Model SUR TAR (Insolvency Petitions)	92
4.6	Model SUR TAR (Actual Insolvencies)	93
E.1	HFCS - Countries of Analysis, calculation with survey sample weights, unconditional on holding debt	117
E.2	Features of consumer insolvency laws across five selected EU countries . .	118
G.1	Description of Variables	131

Summary of the Thesis

This thesis evaluates the increase in private household debt in during the last decades and its link to macroeconomic dynamics. While conventional economic theory considers household borrowing as an instrument to smooth consumption over time, and more importantly excludes the possibility of default, recent events seem to render this explanation insufficient. The chapters of this thesis explore alternative drivers for household overindebtedness both theoretically and empirically. The introductory chapter outlines this motivation and provides an overview of the chapters to follow.

The second chapter investigates the role of social factors and borrowing constraints for household debt and resulting macroeconomic dynamics. For this purpose, an agent-based model of household-bank relationships where households borrow to finance consumption expenditure is developed. It is assumed that financial decisions of households are driven by social influences. In this regard, heterogeneity of disposable income and wealth and hence, their distribution play an essential role. Another crucial feature of the analysis is that overextended households can default on their debt. As a result of several computational experiments, strong social comparison behaviour with respect to other households consumption induces a downward pressure on aggregate consumption, and as it constitutes a major source of Keynesian economic stimulus, it causes a downward pressure on GDP. The reason for this development is not only a large number of low income households that gets caught in a poverty trap, but also because high income households adjust consumption downwards. In the presence of borrowing constraints though, low income households are restrained from overborrowing which reduces the volatility of macroeconomic time series. This effect is particularly pronounced when households have strong preferences to keep up with other households consumption.

The third chapter extends this model and focuses on the interaction of insolvency regulations and income distribution and their effect on macroeconomic dynamics. Empirical studies underline that the distribution of income and wealth is heavily skewed and follows a power law. Therefore, a Generalised Pareto distribution is assumed. To capture the existing large variety of insolvency laws across countries, a debtor friendly and a creditor friendly regime are opposed. These regimes differ with respect to the duration until residual debt is discharged and hence with respect to incentives to borrow excessively. The

simulation results point to higher aggregate debt and a higher number of defaults under the pro-debtor policies. Higher debt-financed consumption in turn generates higher levels of GDP, yet at the price of negative effects on growth due to overborrowing households at the lower end of the distribution. The opposite is true for the pro-creditor regime, where positive growth rates are observed by preventing households from taking up unsustainable levels of debt ex ante.

The last chapter analyses the dynamics of personal insolvencies over the business cycle empirically, focusing on the event of the recent economic downturn that followed the 2007-2008 financial crisis. In doing so, Germany and the UK, which differ with respect to their financial systems as well as their approaches to deal with overindebted individuals are explored. The chapter contributes to the relatively sparse literature on personal defaults in Europe, which is characterised by a multitude of different insolvency procedures, most importantly regarding debt relief tools. Overextended individuals face quite a number of obstacles in Germany until they may eventually be discharged from pre-insolvency debt. On the contrary, the regulatory framework in the UK is more lenient by not only providing a number of options for debtors to manage their liabilities but also by offering debt relief tools that allow for a relatively fast discharge. The results of the empirical analysis provide evidence for a higher persistence of insolvencies in the UK, suggesting that it takes longer for insolvencies to return to their previous level after an external shock. Furthermore, macroeconomic and financial conditions seem to affect only British households, leaving German households untouched, which is also true for the recession.

Zusammenfassung der Dissertation

Die vorliegende Dissertation befasst sich mit dem Anstieg der Verschuldung von Privathaushalten in der jüngsten Vergangenheit und deren Beziehung zu makroökonomischen Größen. In der volkswirtschaftlichen Theorie wird die Verschuldung von Privathaushalten als Instrument für Konsumglättung modelliert. Dies liefert jedoch nicht nur keine Erklärung für den enormen Anstieg der Verschuldung, sondern lässt auch die Möglichkeit von Insolvenzen außer Acht. Die folgenden Kapitel gehen auf diese Kritik ein und untersuchen alternative Erklärungsansätze für dieses Überschuldungsphänomen, sowohl theoretisch als auch empirisch. Das Einleitungskapitel motiviert die Themenwahl und gibt einen Überblick über die einzelnen Kapitel der Arbeit.

Das zweite Kapitel beschäftigt sich mit der Rolle von sozialen Faktoren und Kreditrestriktionen bei der Verschuldung von Privathaushalten und untersucht daraus resultierende makroökonomische Dynamiken. Mithilfe von agentenbasierten Methoden wird ein System modelliert, in dessen Zentrum die Beziehung zwischen Privathaushalten und Banken steht. Finanzielle Entscheidungen von Haushalten werden unter anderem auf Basis sozialer Interaktion getroffen. In diesem Zusammenhang spielen die Heterogenität von verfügbarem Einkommen und Vermögen sowie deren Verteilung eine zentrale Rolle. Ein weiterer wesentlicher Punkt der Analyse ist, dass überschuldete Haushalte insolvent gehen, sobald sie ihre Schulden nicht mehr bedienen können. Mithilfe von Simulationen werden Experimente durchgeführt, die ergeben, dass eine starke soziale Orientierung an anderen Haushalten negative Auswirkungen auf den aggregierten Konsum hat, was insbesondere auf eine erhöhte Anzahl von Insolvenzen zurückgeführt werden kann, und dass viele Haushalte mit Niedrigeinkommen in eine Verschuldungsfalle geraten. Mit dem Konsum als essentielle Größe, schlägt diese Entwicklung direkt auf das Bruttoinlandsprodukt durch. Kreditrestriktionen hingegen halten Haushalte mit Niedrigeinkommen von einer Überschuldung ab und reduzieren dabei die Volatilität makroökonomischer Zeitreihen. Dies ist besonders ausgeprägt in Szenarien mit starker sozialer Konsumorientierung.

Im dritten Kapitel wird dieses Modell erweitert und der Fokus auf das Zusammenspiel von Insolvenzgesetzen und Einkommensverteilung gelegt. Empirisch evident ist, dass die Einkommens- und Vermögensverteilung stark nach rechts geneigt ist und einer exponentiellen Verteilung folgt. Daher wird diese explizit mithilfe einer "Generalisierten

Pareto-Verteilung" modelliert. Um die Vielzahl an weltweit existierenden Insolvenzgesetzen zu berücksichtigen, werden ein schuldnerfreundliches und ein gläubigerfreundliches Regime gegenübergestellt, welche sich in Bezug auf die Entschuldungsdauer sowie die Anreize zu einer Überschuldung unterscheiden. Die Ergebnisse weisen auf eine höhere aggregierte Verschuldung und eine höhere Anzahl von Insolvenzen in einer schuldnerfreundlichen Modellökonomie hin. Dies wiederum führt über einen höheren schuldenfinanzierten Konsum zu einem höheren Bruttoinlandsprodukt, allerdings auf Kosten von negativen Wachstumseffekten, was auf die exzessive Verschuldung der unteren Einkommenschichten zurückgeführt wird. Diese laufen wiederum Gefahr, in eine Schuldenfalle zu geraten. Unter gläubigerfreundlichen Gesetzen hingegen werden positive Wachstumsraten erzeugt, da nicht kreditwürdige Haushalte von Anfang an davon abgehalten werden, sich zu überschulden. Des Weiteren erhöht sich die Anzahl von Privatinsolvenzen mit zunehmender Schiefe der Einkommensverteilung, unabhängig von den Insolvenzgesetzen.

Im letzten Kapitel wird die Dynamik von Privatinsolvenzen über den Konjunkturzyklus hinweg analysiert. Hierbei steht die Rezession, die auf die Finanzkrise von 2007-2008 folgte, im Mittelpunkt. Die Analyse erfolgt für Deutschland und das Vereinigte Königreich, da sich beide Ökonomien zum einen in Bezug auf ihre Finanzsysteme und zum anderen in Bezug auf ihre Möglichkeiten des Schuldenmanagements von Privathaushalten unterscheiden. Dieses Kapitel trägt zur Literatur über Verbraucherinsolvenzen bei. Europa ist von einer Vielzahl an unterschiedlichen Gesetzen und Regelwerken gekennzeichnet, insbesondere im Hinblick auf mögliche Entschuldungsmechanismen. So müssen überschuldete Privathaushalte in Deutschland relativ viele Hindernisse überwinden, um letztendlich von ihren Restschulden befreit zu werden. Im Vereinigten Königreich hingegen können Schuldner aus einer Vielzahl an Optionen des Schuldenmanagements wählen; eine mögliche Entschuldung erfolgt schneller und unbürokratischer als in Deutschland. Die Ergebnisse einer empirischen Analyse weisen auf eine stärkere Persistenz von Insolvenzen im Vereinigten Königreich hin. Dies bedeutet, dass es nach einem externen Schock länger dauert, bis die Insolvenzen wieder ihr vorheriges Niveau erreicht haben. Außerdem scheinen Schuldner im Vereinigten Königreich sehr viel stärker auf äußere finanzielle und makroökonomische Bedingungen zu reagieren als deutsche Schuldner.

Chapter 1

Introduction

1.1 Introduction

Most advanced economies experienced an unprecedented build-up of private household debt in the past decades. That this trend can be dangerous has been demonstrated by the rising number of personal insolvencies. Especially during recessions, debtors tend to be more vulnerable to negative shocks. The recent economic and financial downturn has challenged conventional wisdom about household debt and has highlighted new questions.

While conventional economic theory considers household borrowing merely as an instrument to smooth consumption over time and most importantly, excludes the possibility of defaults, it seems insufficient to explain recent developments. This thesis takes a broader perspective and seeks to enhance the understanding of household borrowing concentrating on three important variables, namely social factors, income distribution and insolvency regulations, asking for the relationship of household debt with each of these variables. It contains three papers, which examine the link between household debt and macroeconomic developments both theoretically and empirically. The theoretical part relies on agent-based modelling, as it constitutes a perfectly suitable tool to study the interaction of heterogeneous agents possibly causing coordination failures and hence to examine the relevance of social factors, income distribution and insolvency regulations for household borrowing. By means of simulation techniques, macroeconomic time series evolve over time resulting from interacting agents on the micro level. This allows to study both cross-sectional as well as macroeconomic dynamics. The empirical part investigates the causal effect of macroeconomic developments on household overindebtedness. As a recurrent theme, apart from household debt itself, it accounts for heterogeneity across countries by looking at different legal and financial systems.

The remainder of this introductory chapter is structured as follows. The subsequent Section 1.2 discusses the relevance of household debt. Section 1.3 presents determinants of household borrowing, accounting for standard explanations in economic theory and presenting alternative variables as enquired in this thesis. Section 1.4 outlines the methodological approach. And Section 1.5 provides a short preview of the thesis.

1.2 Relevance of Household Debt

Household borrowing can enhance economic welfare by allowing smoother consumption paths over time. In this respect, access to credit and a well functioning financial intermediation have been associated with economic prosperity and economic development (e.g. Rajan and Zingales, 1998; Bekaerta et al., 2005)¹.

However, in a world where household debt is used excessively to finance consumption, considerable problems arise. Overindebtedness and the inability to repay debt forces many individuals to file for bankruptcy. Apart from individual welfare losses, feedback effects on the whole economy can be severe.

Research on household finance and the link to the macroeconomy used to be relatively sparse compared to research on firms. Households were rather considered as the suppliers of funds to the banking system, while firms received the attention as debtors. Yet, household borrowing is of paramount importance for macroeconomic outcomes as households use financial markets increasingly to finance consumption. During recessionary times, consumption may even foster economic recovery as it constitutes an important element of Keynesian economic stimulus (Cynamon and Fazzari, 2008; Mian and Sufi, 2010). At the same time, unsustainable levels of debt can trigger and prolong a crisis (e.g. Mian and Sufi, 2014). According to the IMF (2012), household credit increased faster than any other segment of total credit in the past decades. And because banks' balance sheets comprise a large share of personal credit, households' insolvency may pose a threat to financial system stability.

The surge in household debt in the last decades spared hardly any developed economy. For instance in France household debt increased from 66 % of disposable income in 1995 to 105 % in 2014, in Italy it more than doubled from 38 % to 90 % over the same time period, and Spain documents an increase from 80 % of disposable income in 1999 to 141% in 2014. In the UK personal debt increased from 114 % in 1998 to 156 % in 2014 and in the US debt went up from 98 % to 113 % over the same period. The most extreme increases were reported for the Netherlands where household debt increased from already high values of 148 % in 1995 to 274 % in 2014. Surprisingly, Germany is an exception with a slight decrease from 97 % of disposable income in 1994 to 94 % in 2014. During

¹There is a large body of literature on the liberalisation of financial markets and growth (Demirgüunt and Detragiache, 1998; Ranciere et al., 2006). This is not the focus of this thesis though.

the financial crisis of 2007-2008, household debt exceeded levels from 2014 only in the UK with 183 %, in Spain with 150 % and the US with 134 % (all refer to 2008) (OECD, Statistics database)². Chatterjee and Gordon (2012) explain the decline of outstanding debt in the US with the increase in the number of personal insolvencies. As required by law, remaining debt was discharged from overextended households and removed from creditors' balance sheets. For the case of Spain, credit tightening is considered as the main determinant that reduced essentially newly issued debt after the crisis. And for the UK, relatively high rates of post-crisis inflation are predominantly deemed responsible for the reduction of real debt levels (Garotte et al., 2013). In the other mentioned economies, household debt continued to grow steadily.

Yet high burdens of debt are not necessarily associated with a threat to financial fragility. The structure of debt in an economy is an important determinant for its sustainability. High levels of unsecured debt or credit card debt should rather give rise to concerns than mortgage loans and other types of secured credit. An economy's debt structure also tends to be related to the degree of market orientation. For instance, Demirgünt and Detragiache (1998) associate higher financial fragility with more liberalised market economies. Jentzsch and Riestra (2008) provide an overview of household credit markets in Europe and the US putting forward a similar argument: they conclude that credit markets in economies that remained subject to stricter regulations are more stable than economies that went through a more distinctive process of market liberalisation. The classification into market-based and bank-based economies is closely connected to this line of reasoning (see Allen and Gale (2001) for a survey).

Another strand of literature assigns to institutions such as creditor rights, a country's legal origin, mechanisms of information sharing between lenders, etc. an essential role for the development of private credit markets and hence, the level of debt in an economy (e.g. LaPorta et al., 1997, 1998; Djankov et al., 2007; Duygan-Bump and Grant, 2009; Jappelli et al., 2013). Well developed institutions for information sharing between lenders and well-functioning legal systems are positively associated with the amount of credit. That said, the role of institutions and the degree of liberalisation for personal debt are not mutually exclusive, they are rather complementary and closely connected to each other. The subsequent section provides an overview of determinants of household debt.

²<https://data.oecd.org/hha/household-debt.htm>.

1.3 Determinants of Household Debt

Household borrowing behaviour is approached from an intertemporal perspective in economic theory. As this view can only insufficiently explain the observed increase in household debt, this thesis enquires into possible alternative explanations. This section aims to give a brief overview on determinants of household debt including both intertemporal approaches as well as alternatives covered in this thesis.

1.3.1 Intertemporal Explanations

In standard economic theory private household debt derives from a rational household's decision problem on optimal consumption. The basic idea is that households dislike fluctuations in consumption spending over time. Whether a household saves or borrows depends on expectations about future income. Furthermore, as it is accounted for a household's time preference, current consumption is valued higher than future consumption. These intertemporal approaches can be grouped into three motives: consumption smoothing, consumption tilting and consumption stabilising.

Consumption Smoothing: The classical explanation for households to borrow is that they aim to smooth consumption relative to expected income over time (Modigliani and Brumberg, 1954; Friedman, 1957). There are two different interpretations how households smooth their consumption paths. In the life cycle model, Modigliani and Brumberg (1954) argue, that young households typically possess only little wealth and hence borrow to finance consumption and/or housing investment. With growing age income rises and savings are accumulated. Wealth culminates just before retirement allowing households to deplete accumulated savings thereafter. Accordingly, debt is determined by age in this framework as only young households should hold debt. In the permanent income hypothesis by Friedman (1957), age is not essential to the analysis. According to this theory, households take into account their permanent expected income when deciding about consumption expenditure. In case current income deviates from expected average future income, households take up debt or accumulate assets depending on whether current income falls short of or exceeds expected income. In the face of income shocks, an agent's consumption remains therefore stable over time.

Consumption Tilting: An alternative explanation for household borrowing is consumption tilting. The marginal rate of substitution between current and future consumption choice represents the price of future consumption expressed in terms of today's consumption. Hence, if future utility is discounted at the same rate as the market interest rate, a household will be indifferent between consumption and saving. Put differently, if the rate of subjective time preference and the real rate of return on assets coincide, today's consumption equals future consumption (Bagliano and Bertola, 2007). Accordingly, when the rate of time preference exceeds the real rate of return, a household borrows to finance consumption and when it falls short, a household saves.

Consumption Stabilising: In this framework households borrow to stabilise consumption. According to Grössl and Fritsche (2007b) households intend to manage non-diversifiable risk by saving, but have to take up debt in case accumulated assets are insufficient to protect themselves against occurring risks. Further work capturing the idea that households seek to limit their exposure against adverse shocks by accumulating savings refers to a “precautionary savings” motive (Leland, 1968; Sandmo, 1970; Browning and Lusardi, 1996; Lusardi, 1998) or “buffer-stock saving” (Carroll, 1997).³ Hence, the only reason to take up debt in this framework, is to manage risk.

Despite the extension of the life-cycle framework by risk, the key idea remains: households form intertemporal plans aimed at adjusting their consumption preferences over time accordingly. Moreover, none of these frameworks allows for the option of households to default, and it is assumed that outstanding debt is always redeemed at the end of a planning horizon.⁴ All so far mentioned concepts can therefore not explain the empirically observed increase in personal insolvencies following the run-up in household debt. Alternative causes are suggested in the following sections.

1.3.2 Social Aspects of Consumption and Borrowing Behaviour

In the context of household debt, social aspects play a role inasmuch as households are willing to take up debt out of social motives to finance consumption. That social

³Contrary to these approaches, Grössl and Fritsche (2007b) investigate the role of money as a stock of value in the light of low market interest rates.

⁴In such an environment credit constraints function only as an instrument to prevent households from realising their welfare optimum (e.g. Zeldes, 1989; Deaton, 1989; Ludvigson, 1999).

aspects matter for households' consumption decision has a long history. It dates back to Thorstein Veblen in the nineteenth century who argued that individuals seek to signal their social status through the consumption of "luxury goods", the so called conspicuous consumption (Veblen, 1899). About half a century later Duesenberry (1949) formalised the relative income hypothesis pointing to a household's income as the main criterion of comparison. According to Duesenberry's theory, an individual derives satisfaction from a given level of consumption that depends on a relative rather than an absolute level.

Nonetheless, neoclassical economic theory which dominated in the second half of the twentieth century relies on an optimising atomistic agent who is characterised by perfect rationality and who is indifferent about others' behaviour. Recent insights from behavioural economics contradict these notions. A number of studies provide evidence that agents behave rather boundedly rational as put forward by Simon (1959). The basic idea is that individuals apply simple behavioural rules to cope with an uncertain future. In this regard, others' behaviour can strongly influence such rules and hence, economic and social decision making (see for instance Kahneman and Tversky, 1982; Tversky et al., 1990; Kahneman, 2003; Ariely, 2008, 2009). Note that this concept differs from pure status-seeking in the sense of Veblen (1899), which may also be rational.

Based on these insights, macroeconomic models increasingly attempt to account for behavioural aspects and try to include bounded rationality. This comprises agent-based models, network models, but also the mainstream dynamic stochastic general equilibrium (DSGE) models extended by heuristics (e.g. Grauwe, 2008).⁵ In particular, agent-based and network models are very suitable to account for agents' social and economic environment.

The relevance of social aspects in general and comparison effects in particular, has also been recognised by Akerlof (1997), who proposes a reference-dependent utility model, arguing that social status and social distance matter depending on whether individuals identify themselves with a social reference group. In later work, Akerlof and Kranton (2000) developed the concept of "Identity Economics"⁶, arguing that an agent's utility depends on its social identity (with respect to a social reference group). In their model an agent's utility increases if it manages to keep up with this social identity and decreases

⁵Further deviations from perfect rationality in mainstream models include the concept of rational inattention (Sims, 2003) and sticky information (Mankiw and Reis, 2001a,b, 2006).

⁶See also (Akerlof and Kranton, 2002, 2005, 2010).

otherwise. Cynamon and Fazzari (2008) use this concept to explain the consumption boom in the US preceding the recent recession. Specifically, they point to the importance of social influences such as group interactions and the media creating reference points. It is assumed that since households are continually exposed to social interaction, consumption preferences evolve endogenously over time. According to their theory, institutional changes over the past three decades encouraged debt-financed consumer spending, resulting in changing consumption norms. The idea of comparison effects has also been accounted for by Frank et al. (2014). Rather than accounting for fixed reference points though, they model individual reference points through upward-looking consumption behaviour and demonstrate the formation of expenditure cascades caused by rising inequality. All these studies account for social aspects by considering positional effects.

Empirical evidence on comparison effects is relatively sparse compared to the growing rich theoretical work in this field, mostly due to the lack of data. It can generally be grouped into two types: experimental research and research investigating survey data. Concerning the first, Alpizar et al. (2005) show in a laboratory experiment with US students that relative consumption matters, and that women and students with economic majors are particularly prone to positional effects. In a similar experiment, Carbone and Duffy (2014) find evidence that individuals look specifically at the average when deciding about their own consumption. As regards the second type of research, recent work stems from Schmid and Drechsel-Grau (2013) and Drechsel-Grau and Schmid (2014) who investigate relative consumption patterns for the US and for Germany, respectively, reporting upward-looking consumption preferences. Their findings have two essential implications: first, comparison effects constitute an important part of households' consumption and saving decisions and second, households in the lower percentiles of the income distribution are particularly prone to upward-looking consumption behaviour.

1.3.3 Income Distribution

Income distribution matters for household debt insofar as individuals concentrating in the lower and middle percentiles of the distribution may take up debt to finance expenditure (e.g. Debelle, 2004; Barba and Pivetti, 2009).

The link between overindebtedness and income distribution has become particularly prominent since the 2007-2008 financial crisis. The crisis originated in the US, where it was preceded by an increase in private household debt as well as an increase in inequality (Iacoviello, 2008; Mian and Sufi, 2010; Bordo and Meissner, 2012; vanTreeck, 2014; Piketty, 2014). Several researchers point to a relation between these phenomena (Rajan, 2010; Atkinson and Morelli, 2010), arguing that lenders extended credit at unsustainable levels, even to non-creditworthy low income households. According to this supply-side perspective, this lending boom has not only been supported by monetary policy through keeping interest rates at low levels, but also by political authorities as they preferred the extension of credit at low rates over fiscal redistribution fearing to lose votes (Ahlquist and Ansell, 2014; Dobbie and Song, 2014). The demand-side perspective argues that increasing inequality forced households at the bottom of the income distribution to engage in debt-financed consumption due to social pressure and the desire to keep up with other households earning higher incomes. In this regard, Cynamon and Fazzari (2008, 2013) point to changes in consumption norms. Krueger and Perri (2005) report that consumption inequality increased much less than income inequality pointing to an increase in debt-financed consumption.

According to both views, a shift in the income distribution, which leads to relatively lower incomes of the bottom percentiles and/or relatively higher incomes of the top percentiles, triggers soaring household credit demand as poor households seek to keep up with their richer peers.⁷ This is demonstrated in a simple meaningful model by Frank et al. (2014). They show how rising inequality leads to expenditure cascades if each individual seeks to imitate the consumption level of others ranking on the income scale just above them. This mechanism has also been applied in an agent-based model by Cardaci (2014). Further agent-based models studying the role of personal income distribution include Fischer (2013) and Russo et al. (2013). They all report rising financial instability as a result of increasing inequality.

Empirical work focusing on the increase in income and wealth inequality in developed

⁷Not only a desire to consume more than one can afford, but also social pressure and a fear of social exclusion may induce such behaviour.

economies⁸ has increased, particularly since the outbreak of the recent crisis (e.g. Atkinson and Morelli, 2010; Piketty, 2014, to name a few)⁹. Research for the US (e.g. Iacoviello, 2008; Attanasio et al., 2012) and for Europe in general (Brandolini, 2007; Franzini, 2009; Fredriksen, 2012) reports a shift in the income distribution alike. Rising inequality also has important implications for economic growth and stability in general as it impedes an efficient use of resources and may dampen investment (e.g. Berg and Ostry, 2011; Dabla-Norris et al., 2015). In the context of household debt, rising inequality matters when the above mentioned supply-side and demand-side factors promote unsustainable borrowing, thereby increasing the risk of financial and economic instability.

1.3.4 Insolvency Regulations

Insolvency regulations matter for personal debt as they may influence a household's default decision, and knowing this, the tendency to over-borrow, as well as lenders' willingness to extend credit.

As a response to the rising number of households suffering from an overwhelming debt overhang, many European countries gradually began to include insolvency procedures for private individuals in their insolvency regulations. Since the implementation of personal insolvency laws in the 1990s there have been numerous reforms and a continuing debate takes place about an alignment of European insolvency regulations (e.g. Niemi, 2012; Wessels, 2012). There is a large variety of regulatory approaches to deal with the overindebtedness of private households across the world. Insolvency laws range from the complete absence of personal insolvency procedures, over variations in the duration of the restructuring period, to the garnishment of wealth and income. Among the most debtor friendly countries are the US and the UK, as overextended individuals not only have the opportunity to get discharged from their obligations shortly after default, but they can also choose among a variety of options to dealing with their liabilities (see McKenzie Skene and Walters (2006) for the UK and White (2006a,b) for the US). As opposed to the Anglo-Saxon countries, where consumer bankruptcy has a long history, personal insolvencies in Continental Europe attracted increasing attention only in the

⁸For the case of the BRIC countries (Brasil, Russia, India, China) Berthold and Brunner (2011) report a decrease in inequality.

⁹In particular, Thomas Piketty's bestseller, "Capital in the Twenty-First Century" triggered a huge public debate. He argues that if the rate of return on wealth exceeds the rate of growth, inequality increases as inherited wealth grows at a higher rate than earned wealth (Piketty, 2014).

last two decades (e.g. Niemi-Kiesilainen, 1997). Most Continental European countries are classified as rather creditor friendly, yet recent reforms have similarly pushed insolvency regulations towards more pro-debtor directions (e.g. Gerhard, 2009).

Research establishes a positive correlation between pro-debtor insolvency regulations and default rates (Povel, 1999; Fay et al., 2002; White, 2007a). Indeed, leniency of insolvency regulations is highly controversial. While debtors who suffer from bad luck such as severe health problems, divorce or sudden unemployment, are provided with an insurance by benign regulations offering a release of pre-insolvency debt, the risk of moral hazard remains. From a creditor's perspective it is desirable to force repayment or seize collateral. In this regard, the degree of creditor friendliness of an insolvency law also influences the extension of credit.

Moreover, insolvency regulations tend to be closely connected to an economy's financial system and hence to the prevailing contract culture and credit conditions (e.g. Berkovich and Israel, 1999; Dobbie and Song, 2014). Market-based economies, such as the UK and the US, typically have bankruptcy options that allow a relatively fast discharge for overextended debtors, whereas economies with bank-based financial systems, such as Germany and Japan, tend to be less lenient with debtors. The role of changing credit environments driven by reforms in the financial sector or legal frameworks which are liable for the increase in personal insolvencies in general, are discussed by White (2007a) and Livshits et al. (2010).

1.4 Methodology

This section gives an overview on the methodology applied in this thesis. Following widespread empirical evidence that household debt cannot be explained by means of standard theories, this thesis investigates household debt by applying alternative approaches both theoretically and empirically. In particular, the focus is theoretical and relies on an approach that is relatively new to economics, namely agent-based modelling. The empirical approach relies on a SUR TAR model.

1.4.1 Agent-based Modelling

Standard macroeconomic models typically rely on the rational optimising representative agent.¹⁰ Economies are assumed to be stable and hence gradually converge to some unique steady-state equilibrium. While these assumptions allow to derive an optimal solution of a given problem, key features that define an economic (and social) system, such as heterogeneity, interaction between agents and deviations from rational expectations, are excluded by its assumptions. A growing literature therefore promotes the idea to model the economy as a complex adaptive and evolving system which is able to overcome these shortcomings (Tesfatsion, 2006; Delli Gatti et al., 2008, 2011; Kirman, 2010; Fagiolo and Roventini, 2012)¹¹.

Agent-based modelling is a useful tool to model complex adaptive systems, which rely on a multitude of agents interacting with each other and their environment. This leads to emergent phenomena on the macro level that may again feed back on the micro level. Behavioural rules are assigned to agents and they therefore follow some more or less established heuristics. Heterogeneity constitutes a key assumption which in turn renders the coordination of individual plans as extremely complex and complicated giving rise to a multitude of possible outcomes. In particular, the possibility of coordination failures driving the economy towards enduring disequilibria gains attention. The output of the models are simulated time series. Aggregate variables are thus not simple projections from the micro level as in a neoclassical representative agent framework, they rather comprise emergent properties accounting for path-dependencies.¹²

Two chapters in this thesis are based on agent-based modelling techniques. A stock flow consistent agent-based macroeconomic model is constructed, where the interaction between heterogeneous households and a bank are key to the analysis. Implications of the

¹⁰Also the original dynamic stochastic general equilibrium model (DSGE). However, growing research in this field relaxes the strict assumptions by assuming for instance sticky information (Mankiw and Reis, 2001a,b, 2006) or rational inattention (Sims, 2003).

¹¹Complex Systems have long been applied in natural sciences to model natural systems such as ecologies and immune systems. They are also used in social sciences to model for instance societies (e.g. Miller and Page, 2007). Hence, agent-based modelling can act as a bridge between disciplines and thus facilitate interdisciplinary cooperation (Axelrod, 2006).

¹²The emergence from the bottom-up contradicts the top-down approach underlying the representative agent where it is assumed that differences cancel themselves out and that the average may be a good predictor of the whole. The recent crisis has shown that this is not always the case, rendering this approach misleading.

above outlined potential drivers are studied in computational experiments. The agent-based modelling techniques allow to account for social factors, for a changing income distribution and the possibility of default.

1.4.2 Empirical Approach

The empirical part of this thesis is based on a macroeconomic time series analysis and investigates the dynamics of personal insolvencies in Germany and the UK, as their approaches to dealing with overindebted private households are very different.

In order to prevent multicollinearity in the regressions, an exploratory factor analysis is done with a range of independent variables that possibly influence personal insolvencies. Exploratory factor analysis detects correlations between the variables under scrutiny and bundles them into fewer factors (Backhaus et al., 2010).

For the regressions, a SUR TAR model is applied. The SUR (seemingly unrelated regression) is applied to capture correlations of shocks across equations. While dependent and independent variables remain country-specific, i.e. each equation is estimated separately, the correlation of the error terms accounts for shocks that have an effect on both countries. The TAR (threshold autoregressive) model belongs to the class of nonlinear time-series models and was first introduced by Tong (1978, 1983). Despite their simplicity, these models are able to capture nonlinear dynamics in time series. For the purpose of the analysis a threshold is set to account for changing dynamics of personal insolvencies during the recession which was triggered by the 2007-2008 financial crisis.

1.5 Preview of the Thesis

This thesis contributes to the literature on household debt in general and on the role of its sustainability in particular, exploring drivers such as social aspects, income distribution and insolvency procedures. The link between resulting household debt and macroeconomic implications is explored in the theoretical part (Chapter 2 and Chapter 3). The empirical part investigates the dynamics of personal insolvencies and their link to business cycle dynamics, specifically looking at the recent recession (Chapter 4).

An explanation for the above described drivers of household debt requires modelling techniques that account for heterogeneous agents, interaction and nonlinearities. For this purpose an agent-based model of household borrowing is developed, accounting for the link between income heterogeneity, social factors and borrowing regulations (Chapter 2 and Chapter 3). It is assumed that household borrowing affects macroeconomic dynamics through two different channels: aggregate debt and the number of household defaults in an economy (for an overview of the model and an overview of the linkages between the variables see Appendix A). As regards the first channel, three factors influence the amount of aggregate debt in the model. The first one is income heterogeneity as a pre-determinant for households to follow a social orientation such as keeping up with the Joneses. Put differently, if all households are equal with respect to their income and wealth, social comparison behaviour drops out and within the framework of the model loans are no longer required to finance consumption. The second determinant influencing aggregate debt in the model economy is banks' credit supply. To account for this, household specific credit constraints are imposed. The third factor is the insolvency regime. Depending on whether an economy is creditor or debtor friendly, households have different incentives to take up high levels of debt. In line with the literature (e.g. White, 1998), households in a rather creditor friendly economy are more reluctant to demand loans for consumption purposes. Concerning the second channel, the underlying income distribution affects defaults. A distribution skewed to the right increases not only the proportion of low income households, but also decreases the relative size of their incomes, hence promoting a higher demand of credit. Both channels have an effect on resulting macroeconomic dynamics obtained through simulations.

Chapter 2 explores the link between social norms of consumption according to which households want to catch up with the Joneses in the sense of Abel (1990) (Joneses effect) and varying borrowing constraints for resulting macroeconomic dynamics. It is assumed that households want to catch up with average consumption and credit constraints are imposed to prevent excessive borrowing of low income households. Different scenarios are analysed by means of computational experiments. The results can be summarised as follows: While the strength of the Joneses effect has implications for the level of the time paths of macroeconomic time series, borrowing constraints affect their volatility. In particular, a strong Joneses effect has a negative impact on economic growth, while reluctant lending reduces volatility of economic time series. Over the course of the

simulation, inequality increases as households at the bottom of the income distribution are caught in a poverty trap, resulting from the desire to keep up with their richer peers. Although high income households adjust consumption downwards towards the average, their overall wealth increases. Only an external wage shock may influence the destiny of an individual household.

Chapter 3 extends the model from Chapter 2 by modelling income distribution explicitly and enriches it by implementing different insolvency regulations. A further novelty concerns households' social consumption behaviour with upward-looking preferences in this version. Whereas the model in Chapter 2 relies on a uniform distribution of incomes, the latter assumes a Generalised Pareto Distribution to account for the empirically observed income distribution (Levy and Solomon, 1997). Again several computational experiments are conducted to explore the interplay between income distribution, insolvency regimes and household borrowing. Comparing a debtor friendly with a creditor friendly insolvency regime, which differ with respect to the duration until debt is forgiven, and the implied incentives for borrowers to demand loans, two results stand out. First, higher aggregate debt in the pro-debtor regime leads to higher levels of GDP as opposed to the pro-creditor economy. The second result refers to economic growth, which is higher under pro-creditor policies, mostly because low income households borrow less excessively than under pro-debtor policies rendering debt more sustainable. Insolvency regimes also matter for macroeconomic dynamics inasmuch as the number of defaulting households in an economy strongly affects aggregate consumption. This is predominantly due to the fact that they are excluded from credit markets and have to live on a minimum income during the insolvency period. The exclusion from credit markets is much longer under creditor friendly policies. The results further point to a higher number of defaults with increasing inequality, regardless of the insolvency regime.

Chapter 4 analyses the dynamics of personal insolvencies in Germany and the UK, focusing on the recent recession. These countries are particularly interesting as they are both member countries of the European Union, yet have completely different approaches to deal with overindebted individuals. In Germany unfortunate households who file on their debt are required to undergo a relatively long restructuring period until they eventually receive debt relief, whereas British debtors can choose proceeding out of many alternatives to manage their debt. Even under the official bankruptcy option, debt gets discharged relatively fast. In line with their different insolvency procedures, the two

countries also represent two different financial systems: the German system is rather bank-based and the UK system rather market-based. The underlying financial systems already point to different patterns of lending across countries and hence, also to different structures of debt. Specifically, this chapter enquires into the dynamics of petitions and actual insolvencies during the crisis as well as their reaction to exogeneous macroeconomic and financial conditions. The findings suggest that insolvencies are more persistent in the UK than in Germany, i.e. after an external shock it takes longer for insolvencies to return to their previous level in the UK. In both countries, the recent recession has no effect on petitions to default, but it has an effect on actual insolvencies in the UK suggesting that debtors rather opt for official procedures during recessions.

Chapter 2

Catching up with the Joneses and Borrowing Constraints -An Agent-based Analysis of Household Debt

This chapter is based on a revised version of König and Grössl (2014).

2.1 Introduction

Most developed economies have experienced an unprecedented rise in household debt in the past two decades. In microeconomic theory a household's decision on whether to borrow and how much is the solution of an inter-temporal optimisation problem. Given that the household has unlimited access to financial markets, the optimal time path of lifetime consumption opens the possibility to separate period consumption from period income. Hence, a household that wishes to consume more than its period income is free to borrow the necessary money, whereas a household with a desired level of consumption falling short of its income is provided with the possibility to invest resulting savings at a positive real interest rate. Most importantly, however, borrowers will never go bankrupt since according to the assumptions of the model, rationality implies that they will always obey their solvency constraint. Borrowing thus remains to be a temporary phenomenon and should not give rise to policy concerns. Not surprisingly, in such a world credit constraints only prevent households from realising both their individual but also an aggregate welfare optimum (Zeldes, 1989; Bacchetta and Gerlach, 1997; Ludvigson, 1999; Rubaszek and Serwa, 2012).

This approach with its emphasis on borrowings as a temporary phenomenon is obviously unable to explain the evidence of continually rising household debt with a rising number of insolvencies. And indeed financial markets are far from being complete - even in the light of financial innovations. Hence a rational household should very well take a risk of becoming insolvent into account. This holds true even if borrowers can finally expect a release from their residual debt because in most countries debt release does not follow immediately. Rather, the insolvent household has to live on some minimum income for quite a period. Therefore alternative explanations are needed which abandon the strict rationality assumption. That households are at the most boundedly rational has been already put forward by Simon (1959) and recently been confirmed by numerous studies (e.g. Ariely, 2009). The idea is that agents cannot cope with the complexity of the world and hence apply simple behavioural rules when making decisions. In line with bounded rationality is the idea that individual behaviour might significantly be influenced by social variables (see for instance Akerlof and Kranton, 2000; Cynamon and Fazzari, 2008). For the case of the US, Cynamon and Fazzari (2008) explain the increase in household debt by a change in consumption norms.

In our paper we take up this literature and argue that social influences play an important role for household borrowing. In doing so we assume that each individual household seeks to catch up with other households' consumption habits. Abel (1990) modelled such a "catching-up with the Joneses" behaviour by linking individual consumption to a lagged average of aggregate consumption. We take up this approach and examine the role of the Joneses effect as a driver of (excessive) indebtedness. In such a setting credit constraints imposed by the banking sector obtain a rather different role: Whereas they undermine optimal behaviour in the life-cycle approach¹, in our model they exert disciplinary effects upon otherwise excessive household borrowing. In particular we are interested in finding answers to the following questions:

- Given that all households in the economy follow a social orientation like catching up with the Joneses, do we observe differences in resulting household borrowing behaviours with a considerable number of households borrowing excessively?
- How can borrowing constraints discipline households in the sense of protecting them from default and how does this vary for different preferences of consumption?
- How does this in turn affect macroeconomic variables?

The first question is of interest since according to the evidence household debt is concentrated among lower income households (e.g. Barba and Pivetti (2009); Cynamon and Fazzari (2013)). Hence a social norm that is generally obeyed in a society might have different effects depending on the size of income. The second question is interesting since the possibility of household insolvency is still rather under-researched. To the best of our knowledge, it has particularly not been explored in the context of consumption norms. And lastly, we are interested in macroeconomic variables since we want to shed light on potential macroeconomic risks resulting from household debt.

We approach these questions using an agent-based computational (ABC) model. In line with the above specified criticism of the conventional model, these models aim to overcome restrictive assumptions such as rational expectations, the optimising representative agent and the conjecture that all markets clear (Fagiolo and Roventini, 2012). ABCs are characterised by a bottom-up perspective thus focusing on interactions of a multitude of heterogeneous agents at the micro level. Individual behaviour is determined by simple

¹Cp. Modigliani and Brumberg (1954)

behavioural decision rules which lead to non-linear coupling. In our model heterogeneity regarding individual incomes serves as a prerequisite for the Joneses effect.

So far household borrowing has not been a primary focus of ABC models. Rather, existing agent-based models typically neglect the link between households and banks and examine credit relationships between banks and firms instead. Delli Gatti et al. (2005) and Delli Gatti et al. (2009) study business fluctuations and their relations to bankruptcy avalanches. Moreover, a growing number of ABC models focus on the role of banks for macroeconomic stability (Ashraf et al., 2011) and on contagion in the financial system (Battiston et al., 2007, 2012). Delli Gatti et al. (2009, 2010) and Assenza et al. (2007) seek to explain the financial accelerator in an agent-based economy and Stiglitz and Gallegati (2011) focus on monetary aspects of the system.

The remainder of the paper is structured as follows. The subsequent Section 2.2 gives an overview of previous research regarding the Joneses effect. In Section 2.3, we present an agent-based model being composed of households (2.3.1), a financial sector (which comprises commercial banks and a central bank) (2.3.2), and a government (2.3.3). In Section 2.4, we simulate the model for different scenarios (computational experiments) in order to examine the research questions specified above. After describing the computational experiments (2.4.1) as well as parameter settings (2.4.2), Section 2.4.3 presents the simulation results of the respective scenarios. The paper concludes with a summary.

2.2 The Joneses Effect

Above we have already pointed to the inability of the standard model in economics to account for contextual variables. As social comparison effects are key to our analysis and we assume that households want to catch up with the Joneses, this section aims to give a brief overview on previous and related research. The idea that an agent's social environment matters for consumer behaviour is not new to economics. It dates back to the nineteenth century when Thorstein Veblen used the term conspicuous consumption to describe the desire to signal one's position in a society through consumption (Veblen, 1899). In 1949, James Duesenberry put forward the relative income hypothesis, suggesting that an individual's choice of desired consumption and savings depends on the relative income position in the economy (Duesenberry, 1949). He formalised this hypothesis in two ways, in a cross-section and a time series version. The basic notion of the former

is that consumption behaviour depends on the income of others, households identify themselves with. Typically, households with a high income relative to others will save more and consume less, whereas households with a relatively low income will consume more and save less. The time series version states that households consider their current level of income relative to their own income of the past. Higher income in the past will therefore relate to higher consumption today. However, with the revolution of rational expectations² and the representative agent, the life-cycle hypothesis by Modigliani and Brumberg (1954) and the permanent-income-hypothesis by Friedman (1957) became the dominant models of households' consumption and saving behaviour. As opposed to Duesenberry, they claim that household's wish to establish a stable path of consumption over their lifetime. Due to the unprecedented increase of household debt, particularly in the US preceding the sub-prime crisis, and the failure of traditional models to predict this, the concept of relative income and status comparisons revived. In this regard, Frank et al. (2014) argue that context strongly matters for household's consumption-saving choices. Assuming that consumption decisions are based on others consumption in the income scale just above, they demonstrate theoretically how "expenditure cascades" arise. These cascades turn to be more pronounced for higher levels of inequality. In this context, there has been a heated debate about increasing inequality as a major driver of the sub-prime crisis, especially because many households at the lower part of the income distribution have lived above their means (Rajan, 2010; Bordo and Meissner, 2012; van Treeck, 2014; Cynamon and Fazzari, 2013). What followed was an increase in the number of household defaults. As opposed to standard explanations, which include for instance financial innovations, deregulations of financial markets or demographic shifts, Cynamon and Fazzari (2008) argue that changing patterns of consumption in the past decades have been induced by changes in social norms. They emphasise particularly the role of advertising in this process.³ Schmid and Drechsel-Grau (2013) and Drechsel-Grau and Schmid (2014) follow this line of research and investigate consumption preferences empirically for the US and for Germany. For both countries, they find that upward-looking comparison effects matter. In an experimental study Carbone and Duffy (2014) confirm the relevance of interpersonal effects, yet they find that individuals care about average consumption. Recent research that is closely related to our work has been conducted

²Cp. Muth (1961); Lucas (1972), etc.

³In a subsequent paper they focus on rising inequality in this context, and find that the steep increase in household leverage was borne by the bottom 95 % of the income distribution (Cynamon and Fazzari, 2013).

by Fischer (2013), Russo et al. (2013) and Cardaci (2014). They all focus on the role of inequality and financial stability though, reporting a negative relation. Fischer (2013) models consumption as a behavioural function of disposable income, net worth and a term capturing “social consumption” which depends on a household’s income quintile. The consumption function of Russo et al. (2013) also depends on these three components, however, the social parameter enters as an exponent of wealth enabling them to study differing consumption patterns. Cardaci (2014) models expenditure cascades in the sense of Frank et al. (2014). The link between inequality and economic growth has been studied by Dosi et al. (2013). Contrary to the other studies they concentrate on functional income distribution rather than personal income distribution. Attempts to enrich the New Keynesian model with social comparison effects have also been made by a few scholars, in search for puzzles that were impossible to solve otherwise⁴. To study the equity premium puzzle, Abel (1990) formalises different kinds of utility functions, including time-separable utility functions, habit formation in the sense of Constantinides (1990) (internal habit consumption) and “Catching up with the Joneses” utility (external habit consumption). Although the concept of internal habit formation, i.e. current consumption today depends on consumption in the past, has (partly) been established in dynamic stochastic general equilibrium (DSGE) models, external habit formation is mostly excluded by the assumption of the representative agent.

2.3 The Model

In this section we present the main elements of our baseline model. We consider four kinds of agents, namely households, commercial banks, a central bank and a government. For an overview of the model see also Appendix A.

Heterogeneity enters the model through the Joneses effect resulting in disparate consumption patterns. At the beginning of each period each household receives an income and decides on the level of consumption. In the case that desired consumption falls short of available income, the household wishes to save. In the opposite case, the household wants to borrow. As one crucial assumption of our model, current consumption does not only depend on current income but in addition on the consumption behaviour of others

⁴For instance, Gali (1994) incorporates reference consumption in a static capital asset pricing model and a multi-period asset pricing model. And Uhlig and Ljungqvist (2000) study tax policies assuming catching-up-with-the-Joneses utility functions.

(the Joneses effect). Differences between households in this regard result from differences in individual incomes. This assumption is crucial to our analysis because the Joneses effect provides an explanation of why desired consumption may exceed a household's current financial funds and hence requires borrowing. As a further important component of our model we assume that households may be credit-constrained thus leading to deviations between desired and actual consumption. Hence the macroeconomic consequences of household borrowing depend on the significance of the Joneses effect as well as on the severity of credit constraints. The first component is determined by the degree of income heterogeneity in the economy, the second component depends on bank behaviour. In this regard we assume that financial supervision which in our model is exercised by the central bank, uses the severity of credit constraints as a policy variable.

Since household borrowing is at the centre of our analysis we keep the sector of firms rather rudimentary. In particular we neglect the issue of firm ownership and hence profit incomes. We assume that labour is the exclusive factor of production. We assume furthermore that in each period firms adjust current production to aggregate demand. This also implies that we abstract from changes in the price level and hence from inflation. As a consequence we do not distinguish between nominal and real variables in the model. The details of the model will be presented successively in the following sections.

2.3.1 Households

Let $h = \{1, \dots, H\}$ be the finite set of infinitely lived individual households. At the beginning of each period household h receives an income Y_{ht} which is composed of a wage income Y_{ht}^W , a non-wage income Y_t^{NW} and taxes T_{ht}

$$Y_{ht} = Y_{ht}^W + Y_t^{NW} - T_{ht}. \quad (2.1)$$

Wage income is exogenous to household h following the simple rule

$$\begin{aligned} Y_{ht}^W &= \eta_{ht} Y_t \\ \eta_{ht} &= \eta_{ht-1} + u_{ht} \end{aligned} \quad (2.2)$$

where Y_t denotes aggregate income (GDP); η_{ht} is the parameter of income distribution and hence, key to the heterogeneity of households. It adds up to one $\sum \eta_{ht} = 1$, where

u_{ht} is an idiosyncratic shock uniformly distributed on the support $(0, h_u)$ to account for uncertainties in wage setting.

Non-wage income depends on the household's financial status in the previous period. A household might have accumulated deposits, D_{ht-1} , which increase income through interest rates on deposits ($Y_{ht}^{NW} = i_{Dt-1}D_{ht-1}$). If it took up a loan, L_{ht-1} , interest rate payments reduce disposable income, ($Y_{ht}^{NW} = -i_{Lt-1}L_{ht-1}$). i_{Dt} and i_{Lt} denote the interest rates on deposits and loans, respectively. Moreover, in each period a household has to pay taxes according to $T_{ht} = \tau(Y_{ht}^W + i_{Dt-1}D_{ht-1})$.

At the beginning of period t , households receive their income and decide on their desired consumption level C_t^* . It is composed of "standard" consumption, the orientation at a reference standard (Joneses effect) and it is negatively correlated with borrowing and lending rates,

$$C_{ht}^* = \gamma_1 Y_{ht-1} + \gamma_2 \bar{C}_{t-1} - \gamma_3 i_{Dt} - \gamma_4 i_{Lt} \quad (2.3)$$

where γ_1 denotes the marginal propensity to consume out of earnings, γ_2 reveals how much households care about their relative position, γ_3 and γ_4 denote reaction coefficients for the borrowing and lending rate, respectively. $\gamma_j \in (0, 1)$ for $j = 1, 2, 3, 4$.

Following Abel (1990), we choose the average economy-wide consumption per capita of the last period

$$\bar{C}_{t-1} = \frac{1}{H} \sum C_{ht-1} \quad (2.4)$$

as a proxy for a reference standard against which individuals compare themselves. If desired consumption does not exhaust disposable income, then the household wishes to save which is achieved by accumulating financial assets, which are assumed to be composed of risk-free bank deposits and cash. In the opposite case the household is willing to borrow. We assume that the maturity of all financial contracts is one period. Moreover, a household that defaults on its debt will be refused a new loan in the following period. Rather, the household will have to repay as much of its debt as is possible. In this regard we assume the existence of a minimum of income which the law guarantees as non-pledgeable. Moreover we assume a consumer friendly insolvency law that foresees total debt release already after one period. Hence after one period households are free to apply for a new loan. Finally we rule out that a household simultaneously holds deposits or cash and borrows money. This appears plausible considering our assumption that the interest rate on loans exceeds that on deposits and that we ignore durable goods. In

our model desired and actual consumption may deviate either because the household has defaulted on its debt or because its desired borrowings exceed the amount the bank is willing lend.

Depending on their financial status, we can distinguish three types of households. For the respective types the following is true:

- **Type 1:** $D_{ht-1} = L_{ht-1} = BG_{ht} = 0$, where D_h stands for the household h 's deposits, L_h for its loans and BG_h for its cash holdings, $h = 1, \dots, H$. If the household starts period t with zero wealth but also with zero debt, its disposable income equals its wage income minus taxes according to

$$Y_{ht} = (1 - \tau)Y_{ht}^W. \quad (2.5)$$

For a household with zero previous wealth but also with zero debt, actual and desired consumption as defined by equation (2.3), deviate whenever this household now wants to borrow and if its loan demand exceeds what the bank is willing to lend as a maximum, i.e.,

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } Y_{ht} \geq C_{ht}^* \\ C_{ht}^* & \text{if } C_{ht}^* > Y_{ht} \ \& \ L_{ht}^d \leq L_{ht}^{\max} \\ Y_{ht} + L_{ht}^{\max} & \text{if } L_{ht}^d > L_{ht}^{\max}. \end{cases} \quad (2.6)$$

Loans are required if desired consumption exceeds disposable income, hence

$$L_{ht}^d = C_{ht}^* - Y_{ht} \geq 0. \quad (2.7)$$

If loan demand exceeds the maximum amount of credit the bank is willing to lend to the household, it is credit constrained and obtains L_{ht}^{\max}

$$L_{ht} = \min(L_{ht}^d, L_{ht}^{\max}). \quad (2.8)$$

If on the other hand, this household does not want to spend its entire disposable income on consumption but wants to save and hence accumulate wealth, this can

be achieved by opening a bank deposit account which we assume to be interest-bearing, or by holding cash. Hence in our model money serves a store-of-value.

$$D_{ht} + BG_{ht} = Y_{ht} - C_{ht}^* \text{ if } Y_{ht} - C_{ht}^* > 0 \quad (2.9)$$

Desired cash holdings are assumed to be a fixed proportion, $\kappa < 1$, of deposits⁵, i.e.,

$$BG_{ht} = \kappa D_{ht}, \quad (2.10)$$

implying for desired deposits (2.9):

$$D_{ht} = \frac{Y_{ht} - C_{ht}^*}{1 + \kappa}$$

- **Type 2:** $D_{ht-1} > 0$ and hence $BG_{ht-1} > 0$, and $L_{ht-1} = 0$. The household's disposable income equals its wage income plus earnings from interest rates on deposits after tax payments

$$Y_{ht} = (1 - \tau)(Y_{ht}^W + i_{Dt-1}D_{ht-1}). \quad (2.11)$$

Again, actual and desired consumption as given by equation (2.3), deviate if this household wants to borrow more than the bank is willing to lend

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht} + D_{ht-1}(1 + \kappa) \\ C_{ht}^* & \text{if } C_{ht}^* > Y_{ht} + D_{ht-1}(1 + \kappa) \text{ \& } L_{ht}^d \leq L_{ht}^{\max} \\ Y_{ht} + D_{ht-1}(1 + \kappa) + L_{ht}^{\max} & \text{if } L_{ht}^d > L_{ht}^{\max} \end{cases} \quad (2.12)$$

with

$$L_{ht}^d = C_{ht}^* - Y_{ht} - D_{ht-1} \geq 0. \quad (2.13)$$

$$L_{ht} = \min(L_{ht}^d, L_{ht}^{\max}) \quad (2.14)$$

Deposits and cash holdings are desired whenever

$$D_{ht} + BG_{ht} = Y_{ht} - C_{ht}^* - D_{ht-1} - BG_{ht-1} > 0 \quad (2.15)$$

⁵According to a study of the Deutsche Bundesbank from 2010 ("Wie kommt das Bargeld ins Portmonee?") $\kappa \leq 0.05$ in Germany.

- **Type 3:** $D_{ht-1} = BG_{ht-1} = 0$ and $L_{ht-1} > 0$. Disposable income equals wage income minus interest payments for loans after taxes

$$Y_{ht} = (1 - \tau)Y_{ht}^W - L_{ht-1}i_{Lt-1}. \quad (2.16)$$

In determining actual consumption we take into account that a household may not be able to repay its loans. This is the case whenever its disposable income falls short of borrowings. In this case actual household consumption is given by

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht} - L_{ht-1} \\ Y_{ht} - L_{ht-1} & \text{if } C_{ht}^* > Y_{ht} - L_{ht-1} \geq Y_t^{np} \\ Y_t^{np} & \text{if } C_{ht}^* > Y_{ht} - L_{ht-1} < Y_t^{np} \end{cases} \quad (2.17)$$

We assume that non-pledgeable income is a fixed proportion, θ , of the households disposable income

$$Y_t^{np} = \theta Y_{ht} \quad \text{with } 0 < \theta < 1. \quad (2.18)$$

If the household succeeds in meeting its financial obligations and if desired consumption still does not exhaust disposable income, then this household will even be able to save and accumulate deposits and cash according to

$$D_{ht}(1 + \kappa) = Y_{ht} - L_{ht-1} - C_{ht}^* \geq 0 \quad (2.19)$$

Defaulting households will not be granted a new loan in the period in which they are unable to repay their debt

$$L_{ht} = 0 \quad \text{if } Y_{ht} - L_{ht-1} \leq Y_t^{np}. \quad (2.20)$$

In the following section we present the financial sector and the conditions at which households can borrow and accumulate deposits and cash.

2.3.2 The Financial Sector

The financial sector is composed of commercial banks and the central bank. For simplicity we summarise a possibly high number of individual banks into a consolidated banking sector to be called “the bank” henceforth.

The commercial bank grants loans to private households as well as to the government. By assumption loans are extended at the beginning of each period and have to be repayed at the beginning of the next period. Bank lending is financed by household deposits and loans from the central bank. A further simplification in our model concerns the role of bank equity. Arguably, bank equity has gained a crucial importance for constraining bank risk-taking behaviour in the aftermath of the financial crisis and we do not want to downplay its significance. Rather, we are interested in keeping the supply side of the model as simple as possible, which includes simplifying assumptions concerning the composition of household incomes. We therefore assume that the commercial bank is not in private ownership but is owned by the central bank. Hence any net profit earned by the commercial bank directly goes to the central bank. Given this assumption, we assume that the bank plans at the beginning of each period and in doing so has to obey the following balance sheet constraint

$$L_t^s + B_t^s = D_t^d + F_t^d \quad (2.21)$$

where L_t^s denotes total bank loan supply to households, B_t^s denotes the supply of loans to the government, D_t^d stands for the bank's demand for deposits and F_t^d represents its demand for central bank loans. In deciding on its balance sheet composition we assume that the bank fixes interest rates on loans, i_{Lt} , and deposits, i_{Dt} , and does so by accepting the key interest rate, i_{Ft} , set by the central bank as a guideline. Since the key interest rate is only of minor importance for our model we simply assume that it evolves according to the following rule

$$i_{Ft} = i_{Ft-1} + \phi \epsilon_t \quad (2.22)$$

with $\epsilon_t = \epsilon_{t-1} + \nu_t$, where ν_t is a random parameter drawn from a normal distribution with support $\nu \sim N(0, \sigma_\nu^2)$. We assume that households have to pay an interest rate on their loans which exceeds the key interest rate whereas the government will not be charged with a positive mark-up, i_{Bt} . The interest rate on deposits may equal the key interest rate or may be lower but never higher than the key interest rate. This leads to

the following interest rate pattern

$$\begin{aligned}
 i_{Lt} &= \sigma i_{Ft} & \sigma &\geq 1 \\
 i_{Dt} &= \Psi i_{Ft} & \Psi &\leq 1 \\
 i_{Bt} &= i_{Ft}.
 \end{aligned}
 \tag{2.23}$$

At the given interest rate on deposits, the bank accepts any deposit size offered by households. Hence we have

$$D_t^d = \sum_{h=1}^H D_{ht}.
 \tag{2.24}$$

Deposit contracts have a formal and factual duration of one period which excludes withdrawals within the period. The bank's lending behaviour depends on whether there exists a risk of default or not. By assumption public debt bears no risk at all. By consequence, the bank is willing to always satisfy public loan applications

$$B_t^s = B_t.
 \tag{2.25}$$

This is not the case for household borrowings, however. As a crucial assumption we consider a bank which is not indifferent with respect to default but has an interest in avoiding such a situation for reasons which will become clear when we turn to the central bank. For the moment we take the bank's aversion towards default as given. In our model the bank seeks to avoid default by imposing credit lines on individual households. Each credit line is based on the insight that default occurs whenever

$$L_{ht} (1 + i_{Lt}) > Y_{ht+1},$$

that is whenever the contractual repayment obligation exceeds household income. Since the bank is not allowed to claim the borrower's entire income but only the seizable part $Y_{ht} - Y_{ht}^{np}$, a loss from default is even higher amounting to

$$\mathfrak{L}_{ht} = L_{ht} (1 + i_{Lt}) - (Y_{ht+1} - Y_{ht+1}^{np}).$$

If the bank wants to avoid any loss at all, contractual repayments will not be allowed to exceed whatever the bank can seize in case of default, i.e.,

$$L_{ht}(1 + i_{Lt}) \leq (Y_{ht+1} - Y_{ht+1}^{np}).$$

Unfortunately the bank does not know future household incomes and will therefore have to apply some proxy. In this regard we assume that the bank takes the household's previous income as a guideline. By consequence, a bank seeking to avoid any loss at all would choose as a credit line according to

$$L_{ht}^{\max} \leq \frac{(Y_{ht-1} - Y_{ht-1}^{np})}{1 + i_{Lt}}. \quad (2.26)$$

We assume that the bank differs from this worst case rule by taking into account that for any individual household the probability of default will be higher, the lower this household's income is compared to the average income earned in the economy. This leads to the following rule

$$L_{ht}^{\max} = \lambda \frac{(Y_{ht-1} - Y_{ht-1}^{np})}{1 + i_{Lt}} \quad (2.27)$$

where

$$\lambda = \begin{cases} \lambda_1 & \text{if } \frac{Y_{ht-1}}{\frac{1}{H} \sum Y_{ht-1}} < 1 \\ \lambda_2 > \lambda_1 & \text{if } \frac{Y_{ht-1}}{\frac{1}{H} \sum Y_{ht-1}} \geq 1 \end{cases} \quad (2.28)$$

where, as will be explained below, the size of λ represents a policy parameter chosen by the central bank. Credit constraints depend themselves on GDP, too. They behave pro-cyclical and go down if GDP decreases. In light of existing credit lines the bank's lending behaviour towards households is given by

$$L_t^s = \min(L_{ht}^d, L_{ht}^{\max}). \quad (2.29)$$

Taking the balance sheet constraint into account, the bank will plan a demand for central bank loans whenever desired lending will not be fully covered by deposits.

At the beginning of each period the bank realises a cashflow according to

$$CF_t^B = x_{Ht} + B_{t-1}(1 + i_{Ft-1}) - \sum D_{ht-1}(1 + i_{Dt-1}) - F_{t-1}(1 + i_{Ft-1}) \quad (2.30)$$

$$x_{Ht} = \sum_{h=1}^H x_{ht} \quad (2.31)$$

where x_{ht} denotes actual individual repayments from lending to private households and x_{Ht} its aggregate level. Factual individual repayments are determined as follows

$$x_{ht} = \begin{cases} L_{ht-1}(1 + i_{Lt-1}) & \text{if } (1 - \theta)Y_{ht-1} \geq L_{ht-1}(1 + i_{Lt-1}) \\ (1 - \theta)Y_{ht-1} & \text{if } (1 - \theta)Y_{ht-1} < L_{ht-1}(1 + i_{Lt-1}) \end{cases} \quad (2.32)$$

If actual repayments fall short of what had been contractually agreed, the bank's cashflow can become negative. This is equivalent to a situation in which the bank is unable to meet all its financial obligations thus leading to insolvency. However, as has been explained above, the bank is in the ownership of the central bank, and hence any loss will be absorbed appropriately thus leaving the banking sector intact.

The **central bank** provides the economy with banknotes and coins (cash) and does so with the intention to ensure financial stability. At the pre-set key interest rate, i_{Ft} , it satisfies the bank's refinancing demand F_t^d and it covers any excess of the bank's payment obligations over revenues by channelling additional cash into the economy. Hence the central bank's supply of cash changes according to

$$BG_t^s - BG_{t-1}^s = (F_t^d - F_{t-1}^d) + CF_t^- \quad (2.33)$$

where CF_t^- represents a negative bank cashflow. This implies that excessive household lending with a high number of defaulting households will consequently lead to a correspondingly higher supply of cash. By contrast we assume that any positive bank cashflow will be transferred directly to the government thus acting as an additional revenue.

Of course by receiving complete bail-out in case of insolvency, the bank would never have an incentive to take aspects of households' creditworthiness into account when deciding on loans. In order to prevent moral hazard, the bank is obliged to impose on

each individual household a credit constraint, the severity of which is determined by the central bank thus yielding the parameter λ as a policy variable.

2.3.3 The Government

Government expenditures consist of goods and services as well as of interest payments, which are financed by income taxes, transfers from the central bank and by borrowing.

$$B_t - B_{t-1} = G_t + B_{t-1}i_{F_{t-1}} - (T_{Ht} + CF_t^+) \quad (2.34)$$

where CF_t^+ represents a positive bank cashflow and total tax revenues are given by

$$T_{Ht} = \sum_{h=1}^H T_{ht}. \quad (2.35)$$

By assumption the size of government expenditures is exogenously given and constant over time, which renders public borrowing as the residual.

$$G_t = G \quad (2.36)$$

As mentioned above, (equation (2.23)), the government receives bonds at a preferential interest rate equal to the key interest rate.

In the following section, we present the aggregation at the macro level.

2.3.4 Macroeconomics

We now turn to examining how household debt affects the dynamics of GDP development as well as the time path of aggregate consumption. We assume that firms seek to adjust current production flexibly to current aggregate demand and that deviations follow exclusively from random shocks

$$Y_t = Y_t^d + \rho_t \quad (2.37)$$

where ρ_t denotes a temporary stochastic shock which is uniformly distributed on the support $[\underline{\rho}, \bar{\rho}]$ with the following property: $\frac{1}{T} \sum_{t=0}^T \rho_t = 0$.

Aggregate demand is composed of aggregate private consumption and exogenously given public expenditures

$$Y_t^d = \sum_{h=1}^H C_{ht} + \bar{G}. \quad (2.38)$$

Taking equation (2.37) and equation (2.38) together renders as the time path for aggregate production

$$Y_t = \sum_{h=1}^H C_{ht} + \bar{G} + \rho_t \quad (2.39)$$

The following section provides the simulation results, revealing the consequences from different degrees of the Joneses effect as well as the importance of credit constraints in this respect.

2.4 Simulation

2.4.1 Computational experiments

We now conduct various computational experiments in order to test the impact of the “Joneses effect” combined with different credit lines. As described above, the Joneses effect represents the degree to which households want to “catch up with the Joneses” and adjust their consumption behaviour to a reference standard of consumption. In a first experiment we examine in which way the Joneses effect stimulates household consumption and in doing so requires borrowing. As one crucial element of our model we have assumed that households can go bankrupt if they are unable to repay their debt. Hence in the absence of binding credit constraints we should expect a positive correlation between the strength of the Joneses effect and a rising number of household insolvencies. We should furthermore expect that rising insolvencies have a negative impact on the time path of GDP. In a second experiment we study the influence of credit constraints as a possibility to stabilise the development of household debt and GDP in light of an effective Joneses effect. In particular we are interested how the strength of the Joneses effect interacts with the degree of tightness of credit constraints.

In what follows we briefly describe the parameter settings for the different scenarios.

2.4.2 Parameter settings

The model is simulated over 2000 periods for each scenario plus a burn in of 100 periods to account for the initialization of the model. In order to facilitate the clarification of the interaction between the Joneses effect and credit lines we have specified a baseline scenario in Table 2.1. Further scenarios are represented in Table 2.2.

TABLE 2.1: Initial Parameter Values for the Simulation of the Model

Number of Banks	1
Number of Households	200
γ_1 - "Standard consumption"	0.8
γ_2 - "Joneses effect"	0.15
γ_3 - Impact of the lending rate on consumption	0.05
γ_4 - Impact of the borrowing rate on consumption	0.05
θ - Parameter for pledgeable income	0.4
ϕ - Parameter for the shock in the policy rate	1
σ - Parameter for the lending rate	1.2
Ψ - Parameter for the borrowing rate	0.6
λ_1 - Credit line parameter for the poorer half	0.2
λ_2 - Credit line parameter for the richer half	0.7
G - Government expenditure	100

According to German law (§§ 832, 835 ZPO) the share of seizable income depends on various variables: income, household members, etc. θ is an approximative factor.

While, scenario 1.1, 1.2 and 1.3 abstract from credit lines completely, scenario 2.1, 2.2 and 2.3 introduce "loose" credit lines, moving on to scenarios 3.1, 3.2 and 3.3, where households face "tight" credit constraints. The columns of Table 2.2 represent differences in household behaviour induced by the Joneses effect, ranging from weak to strong social orientation. Note that we are primarily interested in the significance of the Joneses effect compared to the impact of current income. Therefore, for each household the overall propensity to consume remains the same over all scenarios under scrutiny.

TABLE 2.2: Parameter Variation for different Scenarios

	$\gamma_1 = 0.95; \gamma_2 = 0$	$\gamma_1 = 0.8; \gamma_2 = 0.15$	$\gamma_1 = 0.4; \gamma_2 = 0.55$
$L^{max} = \infty$	1.1	1.2	1.3
$\lambda_1 = 0.7, \lambda_2 = 0.2$	2.1	2.2 = Baseline scenario	2.3
$\lambda_1 = 0.07, \lambda_2 = 0.02$	3.1	3.2	3.3

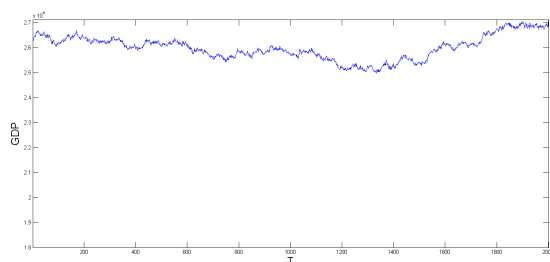
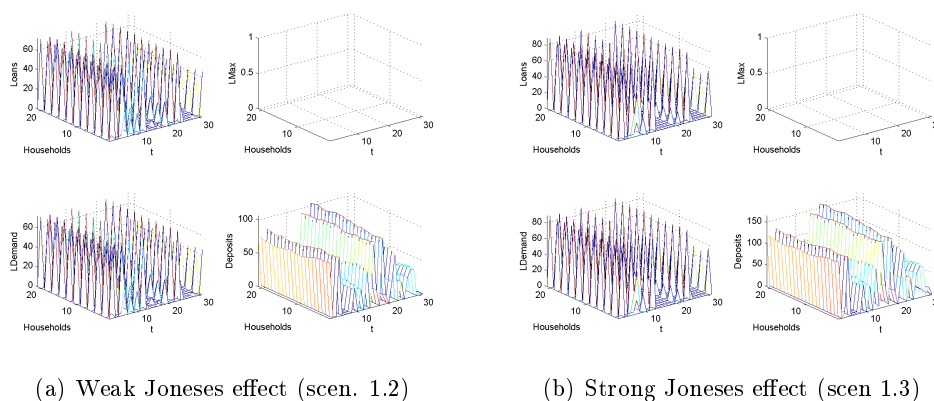


FIGURE 2.1: GDP times series without Joneses effect



(a) Weak Joneses effect (scen. 1.2)

(b) Strong Joneses effect (scen 1.3)

FIGURE 2.2: Lending Variables, without credit constraints, $\gamma_2 = 0.15$ and $\gamma_2 = 0.8$

2.4.3 Results

2.4.3.1 The model economy without credit constraints

Absence of the Joneses effect (scenario 1.1 =2.1 =3.1): In the absence of the Joneses effect and given that the propensity to consume is smaller than one, households can always realise desired consumption. In this case we should expect that aggregate consumption and aggregate production gradually converge to their long-run equilibrium values determined by the size of government expenditures and the aggregate propensity to save. As can be seen from Figure 2.2, loan demand is zero, while households accumulate deposits and hence earn an interest income on them. The time path of aggregate consumption is relatively stable and increasing. Occasional periods of falling consumption follow exclusively from negative shocks in wages. As can be seen from Table 2.4, aggregate consumption is largest when households ignore a social orientation and hence display a Keynesian consumption function. Note, that shocks in income have a strong influence on both the volatility in aggregate consumption as well as the dynamics of the time path of GDP (Figure 2.1, scales are adjusted for the purpose of comparative

analysis across scenarios).

TABLE 2.3: Aggregate Household Debt

Scenario	median L_t	$\sum L_t$
1.1 = 2.1 = 3.1	0	0
1.2	813,2	1 040 700
1.3	5174,8	3 845.500
2.2	163,1	153.860
2.3	836,3	439.890
3.2	63,1	42.992
3.3	119,4	78.442

TABLE 2.4: Model Output: Macroeconomic Time Series

Scenario	Y_t (mean)	Std. Dev. Y_t	C_t (mean)	Std. Dev. C_t
1.1 = 2.1 = 3.1	25.989	482,13	25.904	418.74
1.2	24.561	656,67	24.476	644,94
1.3	21.289	1327,2	21.204	1310 ,0
2.2	24.303	528,5	24.218	525,07
2.3	20.217	950,16	20.133	949,47
3.2	24.620	517,97	24.176	517,78
3.3	20.122	940,53	20.035	937,27

TABLE 2.5: Average Number of Household Insolvencies in the Different Scenarios (median values)

	$\gamma_1 = 0.95; \gamma_2 = 0$	$\gamma_1 = 0.8; \gamma_2 = 0.15$	$\gamma_1 = 0.4; \gamma_2 = 0.55$
$L^{max} = \infty$	0	26,5	30
$\lambda_1 = 0.7, \lambda_2 = 0.2$	0	14	20
$\lambda_1 = 0.07, \lambda_2 = 0.02$	0	14	19

Accounting for a Joneses effect (scenario 1.2 and 1.3): We now assume that households want to keep up with their neighbours and hence take up debt if desired consumption exceeds disposable income. In the absence of binding credit constraints, households' demands for loans are fully satisfied unless they had gone bankrupt in the previous period. We observe that aggregate household debt is very high (see Table 2.3) and increases over time the degree of which is positively correlated with the strength of the Joneses effect. Compared to a situation without the Joneses effect, aggregate consumption no longer follows a continually rising trend towards equilibrium but may fall temporarily (Table 2.4). To understand this result observe that in our model the Joneses effect acts asymmetrically in the sense that households earning an income above average consume less than without social orientation. Arguably, households with an

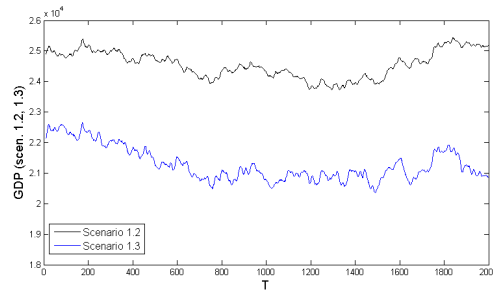


FIGURE 2.3: GDP for Varying Joneses effects (scen. 1.2 and 1.3), without credit lines

income below average consume more if they want to keep up with the Joneses, however, among this class of households we also find those which regularly go bankrupt, which implies that the size of their consumption expenditures is constrained to non-pledgeable income at least for one period. This effect has a particularly high dampening effect on consumption if the Joneses effect is high. Household bankruptcies together with the provision that fresh loans are possible again after one period, also enhances the volatility of aggregate consumption. In Figure 2.2 we observe a zigzag in borrowing which has feedback effects on aggregate consumption. During the whole simulation households go insolvent repeatedly with an average of 26,5 households going bankrupt each period (see Table 2.5) if the Joneses effect is weak and an average of 30 for a strong Joneses effect. Since GDP is strongly correlated with aggregate consumption in our model we observe the same pattern for both variables (see Figure 2.3 (a,b) and Table 2.4). Note that varying the strength of the Joneses effect does not alter the qualitative pattern of response of borrowing, consumption and GDP.

2.4.3.2 The model economy with loose credit constraints

Imposing credit constraints in the model alters the analysis by the fact that household loan demand will not always be fully satisfied, the probability of which is higher for lower than for higher incomes (see equation 2.27 and 2.28). Figure 2.4 shows that loan demand and extended loans deviate.

Accounting for a weak Joneses effect (scenario 2.2): Not surprisingly below-average income households in their desire to catch up with their neighbours are the ones most affected. As described in scenario 1.2, very poor households permanently require a loan. Introducing credit constraints in the analysis acts as a measure that prevents

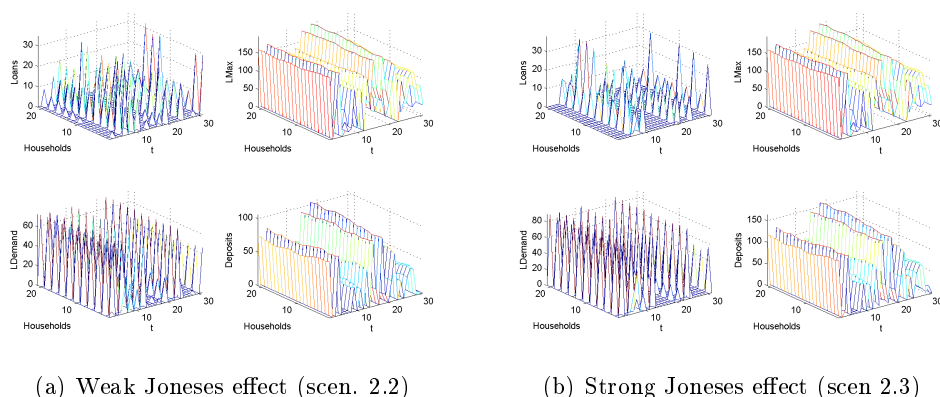


FIGURE 2.4: Lending variables and deposits, loose credit constraints

households from overborrowing. This lowers the probability that they are unable to repay debt in the following period and therefore, they are less likely to go bankrupt. From Table 2.3, we can see that aggregate household debt goes down when credit constraints are binding. The average number of households going bankrupt in each period drops to 14 (see Table 2.5).

Those who still file for insolvency do not have to curtail consumption as severely as in the case without credit constraints. This offers an explanation for the evidence that now aggregate consumption as well as GDP are less volatile than in the economy without constraints to borrowing and does not experience an equally strong temporary drop.

Accounting for a strong Joneses effect (scenario 2.3): Above we have described how a stronger social orientation leads to an increase in loan demand. In this scenario, the increase in loan demand is curtailed by prevailing credit constraints though. We therefore observe a stronger deviation of loans from loan demand (see Figure 2.4) and correspondingly a higher deviation of desired from actual consumption as compared to a weaker Joneses effect. But still aggregate debt is higher, and we also observe on average a higher number of insolvencies (20) as compared to scenario 2.2 (which is still below both scenarios without credit constraints). We have already seen that a strong Joneses effect puts downward pressure on both aggregate consumption and GDP and increases volatility. Credit constraints are unable to reverse this downward development at least not as long as they are not sufficiently severe. Rather from Table 2.4 we can see that the time path of GDP is below all previous scenarios. However, credit constraints

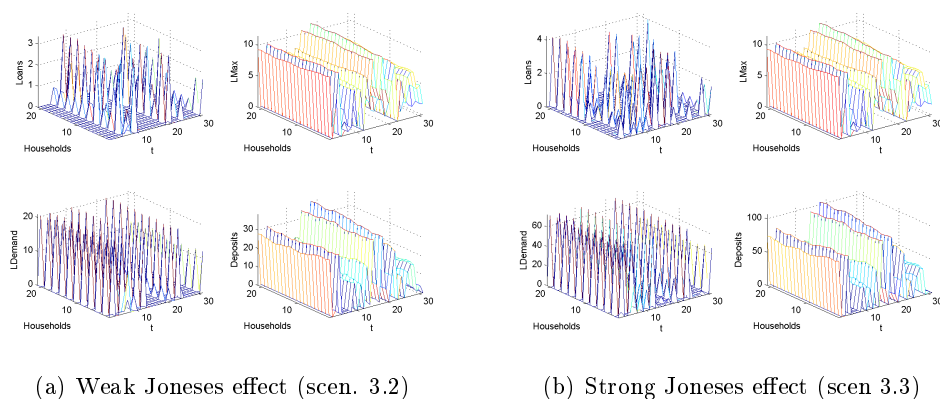


FIGURE 2.5: Lending Variables and Deposits, strict credit constraints

dampen volatility. We conclude that there is a strong correlation between the number of insolvencies and a volatility of GDP (and aggregate consumption).

2.4.3.3 The model economy with tight credit constraints

Accounting for a weak Joneses effect (scenario 3.2): Compared to the scenarios with loose credit constraints, tight credit constraints lead to an even stronger deviation of loan demand from loans (see Figure 2.5). Hence, more households are credit constrained. Unsurprisingly, stricter credit constraints lower aggregate debt. In fact, aggregate debt is lowest in this scenario (apart from the scenario without social orientation.). The average number of insolvencies does not change compared to scenario 2.2. However, the overall credit loss decreases substantially since it is the class of very poor households which is willing to borrow too much compared to their incomes and hence find themselves credit constrained. By contrast, households with a relatively higher income are treated less restrictively when they want to borrow. If previous period income was above average they are downgraded even less (see equation (3.14)). (Note that all those effects apply for scenario 2.2 as well. Yet, they are less severe with loose credit constraints.) This interplay between poor and richer households may explain why the time paths of aggregate consumption and GDP are very similar to scenario 2.2., though volatility can be found to be a bit less pronounced.

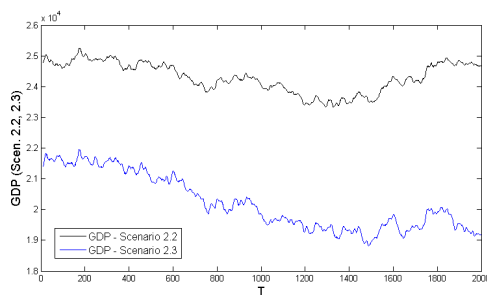


FIGURE 2.6: GDP for varying Joneses effects (scen. 2.2 and 2.3), loose credit lines

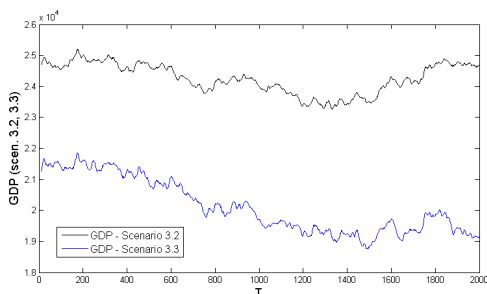


FIGURE 2.7: GDP for varying Joneses effects (scen. 3.2 and 3.3), strict credit lines

Accounting for a strong Joneses effect (scenario 3.3): Tight credit constraints imply that a strong social orientation explains an even higher deviation of actual household borrowing from its desired level. Indeed aggregate debt is about seven times lower compared to loose credit constraints. Given that credit constraints are independent of the strength of social orientation we should not expect that the time path of aggregate consumption and GDP differs much from scenario 2.3. This expectation is confirmed by Table 2.4 and Figures 2.6 and 2.7. On average one household less files for insolvency as opposed to the scenario with loose credit constraints. Yet, the strength of the Joneses effect leads to a higher number of insolvencies as opposed to the previous scenario with weak social orientation.

2.5 Summary and Conclusion

The incorporation of a Joneses effect in the sense of Abel (1990) into an otherwise Keynesian consumption function sets households with an income below the average incentives to borrow the size of which correlates positively with the desire to come closer to what is considered as standard consumption. As long as these households remain able to service their loans, the Joneses effect does neither alter the trend of consumption and GDP nor their volatility. The situation changes, however, once households default on their debt and are exposed to bankruptcy. In this case the size of their non-pledgeable income constrains the size of what they are able to consume. Since the typical borrower earns a low income and hence borrows excessively in order to catch up with the Joneses, the number of bankruptcies in our model show macroeconomic effects. In such a situation it also plays a role that the Joneses effect acts asymmetrically with above income households consuming less as would be the case for the standard Keynesian consumption function. Hence once households go bankrupt, keeping up with the consumption standard lowers the size and change of consumption and GDP over time. Of further importance is the assumption that households which have gone bankrupt are released from their debt after one period and are again free to borrow. Earning an income below the average, these households continue to have an incentive to take a loan with bankruptcy following suit. Repeated bankruptcies followed by repeated fresh borrowing adds pronounced volatility to both aggregate consumption and GDP. Both the downward trend in these variables as well as their volatility correlate positively with the Joneses effect. Introducing credit constraints with disposable (lagged) household income determining the maximum of a loan the bank is willing to grant, is a useful tool to dampen GDP and consumption volatility by interrupting the vicious circle of excessive borrowing and bankruptcies. However, credit constraints are unable to reverse the downward trend of GDP and consumption. This again can be explained by two properties of our model: the first one concerns the class of lower income household that will find themselves credit constrained very easily thus having to adjust their effective consumption downwards. The second property refers to the class of high income households being subject to the Joneses effect alike and hence, adjust consumption downwards. This effect is of course more pronounced for a stronger Joneses effect.

These results lead us to conclude that credit is no way to allow for a better convergence of

living standards in a society. The reason is that loans enable households only temporarily to separate consumption from income possibilities. Once loans have to be repaid the debtor is faced with the situation of having even less available for consumption that would be possible with his wage income. Bankruptcy results as a repeated reality in particular for low income households. On the other hand credit constraints pose no solution because again it is the typical low income household which will be credit constrained and hence will find itself far from being able to come closer to realising what is considered as standard consumption. Notably both easy access to credit as well as credit constraints act as a poverty trap for low income households.

We conclude with remarks on shortcomings of our theoretical analysis pointing to worthwhile future research. We are well aware that our analysis exhibits several deficiencies. The assumption that households are restrained to minimum consumption for only one period in case of insolvency could be relaxed in future research. One option would be to investigate different durations before releasing households from debt. In doing so, one could account for differences in insolvency laws across countries.

Moreover, our assumption that all households care about others to the same extent (γ_2 is equal for all households) within the respective scenarios can easily be relaxed. For the purpose of our comparative analysis, this assumption is fundamental as we are interested in the different strengths of consumption preferences and we feel justified working with it. An interesting direction for future research could be to focus on variations in the Joneses effect, possibly for different groups of income.

A further departure of our model from reality is the assumption that households either borrow or save, but never both. Although, simultaneous holdings of assets and liabilities are a widely accepted assumption in the theoretical literature due to complexities of modelling, one should however bear in mind, that in reality it is rather common that households hold both.

Chapter 3

Household Debt and Macrodynamics - How do Income Distribution and Insolvency Regulations interact?

This chapter is based on König (2015).

3.1 Introduction

Insolvency laws regulate the comparative rights of the defaulting borrower and the various lenders. In doing so their impact is not restricted to solving issues turning around the distribution of what has been left by the defaulting borrower (*ex post effects*) but in addition also concerns both borrowers' incentives to borrow more than would be wise in light of future earning prospects, and lenders' incentives to establish appropriate financial constraints (*ex ante effects*). Academic research so far has overwhelmingly evaluated the optimality of an insolvency law according to its capability to avoid moral hazard on the part of the borrower (see for instance White, 1998; Berkovich and Israel, 1999; Adler et al., 1999). While significant research concentrates on the incentive structure of insolvency laws (Povel, 1999; Bebchuk, 2002) much less attention is devoted to the macroeconomic implications of varying insolvency laws. Moreover, not least since the recent financial crisis is it widely acknowledged that credit matters for both macroeconomic stability as well as macroeconomic growth. This applies both to the access to credit as well as to defaults occurring in significant numbers. However both is highly dependent on the prevailing insolvency law. By implication its integration into macroeconomic models with a focus on the role of credit appears overdue. The following paper takes these considerations into account. In doing so, however, we focus our attention to household debt which has been rising continuously for some decades, now raising political concerns not only about its sustainability but also about implied macroeconomic stability.

Surprisingly, the problem is mostly analysed without taking into account the impact of income and wealth distribution as an additional driver for household indebtedness. Resulting from the assumption of the representative agent in conventional macroeconomic models, economic and social interaction used to be rather neglected and income distribution did not play any role. However, as soon as access to credit for everyone is encouraged by established policies, income and wealth distribution truly gain significance. In this context, US pro-debtor policies are often blamed for favouring the extension of credit to low income households over fiscal redistribution (see for instance Rajan, 2010). There is a growing literature showing that a country's income distribution indeed matters for household indebtedness. Households in the lower part of the income distribution often tend to overborrow in order to maintain a certain standard of living (see for instance Barba and Pivetti, 2009; Atkinson and Morelli, 2010). The desire of poor households to

keep up with their wealthier neighbours might not only be driven by status consumption, but also by the fear of social exclusion in a world where certain standards are expected to be fulfilled. A recent experimental study by Carbone and Duffy (2014) confirms that individual consumption is strongly affected by average consumption. Following this strand of literature, we argue that an optimal insolvency law should very well take the skewness of income and wealth distribution into account, in particular with respect to the finding that prevailing regulations have a strong impact on borrowers' incentives to take up debt and possibly even encourage strategic default. However, and contrary to the current discussion, we incorporate macroeconomic stability as an additional variable determining the optimality of alternative insolvency regulations.

We build on an agent-based model of relationships between households and banks developed in König and Grössl (2014). The model is perfectly suitable for the analysis as it shows theoretically that income distribution and household over-indebtedness are closely related. We enrich the model by accounting for the empirically observed skewness of income and wealth distribution and model the latter explicitly by means of a Generalised Pareto distribution. The framework also allows for household insolvencies and is built around the assumption that consumption and therefore loan demand are driven by social phenomena. A further novelty implied by the focus on household defaults, are the varying durations of the insolvency restructuring periods depending on whether an economy is creditor or debtor friendly. Being well aware that insolvency regulations are far more complicated in reality, the variation in the length until an unfortunate debtor is released from remaining debt, already enables the model to reproduce stylised phenomena.

The remainder of the paper is organised as follows. The following Section 3.2 gives an overview on related literature. In Section 3.3 we briefly present the model. Section 3.4 describes the simulation procedure and presents the results. We first describe the results for the creditor friendly economy, followed by results on a debtor friendly economy. Finally, Section 3.5 concludes.

3.2 Literature Review

There is a large literature dealing with household debt and household insolvencies. This paper combines two strands of previous research. The first includes literature investigating the link between income distribution and household debt. The second includes literature on household insolvencies in general and optimal insolvency regulations in particular.

A key motivation for this paper originates from the sharp increase in household debt overhang in most industrialised countries and the role of income and wealth distribution therein. In this respect, Iacoviello (2008) provides evidence that while the skewness of income distribution and the size of household debt in the US were stable from 1967 until 1980, a rise in both variables has been observed thereafter. Income inequality increased strongly in the 1990s and household debt followed in the 2000s. During the same period, an increasing number of private insolvencies was observed (Athreya, 2008). There are two opposing interpretations of this development, accusing either supply or demand side factors. For the case of the US, Rajan (2010) claims that prior to the recent crisis, the supply of credit had been increasingly extended to low income groups resulting from political motivations to conceal the increased income inequality. Political scientists often argue that pro-debtor policies favour the extension of credit to low income households over fiscal redistribution in order to avoid losing potential voters (Ahlquist and Ansell, 2014). US monetary policy is prone to support credit by setting interest rates accordingly, and laws have been designed to provide an insurance for private individuals against over-indebtedness (Dobbie and Song, 2014).¹

There is also a growing literature pointing to the importance of demand side factors, accusing an increase in inequality as the main reason for soaring household debt. Households in the lower part of the income distribution often tend to overborrow in order to maintain a certain standard of living (see for instance Barba and Pivetti, 2009; Atkinson and Morelli, 2010). There are some recent studies accounting for relative consumption preferences (Drechsel-Grau and Schmid, 2013; Fischer, 2013). In this regard, Cynamon and Fazzari (2008) argue that changing consumption norms since the 1990s have played a decisive role.

¹Changing credit environments as a determinant for the increase in household insolvencies in general are discussed by White (2007b) and Livshits et al. (2010).

Given the origin of the recent crisis, inequality is mostly discussed for the case of the US (Piketty and Saez, 2003; vanTreeck, 2014), yet several studies also report increasing income inequality in Europe since the 1980s (Brandolini, 2007; Franzini, 2009; Fredriksen, 2012). In this respect, Franzini (2009) deplors the increase in the top income shares in the face of stagnating low incomes. He also argues that the financial crisis further exacerbated differences in income. Apart from studying inequality separately in the individual European countries, these studies all argue that inequality in Europe should be considered from a “one-country” perspective. After controlling for different currencies and adjusting purchasing power parities, they find that overall income inequality has increased as well. As opposed to the US, this generalisation should be treated with care though, as the individual countries differ in many respects such as their institutional, in particular legal environment. We argue instead that a country’s institutional background is crucial and should be very well taken into account.

A further motivation for this paper originates from heterogeneity of household overindebtedness across countries and the role of personal insolvency regulations therein. Most literature approaches personal insolvency regulations from the viewpoint of conflicting interest between debtors’ opportunity to cope with unfortunate events inducing insolvency in the absence of an adequate insurance system on the one hand and strategic default on the other.

A relatively large literature indeed reports a positive correlation between private credit demand and debtor friendly insolvency laws (Livshits et al., 2007; Chatterjee and Gordon, 2012). Similarly, Jappelli et al. (2008) relate pro-debtor reforms to an increase in the number of personal insolvencies in several countries. In this regard, debtor friendly insolvency regulations are often evaluated critically, as the option of having one’s debt discharged might render filing for bankruptcy beneficial thus generating moral hazard (White, 1998; Wang and White, 2000). That households might even default strategically has been empirically confirmed by Fay et al. (2002). They find that for creditor friendly insolvency regulations, where benefits from filing are rare, insolvency rates tend to be substantially smaller. The literature often distinguishes between debtor friendly Anglo-Saxon insolvency regulations which are considered to be extremely generous as individuals can get immediately discharged from pre-bankruptcy debt (“fresh start”),

and rather creditor friendly continental European countries (see for instance Niemi-Kiesilainen, 1999; Gerhard, 2009).² While distorted incentives in debtor friendly environments represent one side, the insurance character in otherwise often rather poorly developed social systems reflects the other. In creditor friendly regimes on the contrary households mostly have to undergo a long and demanding debt restructuring process until unpaid debts might finally get charged off. Niemi-Kiesilainen (1999) distinguishes three factors characterising most continental European insolvency regulations. First, restricted access to debt restructuring, second, a compulsory repayment plan which is pre-conditional for the discharge of residual debt and third, mandatory debt counselling services to deal with defaulting households. Given this, Niemi-Kiesilainen (1999) points out that insolvencies in continental Europe are also linked to moral values, as the main rationale behind the extensive restructuring procedure is to ensure that there is not an easy solution to the problem of overwhelming debt. Hence, insolvency laws in continental Europe they tend to be less lenient with respect to debt relief compared to Anglo-Saxon economies, which may be largely ascribed to the prevention of distorting incentives for debtors. Overall, insolvency laws are extremely heterogeneous, even within European countries. For an overview on consumer insolvency laws in selected countries see Gerhard (2009) and Heuer (2014). For a more detailed evaluation of US personal bankruptcy laws specifically see Porter (2011).

A number of studies conduct comparative analysis evaluating different insolvency regulations with the objective to identify their respective merits. For instance Livshits et al. (2007) employ a life-cycle model comparing a “Fresh Start” System with a “No Fresh Start” system. Calibrating their model to US and German data, they find that due to higher income and expense uncertainty in the US, the “Fresh Start” system is welfare enhancing while the opposite is true for the “No Fresh Start” system, which performs better with German data. They argue that the performance of an insolvency regulation depends on the underlying social system. Put differently, prevailing institutions play a crucial role and insolvency regulations should be adjusted to the respective social and economic environment (in line with Niemi-Kiesilainen, 1999). In a similar analysis, Chatterjee and Gordon (2012) compare the current US law on consumer bankruptcy with an alternative regime without debt relief tools. Contrary to Livshits et al. (2007) they focus on optimal garnishment rates, arguing that household insolvency exists also

²Heuer (2014) provides a more refined distinction, classifying insolvency laws according to the ‘market model’, the ‘restrictions model’, the ‘liability model’ and the ‘mercy model’.

in the absence of discharge options highlighting the importance of garnishment. In their model, the commitment to repay debt leads to a reduction in interest rates and hence, facilitates poor households' access to credit. Overall welfare increases if garnishment laws are strict enough, enabling less wealthy households to smooth consumption and more wealthy households to benefit from lower borrowing rates. Their criticism of the current US bankruptcy law results from the sharp increase in consumer insolvencies in the aftermath of the sub-prime crisis. They report that the outstanding volume of consumer debt has declined though not because overall borrowing declined, but rather because many overindebted households made use of their option to default. Non-performing loans resulting from a massive debt relief were removed from banks' balance sheets. In this debate about the merits of different insolvency laws, strategic default is indeed the main argument put forward against a "Fresh start" system (White, 1998; Athreya, 2006). On the other hand though, the opportunity of having one's debt charged off provides an insurance for individuals against adverse shocks ("bad luck") such as job loss or divorce by offering them a fresh start (Dobbie and Song, 2014). In this regard, the findings by Livshits et al. (2007), who argue that a country's insolvency law should be considered in the context of its underlying system plays an essential role.

Regardless of the insolvency regulation and possible discharge of residual debt, research on post-bankruptcy predominantly agrees that households are not better off after filing. In this respect, Cohen-Cole et al. (2009) find that debt relief does not benefit debtors as they not only have difficulties to get external finance afterwards but that they also struggle to repay potential debt as opposed to prior receiving insolvency protection. And Jagtiani and Li (2014) report that their access to credit is constrained even long after the discharge date. That previously defaulted households are charged significantly higher interest rates compared to non-filers has been found by Han and Li (2011). They also show that filers are more prone to face repayment difficulties after bankruptcy and accumulate less wealth. Hence, in spite of the insurance character of bankruptcy in rather debtor friendly economies, individual welfare may still be punished in the sense, that access to external finance may be more difficult post-bankruptcy. Optimal insolvency laws and their relation to different economic and social systems has been discussed vividly in the literature. However, the role of income distribution in light of rising household debt has not received sufficient attention so far.

The following section presents the model and describes how we model income distribution and varying insolvency procedures.

3.3 The Model

3.3.1 Overview

The paper builds on an agent-based model developed in König and Grössl (2014). The model is suitable to study household bankruptcy and their feedback effects on macroeconomic dynamics. It contains features such as household-bank relationships, and consumption preferences which are partially driven by social phenomena inducing a number of households to live above their means, which in turn may force them to default on their debt. Macroeconomic phenomena emerge from the bottom-up resulting from interaction between agents on the micro level (Kirman, 1995; Tesfatsion, 2006; Delli Gatti et al., 2011). As the present analysis focuses on the role of income distribution and insolvency laws, we model income and wealth distribution explicitly according to a Generalised Pareto distribution (Section 3.3.2) and enrich the model by accounting for different insolvency procedures (Section 3.3.3). This leads to varying consumption patterns for insolvent households (Section 3.3.4). Moreover, banks receive different loan repayments depending on the insolvency regulation (Section 3.3.5). Further elements of the original model are only briefly outlined. For a detailed description of the model see König and Grössl (2014) or the Appendix D.

The model economy is composed of h households ($h = 1, 2, \dots, H$), a representative commercial bank, a central bank and a government. Agents follow simple behavioural rules and heterogeneity enters the model through different channels. The most important source of heterogeneity is households' income. In addition to that, households hold either varying amounts of deposits and cash, where they earn additional income through interest rate payments on deposits, or loans on which they have to pay interest. For simplicity it is assumed that households can either save or borrow, but never both and loan contracts have a duration of one period. Moreover, loan demand may not always be fully satisfied. It can be rejected in two cases: First, if loan demand exceeds household specific credit lines or second, if a household recently filed on its debt and is still subject to an insolvency procedure.

The crucial element of the model is a household's decision about desired consumption. Households follow a consumption norm (Cynamon and Fazzari, 2008), according to which they care about their relative position in the economy. Choosing a reference standard against which individuals compare themselves has a long tradition in the economic literature beginning with the famous contribution by Duesenberry (1949). In a very recent experimental study, Carbone and Duffy (2014) confirmed that individuals indeed consider consumption decisions made by others. Desired consumption in our model is

$$C_{ht}^* = \gamma_1 Y_{ht-1} + \gamma_2 \bar{C}_{t-1} - \gamma_3 i_{Dt} - \gamma_4 i_{Lt}. \quad (3.1)$$

The median economy-wide consumption of the last period is

$$\bar{C}_{t-1} = \frac{1}{2}(C_{\frac{H}{2},t-1} + C_{\frac{H}{2}+1,t-1}). \quad (3.2)$$

Y_{ht} refers to a household's disposable income, and i_{Dt} and i_{Lt} denote interest rates on deposits and loans, respectively. γ_1 is the marginal propensity to consume out of earnings, γ_2 the parameter for the consumption norm and γ_3 and γ_4 are reaction coefficients for the lending and borrowing rate, $\gamma_j \in (0, 1)$ for $j = 1, 2, 3, 4$. If households' desired consumption exceeds disposable income, they require external finance to reach their desired consumption level. As can be seen from equation (3.1), mostly households in the lower part of the income distribution require a loan. Above average households require external finance only if they suffer from a negative wage shock. Loans provide poor households with the opportunity to keep up with their wealthier neighbours or to insure against unforeseen contingencies.

As opposed to König and Grössl (2014), where we assumed that all households compare themselves to the average, as a novelty of this paper we model upward-looking consumption preferences with median income as the decisive variable determining a household's consumption preferences.

$$\gamma_2 = \begin{cases} \gamma_2 & \text{if } \frac{Y_{ht-1}}{\frac{1}{2}(Y_{\frac{h}{2},t-1} + Y_{\frac{h}{2}+1,t-1})} \leq 1 \\ 0 & \text{if } \frac{Y_{ht-1}}{\frac{1}{2}(Y_{\frac{h}{2},t-1} + Y_{\frac{h}{2}+1,t-1})} > 1 \end{cases} \quad (3.3)$$

Accordingly, below median income households have a higher propensity to consume and hence either save less out of their incomes than above median income households, or even take up debt to satisfy desired consumption. Recent research with a similar approach to relative consumption assumes that all households compare themselves to households with higher levels of consumption splitting them into different income groups (i.e. Drechsel-Grau and Schmid, 2014; Belabed et al., 2013; Frank et al., 2014; Cardaci, 2014). We choose to take the median consumption of the last period as a reference standard with upward-looking comparisons for two main reasons. First, empirical evidence shows that it is mostly poor income households (or households in bad financial shape) that require external finance (see for instance Flynn, 1999; Atkinson and Morelli, 2010). Splitting households in percentiles and modelling upward-looking behaviour would render unrealistically many households as debtors. Second, with the present modelling choice, assuming a Generalised Pareto distribution, the median tends to be a better proxy than the mean. If a distribution is heavily skewed, i.e. if few households possess a very high proportion of income and wealth, the mean is extremely high. Hence, taking the latter as a reference point would lead to unrealistically high values of loan demand and induce excessive debt levels for the majority of households. Moreover, only a very small fraction of very rich households would accumulate savings. Dynan et al. (2004) points out that mostly high income households can afford to save a larger fraction of their income. Thus, we suppose that median consumption is a good proxy to balance loan and saving decisions of households. I.e. a household's position in the income distribution decides about its classification as either a saver or a borrower.

Regarding households' income dynamics, it is further important to note, that due to adverse shocks, wage income at the micro level can be relatively volatile and hence, above median income households might eventually fall below the median in the proceeding period. That notwithstanding, the majority of defaulting households possess rather low income and wealth. This mechanism is described in Section 3.3.3. The following section describes how income distribution is modelled.

3.3.2 Income Distribution

There is a huge debate in the literature about the appropriate distribution function for the size of incomes. Despite this discussion, income distribution is to the best of our

knowledge only rarely modelled explicitly. There are several distributions which are deemed to fit the distribution of incomes (see for instance McDonald, 1984). Given this, there is empirical evidence that income and wealth distribution are heavily skewed and follow a power law (see for instance Levy and Solomon, 1997).

Accounting for this insights, we model the distribution of income explicitly, drawn from a Generalised Pareto distribution which was first introduced by Picklands (1975). It is particularly suitable to model long right tails, stating that a very large proportion of income and/or wealth is owned by a very small proportion of people. It contains three parameters. A location parameter, μ , a scale parameter, σ , and a shape parameter, ζ . The cumulative distribution function of a random variable N is

$$P(N \leq \eta) = \begin{cases} 1 - \left(1 + \frac{\zeta(\eta - \mu)}{\sigma}\right)^{-1/\zeta} & \text{for } \zeta \neq 0 \\ 1 - \exp\left(-\frac{\eta - \mu}{\sigma}\right) & \text{for } \zeta = 0 \end{cases} \quad (3.4)$$

with $\sigma > 0$ and $\eta - \mu \geq 0$ when $\zeta \geq 0$ and $\eta \leq \mu - \sigma\zeta$ when $\zeta < 0$ and $\mu = 0$. It is generalised as it contains several special cases. When $\zeta > 0$ and $\mu = \frac{\sigma}{\zeta}$, one gets the Pareto distribution with $a = 1/\zeta$ and $K = \sigma/\zeta$.³ In the context of our analysis, the shape parameter ζ plays the key role as increasing values for ζ represent increasing skewness of the income distribution, i.e. the frequency of poor income households increases. Put differently, fewer rich households get richer and more poor households get poorer. μ relates to the average household income and σ to the standard deviation thereof.

At the beginning of the simulation, each household is endowed with an income randomly drawn from the above described Generalised Pareto probability distribution.

$$Y_{ht} = \eta_{ht} Y_t \quad (3.6)$$

η_{ht} denotes the parameter of income distribution and adds up to one, $\sum \eta_{ht} = 1$. Y_{ht} stands for a households disposable income and Y_t denotes the GDP of the model economy.

³The corresponding cumulative distribution function for a Pareto distributed random variable would then be

$$F(x) = \begin{cases} 1 - \left(\frac{K}{x}\right)^a & \text{for } x \geq K \\ 0 & \text{for } x < K \end{cases} \quad (3.5)$$

where K denotes the scale and a the shape parameter.

3.3.3 Insolvency Regulations

In reality insolvency procedures are very complex, and respective laws differ substantially across countries, ranging from the opening of proceedings over the filing of claims and verification to reorganisation plans (EU Note 2011) which again vary in length and practical operation.

To keep the model and the analysis as simple as possible, we assume that households enter an insolvency restructuring period, $j = 1, 2, \dots, J$, once they default on their debt. During the insolvency period, households are punished in two ways. They are excluded from the credit market and creditors can seize a share of their income each period during the restructuring process. For a single household this means that it falls back to a minimum income after filing for bankruptcy.

$$Y_{ht,j}^{np} = \theta Y_{ht} \quad (3.7)$$

where $Y_{ht,j}^{np}$ denotes “non-pledgeable” income and θ the exemption rate. Once a household enters an insolvency process, it remains in this state until it reaches the end of the process J

$$Y_{ht+1} = Y_{ht+1,j}^{np} \quad \text{if } Y_{ht} = Y_{ht,j}^{np} \quad \& \quad j < J \quad (3.8)$$

At the end of the insolvency period, J , residual debt is discharged and the household can apply for credit anew. In the context of the model, the duration of an insolvency period determines the degree of creditor or rather debtor friendliness of a regulation: $J^{DF} < J^{CF}$. Well knowing that punishment of default is more severe in a creditor friendly economy, it is assumed that households take this into account and adjust consumption preferences accordingly. This translates into a higher willingness to take up debt in order to finance consumption expenditure under pro-debtor laws. This idea is based on research by Grössl and Fritsche (2007b), who show that households borrow more with a default option in place as they face limited liability. There is also empirical evidence reporting that households are more prone to strategic default under rather pro-debtor regulations (i.e. Wang and White, 2000; Fay et al., 2002). Based on these insights, we model lower incentives to overborrow in a creditor friendly economy as expressed through

$$\gamma_2^{CF} < \gamma_2^{DF}. \quad (3.9)$$

The following section outlines consumption dynamics of insolvent households.

3.3.4 Consumption Dynamics of Insolvent Households

Insolvency procedures change aggregate consumption dynamics inasmuch as insolvent households cannot consume more than a minimum income. In a world where debtors are discharged immediately such as assumed in König and Grössl (2014), three different types of consumers can be identified: borrowers ($L_{ht-1} > 0; D_{ht-1} = BG_{ht-1} = 0$), savers ($L_{ht-1} = 0; D_{ht-1} > 0; BG_{ht-1} > 0$), and those who neither save nor borrow, ($L_{ht-1} = D_{ht-1} = BG_{ht-1} = 0$).⁴ With enduring insolvency periods however, the process turns somewhat more complex and a fourth type enters the dynamics, namely households who defaulted in an earlier period and who are subject to an insolvency process: $Y_{ht-1} = Y_{ht-1,j}^{np}$. The possibility of new debt is excluded as insolvent households are not allowed to participate at credit markets. In very rare cases though, for instance after profiting from a positive wage shock, it may theoretically be able to accumulate savings: $D_{ht-1} \geq 0$ and hence $BG_{ht-1} \geq 0$, which are also seized by the lender. The income of an insolvent household is then

$$Y_{ht,j}^{np} = \theta Y_{ht} = \theta[(1 - \tau)Y_{ht}^W + i_{Dt-1}D_{ht-1}]. \quad (3.10)$$

Resulting in the following consumption pattern

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht,j}^{np} + D_{ht-1} \\ Y_{ht,j}^{np} & \text{if } C_{ht}^* > Y_{ht,j}^{np} + D_{ht-1}. \end{cases} \quad (3.11)$$

In case a household holds deposits, they amount to

$$D_{ht}(1 + \kappa) = C_{ht}^* - Y_{ht,j}^{np} - D_{ht-1}(1 + \kappa) \geq 0. \quad (3.12)$$

As mentioned above, bankrupt households are not allowed to take up new debt and are only discharged from their liabilities at the end of the insolvency period. Consumption dynamics change insofar that, with an enduring duration of the insolvency period, J ,

⁴See König and Grössl (2014) for a detailed description.

relatively more insolvent households consume exactly what they earn, i.e. their propensity to consume is one, $c = 1$. Aggregate consumption is composed of the four different subtypes of consumers as will become clear when we turn to the aggregation procedure.

3.3.5 Banks

The banking sector is only outlined briefly in this paper. For a detailed description see König and Grössl (2014) or the Appendix D. It is assumed that lenders set credit lines based on a household's income of the previous period. While insolvent households are not allowed to participate at credit markets, they also face extremely tight credit constraints after leaving the insolvency process (Cohen-Cole et al., 2009; Han and Li, 2011). Lenders also account for the exemption rate in place as default is more attractive for households when exemption rates are high (see for instance Athreya, 2006). For the sake of simplicity though, we abstract from varying exemption rates for the moment in our analysis. Banks set credit lines according to

$$L_{ht}^{\max} = \lambda \frac{(Y_{ht-1} - \theta Y_{ht-1})}{1 + i_{Lt}} \quad (3.13)$$

where

$$\lambda = \begin{cases} \lambda_1 & \text{if } \frac{Y_{ht-1}}{\text{median} \sum Y_{ht-1}} < 1 \\ \lambda_2 > \lambda_1 & \text{if } \frac{Y_{ht-1}}{\text{median} \sum Y_{ht-1}} \geq 1. \end{cases} \quad (3.14)$$

We assume that the bank is cautious in the sense that lending behaviour is more restrictive for households whose income is below the median level.

With enduring insolvency periods, households' loan repayment behaviour, x_{ht} , is composed of loans plus interest rates from solvent households and the pledgeable share of income of those households who are either unable to repay their current debt or who are already subject to an insolvency process

$$x_{ht} = \begin{cases} L_{ht-1} (1 + i_{Lt-1}) & \text{if } (1 - \theta) Y_{ht-1} \geq L_{ht-1} (1 + i_{Lt-1}) \\ (1 - \theta) Y_{ht-1} & \text{if } (1 - \theta) Y_{ht-1} < L_{ht-1} (1 + i_{Lt-1}) \\ (1 - \theta) Y_{ht-1} & \text{if } Y_{ht-1} = Y_{ht-1,j}^{np} \quad \& \quad j < J. \end{cases} \quad (3.15)$$

The longer the duration of a debt restructuring period, J , the smaller the losses for the lender as it seizes relatively more income, and hence macroeconomic write-offs. From the perspective of a bank, non-repayment of credit reduces its cashflow and might even become negative. If the latter is the case, the central bank acts as a lender of last resort and absorbs any losses to maintain financial sector stability. The duration of the insolvency period affects not only a bank's cash flow but via household consumption also macroeconomic variables.⁵ For the moment, the analysis concentrates rather on the demand side. Future research may include a more sophisticated banking sector, where loan supply should take insolvent households into account.

3.3.6 Aggregation

We have seen that on the micro level, households and banks cope with complexity by means of simple behavioural rules. For the aggregation process we proceed as is usual in agent-based computational economics, namely by simulating the model. Aggregate time series emerge through the interaction of agents at the micro level (see for instance Delli Gatti et al., 2008, 2011). As the focus lies on the relationship between households and banks, we assume that supply is driven by aggregate demand and firms adjust output accordingly. Deviations follow solely from exogenous shocks.

$$Y_t = Y_t^d + \rho_t \quad (3.16)$$

where ρ_t is a uniformly distributed temporary macro stochastic supply shock with support $[\underline{\rho}, \bar{\rho}]$. Aggregate demand comprises aggregate consumption and government expenditures, G , which we assume to be exogenous

$$Y_t^d = \sum_{h=1}^H C_{ht} + \bar{G}. \quad (3.17)$$

⁵Stock-flow-consistency of the model is ensured as we assume that the commercial bank is owned by the social planner and that all positive cash flows are directly transferred. In case of negative cashflows, the commercial bank requires central bank loans. For a detailed description of the financial sector see Section 2.3.2 in König and Grössl (2014) or the Appendix D.

Aggregate household consumption is composed of the four different subtypes of consumers, $H = H_1, H_2, H_3, H_4$, depending on their individual desire to consume and potential related constraints. The aggregate consumption function is

$$\sum_{h=1}^H C_{ht} = \sum_{h=1}^{H_1} Y_{ht,j}^{np} + \sum_{h=H_1+1}^{H_2} (Y_{ht} + L_{ht}^{max}) + \sum_{h=H_2+1}^{H_3} (Y_{ht} + L_{ht}^d) + \sum_{h=H_3+1}^{H_4} (\gamma_1 Y_{ht} + \gamma_2 \bar{C}_{t-1} - \gamma_3 i_{Dt} - \gamma_4 i_{Lt}). \quad (3.18)$$

Type H_1 is insolvent, Type H_2 is a borrower who is (partially) credit constrained, Type H_3 is a borrower who is not credit constrained and Type H_4 can satisfy desired consumption without relying on external funds. The time path for the aggregate dynamics is then given by

$$Y_t = \sum_{h=1}^H C_{ht} + \bar{G} + \rho_t \quad (3.19)$$

In the following section, we describe the simulation procedure, the computational experiments and resulting outcomes.

3.4 Simulation

3.4.1 Calibration and Computational experiments

Being interested in the effects of varying income distributions under different insolvency laws on aggregate debt and macroeconomic stability, we conduct several computational experiments. We oppose a creditor friendly economy to a debtor friendly economy, where the degree of creditor or debtor friendliness is assumed to be determined by the length of period until a defaulting household is discharged from residual debt. Following the literature on insolvency laws and strategic default (see for instance White, 1998, 2007a; Grössl and Fritsche, 2007a), we presume that households in a debtor friendly economy have stronger preferences to take up larger amounts of debt, while the opposite is true for a creditor friendly economy. For all insolvency regimes we simulate three different scenarios to test the effects of increasing income inequality. We begin by analysing different levels of skewness related to the distribution of incomes in a creditor friendly economy and conduct the same exercise for a debtor friendly economy thereafter. We should expect increasing inequality to come along with higher aggregate debt and a higher number of insolvencies as relatively more households concentrate at the lower

part of the income distribution where the desire to keep up with other households is stronger. Using the same starting values for the creditor friendly and debtor friendly economy, we should, however, expect lower aggregate debt and fewer insolvencies for creditor friendly insolvency regimes.

Table 3.1 shows the initial parameter values for the simulation. As described in Section 3.3, a household's desire to keep up with other households' consumption, γ_2 , differs across insolvency regimes as households' behaviour is influenced by the underlying institutional setting. Note that we model upward-looking preferences, i.e. only households whose incomes are below the median care about others' consumption. $\lambda_{1,2}$ is the credit line parameter and can be interpreted as expectations about future economic development; it is kept constant across scenarios as the role of credit lines has already been studied in previous work (König and Grössl, 2014). The parameter which determines the minimum income, θ , is also kept constant as we assume that it is based on socio-political motives rather than being subject to optimal insolvency laws. According to the laws of several EU countries (i.e. German law (§§ 832, 835 ZPO); French law (§ L312-2, Code de la consommation); Dutch law (FW § 295 and Wetboek van Burgerlijke Rechtsvordering, § 475d)), the share of seizable income depends on various variables like income, household members, etc. θ is an approximative factor, based on averages from these laws.

For internal validation of the model, we run 300 independent simulations for each scenario, each one with a different random draw. Simulated data as reported in Tables 3.2 and 3.3 and the related Figures 3.3 and 3.4, refer to the mean value across simulations. The model is simulated over 2000 periods plus a burn in of 100 periods for the initialisation. We assume that one time period refers to a month time as households receive wages each period.

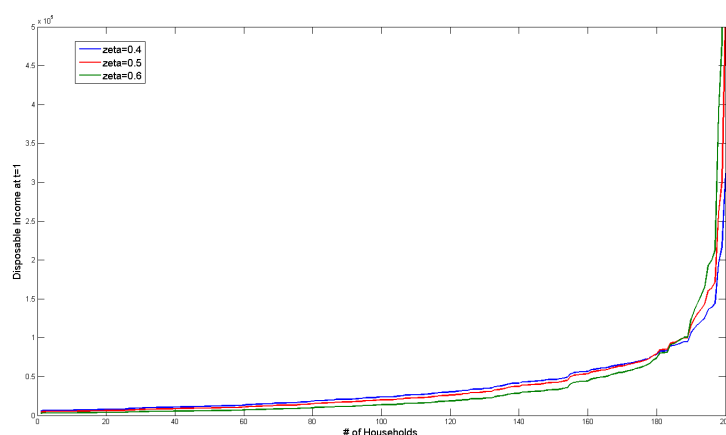
3.4.2 Results

3.4.2.1 The Role of Income Distribution in a Creditor Friendly Economy

In this section we present the simulation results for the creditor friendly economy. We assume that debt relief follows after an eight-year insolvency period. Three different

TABLE 3.1: Initial parameter Values for the Two Model Economies

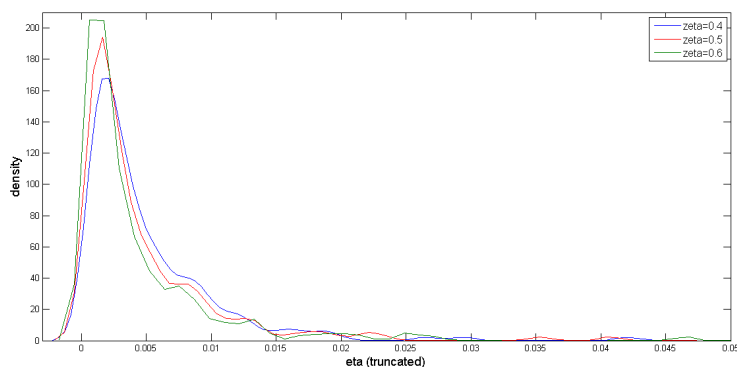
Time, T	2000
Number of Banks, B	1
Number of Households, H	200
γ_1 - "Standard consumption"	0.6 / 0.6
γ_2 - "Impact of others consumption"	0.4 / 0.3
γ_3 - Impact of the lending rate on consumption	0.05
γ_4 - Impact of the borrowing rate on consumption	0.05
θ - Parameter for pledgeable income	0.4
λ_1 - Credit line parameter for the richer half	2
λ_2 - Credit line parameter for the poorer half	1
μ - Location parameter of the distribution	\bar{Y}
σ - Scale parameter of the distribution	Std. Dev. Y
ζ - Shape parameter of the distribution	0.4 / 0.5 / 0.6
\bar{G} - Government expenditure	100
τ - Tax rate	0.1

FIGURE 3.1: Income at $t=1$, Cumulative Generalised Pareto Distribution

scenarios of varying income distributions are tested. Initial income distribution is displayed in Figure 3.1 and its corresponding kernel density⁶ of the distribution variable, η , in Figure 3.2.⁷ As described in Section 3.3.2, the distribution of income is modelled by means of a Generalised Pareto distribution, i.e. with increasing skewness few rich households get richer, while the overall number of poor households increases. Higher ζ 's represent higher inequality. Households are subject to wage shocks, which can change the distribution of income over time. However, as we assume that the magnitude of shocks is the same across scenarios, their impact on the distribution of incomes weakens for higher income inequality.

⁶Kernel density estimates the probability distribution of a random variable.

⁷Although the analysis is based only on small differences in the skewness, substantial effects can already be observed.

FIGURE 3.2: Kernel density of the distribution variable η 

From Table 3.2, we can see that GDP decreases with rising inequality. Explanations follow from the interplay of households social orientation and the prevailing insolvency regulation. With increasing income inequality, other households' consumption gains importance as more households earn lower incomes. Households at the bottom of the income distribution increasingly seek to keep up with their richer peers through debt-financed consumption. However, increasing inequality renders fewer households creditworthy and they hence face difficulties to repay their debt. This is evidenced by a sharp rise in the number of insolvencies for stronger skewness. A higher number of bankrupt households has to live on a minimum income during the insolvency period, which has a negative effect on the level of aggregate consumption, as expressed in equation (3.18). This again puts a downward pressure on the level of GDP for higher inequality.

The effect on GDP volatility, as measured by the variance of time series, is less intuitive. It decreases with increasing inequality. Within the framework of the model, volatility of macroeconomic time series such as consumption and hence GDP, is predominantly caused either by household specific wage shocks which influence consumption and hence loan demand, and/or macroeconomic supply shocks. Yet, both are kept constant across scenarios. The explanation therefore derives from the changing income distribution which affects borrowing behaviour through changing consumption preferences, thereby strongly influencing the composition of consumer types as well as the size of loans required to finance desired consumption. Given this, a major source of volatility is repeated loan taking by households. The duration of loan contracts of only one period and repeated repayment behaviour directly affects borrowers consumption patterns. In this respect, the higher number of insolvent households that are excluded from credit markets as well

as slightly tighter credit constraints in higher inequality scenarios suggests a stabilising effect on the aggregate level.

Surprisingly, aggregate debt declines for rising inequality. Three determinants can be identified in this regard: demand-side, supply-side and institutional factors. On the demand side, an explanation follows from decreasing median income when inequality is high. Although more households earn relatively lower incomes, the amount of loans they require to satisfy desired consumption declines as the macroeconomic part of equation (3.1) is lower for higher inequality. As a supply-side factor, tightening credit conditions reduce aggregate debt. As can be seen from equation (3.13), lenders take a households income into account when deciding about loan supply. With relatively more households earning lower incomes, credit constraint tighten (as also confirmed in Table 3.2). Moreover, equation (3.14) shows that below median income households face even tighter borrowing constraints than above median income households (as expressed through the parameter λ). Another reason is to be found in the institutional environment, namely the comparatively long duration of the insolvency period in the creditor friendly regime: Defaulting households remain excluded from credit markets during the restructuring process and are only discharged from residual debt after eight years. The rising number of insolvencies for higher inequality regimes hence points to a lower number of households that participate at credit markets.

Aggregate savings increase with increasing skewness as the rich get richer and accordingly save more. This is also confirmed by higher wealth-to-GDP ratios. Figure 3.3 shows the course of GDP development across all inequality scenarios for the creditor friendly economy. One can also see, that in spite of the decrease in the level of GDP for higher inequality, GDP time series still show a positive growth rate under pro-creditor laws.

3.4.2.2 The Role of Income Distribution in a Debtor Friendly Economy

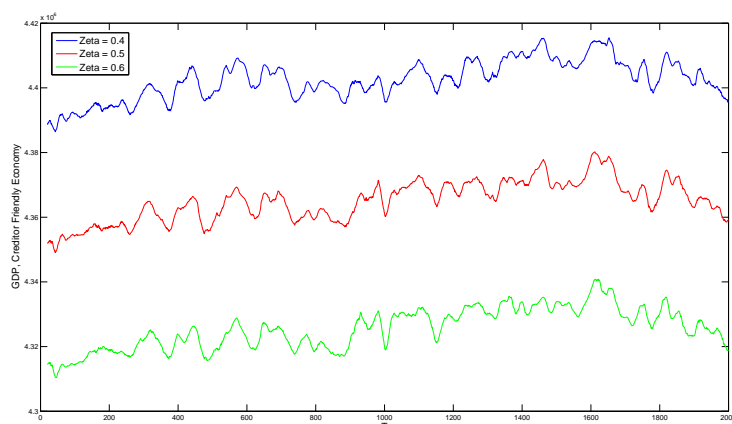
We now turn to a debtor friendly regime where residual debt of defaulting households is discharged after three years.⁸ Again we simulate three different scenarios for varying income distributions. We now assume that households incorporate the pro-debtor insolvency law in their consumption decision. As described in Section 3.3.3, households

⁸Despite the existence of more debtor friendly insolvency regulations, such as the US or UK law, we decided for the three year insolvency period as it represents the most debtor friendly law in Continental Europe.

TABLE 3.2: Simulation Results: Creditor Friendly, Debt relief after 8 years ($\gamma_2 = 0.3$)

Scenario	1a	1b	1c
Shape parameter of the Income Distribution	$\zeta=0.4$	$\zeta=0.5$	$\zeta=0.6$
GDP (mean), in mio.	4,369	4,329	4,288
σ^2 GDP (cyclical), in mio.	30,913	29,525	29,396
GDP Growth Rate	0,00016	0,00009	0,00006
Aggregate Debt, $\sum L$, in mio.	61,64	58,79	53,91
Aggregate Savings, $\sum D$, in bn.	4,905	4,985	5,066
Max. income	365420	469030	603450
Median Income	18308	16438	14501
Number of insolvencies	36	55	112
Credit constraints in %	49,99	49,99	50,01
Debt-to-GDP ratio	14,10	13,58	12,57
Wealth-to-GDP ratio	1122,44	1151,49	1181,55

The table reports mean values for the 300 iterations.

FIGURE 3.3: GDP - Creditor friendly regime (Moving averages), Generalised Pareto Distribution, $\gamma_2 = 0,3$ 

have stronger incentives to take up higher amounts of debt, as they are aware that discharge from debt follows after a relatively short time period (see also Grössl and Fritsche, 2007b). As opposed to previous scenarios, “keeping up with the Joneses” behaviour is therefore more pronounced which results in an overall higher propensity to consume.

In line with the creditor friendly economy, we observe lower levels of GDP with increasing inequality (see Table 3.3 and also Figure 3.4). Again aggregate debt decreases and the number of insolvencies increases for stronger skewness.

As households at the lower scale of the income distribution have an overall higher propensity to consume as opposed to the creditor friendly regime, aggregate debt is much higher. Yet, despite the increasing relevance of other households' consumption, higher inequality leads to a reduction in aggregate debt as observed for the creditor friendly case. While the underlying causes are again the decrease in median income leading to both lower demand for credit as well as a tightening supply, the influence of the prevailing debtor friendly insolvency regulation on aggregate debt is comparatively weaker: Shorter insolvency periods imply that insolvent households are released from remaining debt earlier, and hence regain access to credit markets faster. Although earlier access to debt contributes to slightly higher aggregate consumption, and hence higher levels of GDP, it also leads to very high levels of debt and repeated insolvencies.⁹

As in the creditor friendly economy, GDP volatility is largest if inequality is lowest, because the higher propensity to consume of low income households as opposed to high income households exposes them to a higher risk of default. Hence, the number of insolvencies is already relatively high for the scenario with lowest inequality. Volatility of time series decreases for the higher inequality scenarios. First, because relatively more insolvent households are excluded from credit markets, and second, due to tightening credit on the side of the lenders. Interestingly, volatility is lowest for medium inequality, and slightly higher for the highest inequality scenario. An explanation follows from reduced loan demand due to lower median income and therefore lower aggregate debt: Although, the largest number of defaults is documented for the high inequality scenario, the rise of defaults from the medium to the high inequality scenario (approx. 1,61 times as many defaults) is lower than from the low to the medium inequality scenario (where almost twice as much defaults are documented). We presume that the effect of excluded households from credit markets lowers aggregate volatility for the medium inequality scenario, whereas in the high inequality scenario, the size of loan demand is relatively lower and credit constraints are relatively higher enabling relatively more debtors to repay their obligations. In this regard, insolvency laws act as a device to reduce volatility for medium inequality.

Contrary to the creditor friendly regime, from Figure 3.4 and Table 3.3, one can see that GDP time series show a slightly negative growth rate. The debtor friendly regime with

⁹From a creditors perspective, debtor friendly insolvency laws imply that they can seize less of a insolvent households wealth. As the bank is always bailed out in our model, there are no repercussions on GDP dynamics.

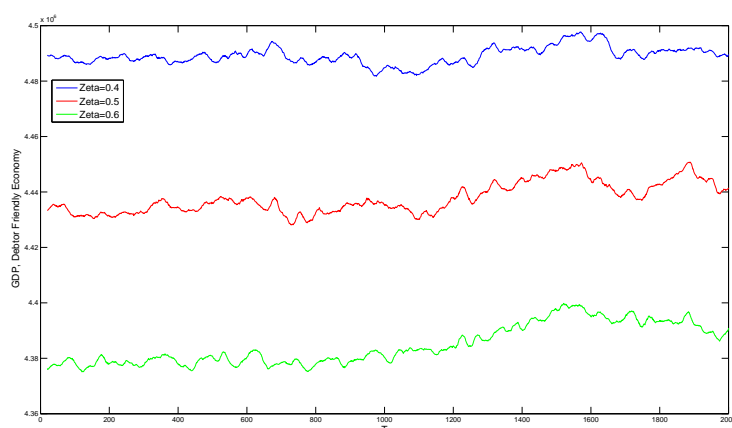
TABLE 3.3: Simulation Results: Debtor Friendly, Debt relief after 3 years ($\gamma_2 = 0.4$)

Scenario	2a	2b	2c
Shape parameter of the Income Distribution	$\zeta=0.4$	$\zeta=0.5$	$\zeta=0.6$
GDP (mean), in mio.	4,489	4,438	4,385
σ^2 GDP (cyclical), in mio.	191,555	147,411	154,519
GDP Growth Rate	-0,00044	-0,00021	-0,00027
Aggregate Debt, $\sum L$, in mio.	179,469	163,647	144,677
Aggregate Savings, $\sum D$, in bn.	4,801	4,894	4,987
Max. income	365420	469030	603450
Median Income	18304	16435	14498
Number of insolvencies	153	303	489
Credit constraints in %	50,00	50,05	50,08
Debt-to-GDP ratio	39,98	36,88	32,99
Wealth-to-GDP ratio	1069,43	1102,73	1137,37

The table reports mean values for the 300 iterations.

stronger incentives to overborrow has an overall negative effect on GDP development. We can further see from Table 3.3, that like in the creditor friendly regime, savings increase for higher inequality as the range of the income distribution is expanded. Under the debtor friendly regulation however, the overall amount of savings is lower across all levels of skewness as low median income households have a higher propensity to consume and hence fewer households save at all.

FIGURE 3.4: GDP - Debtor friendly regime with moral hazard (Moving averages), Generalised Pareto Distribution, $\gamma_2 = 0,4$



3.4.2.3 Debtor versus Creditor Friendly Economies

Opposing the debtor friendly to the creditor friendly insolvency regime, several results stand out. First, in both model economies, inequality has a negative effect on the level of GDP. Second, given that the need for external finance rises with increasing inequality, insolvency laws can have a stabilising effect on GDP volatility as they reduce credit market activity. The stabilising effect is substantially larger for the creditor friendly regime.

Third, the level of GDP, GDP volatility, aggregate debt and the number of insolvencies are considerably higher in the debtor friendly economy, while savings are slightly lower. Because credit demand is remarkably larger due to low income households' higher propensity to consume, not only debt-financed consumption as an essential element of GDP is higher, but also aggregate debt leading to both higher aggregate volatility and a higher number of insolvencies. Forth, from Figures 3.3 and 3.4, we can see that the creditor friendly economy exhibits positive growth rates, while we observe slightly negative growth for the debtor friendly economy over the course of the simulation. Put differently, while debt-financed consumption increases the level of the GDP in the first place it can have negative effects on economic growth. The latter is particularly pronounced under moral hazard behaviour.

To sum up, from a microeconomic perspective, debtor friendly insolvency laws promote higher consumption in the favour of households preferences. Moreover, households profit from earlier discharge of residual debt ex post insolvency. Creditor friendly economies on the contrary prevent them ex ante from taking up unsustainable levels of debt not defaulting in the first place. On the macroeconomic level however, debtor friendly insolvency laws impede economic growth and negatively affect macroeconomic stability while the opposite is true for creditor friendly laws.

3.5 Summary and Conclusion

Insolvency laws vary strongly across countries. An optimal insolvency law, that balances the conflicting interests of creditors and debtors, is still the subject of controversy among both, scholars and policymakers. The debate is essentially based on the large number of

filings in the United States where an extremely pro-debtor consumer insolvency law is often deemed to promote strategic default (see for instance White, 2007a). In Europe, where insolvency laws are very heterogeneous, yet rather classified to be creditor friendly, lawmakers are currently discussing about uniform insolvency laws for the EU to prevent debtors from using legal loopholes such as defaulting under the law of a more pro-debtor EU country. This process is however, not only complicated because of the difficulty of finding an optimal insolvency law, but also because of the strong heterogeneity of European countries with respect to institutional, economical and social factors. Our results have therefore important implications as we analysed heterogeneous income distributions under different insolvency laws. To demonstrate the magnitude of heterogeneity in European economies, the Appendix E provides a detailed overview and some descriptive statistics on personal insolvency regulations as well as income and wealth distribution in five selected EU countries.

In this paper we have explored the effects of increasing inequality under varying consumer insolvency regulations. In doing so, we applied an agent-based model of household-bank relationships where increasing inequality leads to higher credit demand. We further assumed that pro-debtor policies are more likely to promote moral hazard as punishment in case of default is less severe. Opposing a creditor friendly with a debtor friendly economy we find that aggregate debt, aggregate consumption and the levels of GDP are higher under pro-debtor regulations while volatility and economic growth perform better under pro-creditor regulations. In fact, the tendency of low income households to overborrow under pro-debtor laws puts a downward pressure on economic growth, while GDP growth rates are positive in the creditor friendly regime, where debt-financed consumption is more sustainable. In both model economies however, insolvency laws have a stabilising effect for higher inequality, while the effect is more pronounced under creditor friendly laws. From a microeconomic perspective, insolvent households are better off under debtor friendly regimes in the sense that the insolvency duration is shorter, while creditor friendly insolvency regimes prevent households from overborrowing in the first place.

Chapter 4

Personal Insolvency Dynamics in Germany and the UK - A SUR-TAR Approach

This chapter is based on Arnold and König (2015).

4.1 Introduction

During recessionary times indebted households are increasingly exposed to adverse shocks putting their solvency at stake (e.g. Fieldhouse et al., 2012). However, the sustainability of household debt varies greatly across countries. While unemployment and/or events of bad luck such as divorce or health problems are intuitive explanations that can increase the probability of default, they fail to explain existing differences across countries. Theoretical research points to the role of insolvency regulations arguing that there is a link between benevolence towards debtors and the number of insolvencies (e.g. Fay et al., 2002; White, 2007a). Indeed, research comparing different insolvency regimes is mostly theoretical (Livshits et al., 2007; Chatterjee and Gordon, 2012). Empirical studies emphasise the role of institutions¹ for debt repayment behaviour. Duygan-Bump and Grant (2009) use micro data, where insolvencies constitute a rare event and therefore focus on repayment difficulties of households instead of actual defaults. And Jappelli et al. (2013) use yearly data to analyse insolvencies. However, both studies neglect cyclical fluctuations and responsiveness of debtors during recessions. The literature on optimal insolvency laws typically takes a static view and has so far greatly neglected the underlying dynamics of insolvencies in different economies.

This paper aims at studying the dynamics of personal insolvencies under different insolvency laws. We examine Germany (DE) and the United Kingdom (UK) as their approaches to dealing with over-indebtedness are fundamentally different and as they can be roughly considered as representatives of two opponent models of financial system architecture within the European Union: Germany has a bank-based system with a long tradition of relationship lending, which is characterised by dominating long-term credit contracts with fixed terms of contract. On the contrary, the Anglo-Saxon market-based financial system relies on the market as a coordination mechanism, where transactional lending dominates. This translates into less favourable credit conditions exposing borrowers to sudden changes of contract terms. Rather short-term creditor-debtor relationships prevail and hence, informational asymmetries are more pronounced. Accordingly, debtors' liquidity problems tend to be more frequent in the UK, which is absorbed

¹ Duygan-Bump and Grant (2009) account for the time before debt get resolved, the related bureaucracy, the cost to default and public as well as private coverage. Jappelli et al. (2013) focus on creditor rights, judicial enforcement and information sharing policies.

through an insolvency regulation that is more lenient towards debtors compared to Germany, where borrowers enjoy more reliable contract relationships². We are interested in reactions of personal insolvencies to (macro)economic shocks and other macroeconomic factors under these different institutional frameworks. Specifically, this paper asks how the 2007-2008 financial crisis and the subsequent economic downturn affected sustainability of private household debt measured by the number of insolvencies. There are two main developments which recently increased the importance of this issue. The first refers to growing concerns about the sustainability of private household debt, particularly since the event of the sub-prime crisis and its consequences for the real economy. A larger share of household liabilities in banks' balance sheets³ turns repayment behaviour into a key variable that poses a threat to financial stability, and via the credit channel, also to the real economy (Bernanke and Gertler, 1995; Bernanke, 2007). The second refers to institutional heterogeneity within the European Union and related discussions about a harmonisation of insolvency laws (e.g. Wessels, 2012).

We conduct a time series analysis for Germany and the UK, using data on personal insolvencies (petitions and actual filings) to detect the dynamics under varying economic conditions. Controlling for key macroeconomic and financial variables, we first apply a factor analysis to consolidate many variables into few main factors for each country. Then we turn to time series regressions, particularly focusing on the event of the great recession in the two countries.

This paper is organised as follows. Section 4.2 gives an overview of related literature. In Section 4.3 we provide a theoretical background on the link between financial systems, insolvency laws and private household indebtedness. The subsequent Section 4.4 gives an overview of the personal insolvency laws in Germany and the UK. Section 4.5 presents the data and some descriptive statistics. The empirical strategy and results are described in Section 4.6. Section 4.7 concludes.

4.2 Literature on Personal Insolvencies

This section gives a brief overview on previous research. The literature on personal insolvencies is manifold and addresses different yet related questions. Research ranges from

²See also Berkovich and Israel (1999).

³See for instance Chmelar (2013); Jappelli et al. (2013).

literature dealing with distortive incentives of pro-debtor insolvency laws (White, 1998; Fay et al., 2002; White, 2007a, to name a few), to a literature dealing with consequences for debtors who previously filed for insolvency (Cohen-Cole et al., 2009; Han and Li, 2011; Jagtiani and Li, 2014) and literature comparing advantages and disadvantages of different insolvency laws (Livshits et al., 2007; Chatterjee and Gordon, 2012).⁴ Due to data availability on the one hand, and the relevance of overextended households resulting from the sub-prime crisis on the other hand, most previous empirical studies have continued to investigate developments in the US, whereas literature concentrating on Europe is relatively sparse. Among the few exceptions is research on corporate insolvencies (Kaiser, 1996; Franks et al., 1996; Davydenko and Franks, 2008) and research with a close proximity to jurisprudence and/or research which takes an international but less refined perspective (e.g. Kilborn, 2007; Gerhard, 2009; Niemi, 2012; Heuer, 2014).

Most studies mentioned so far do not account for the link between insolvencies and changing macroeconomic conditions. While the relationship between household debt and macroeconomic stability has previously been covered by the literature (e.g. Debelle (2004); Barba and Pivetti (2009)), resulting defaults have so far not received sufficient attention. This is crucial however, as sustainability of household debt depends on several factors, that are not yet well enough understood. Empirical research typically studies micro factors pointing to sudden unemployment, divorce, health problems or similar unfortunate events as determinants for the probability of default (Sullivan et al., 2000; Gross and Souleles, 2002; Warren, 2003; Himmelstein et al., 2005; White, 2007a). In this context, the role of differing institutional settings such as insolvency laws and their relation to macroeconomic developments is also of crucial importance and yet, has been hardly studied. One contribution of this paper is therefore to study the effects on private household vulnerability (focusing on the 2007-2008 financial crisis) under differing insolvency regimes.

Papers that are closest to our research are Fieldhouse et al. (2012) and Garrett and Wall (2014). Using Canadian data, Fieldhouse et al. (2012) investigate the factors which induced an increase of almost 50 % in personal insolvencies filings during the 2008-2009 financial crisis. They use aggregate data as well as a unique micro data set to study

⁴Theoretical contributions predominantly focus on the optimality of insolvency laws in light of conflicting interests between creditors and debtors (see for instance Berkovich and Israel (1999); Povel (1999) and Wang and White (2000)).

which recession-induced adverse shocks led to this observed rise and how the characteristics of defaulters changed. Two potential channels are deemed to be responsible for the rise in insolvencies. On the demand side they identify higher income volatility as mirrored in higher unemployment rates and on the supply side, restrictive lending standards as reflected in interest rate changes. They find both channels to be highly significant for cyclical fluctuations of personal insolvencies. Their findings are confirmed also for the provincial and city level for annual data ranging from 1987-2011 and house price data covering the period 1999-2012, which is particularly pronounced at the city level. With respect to the characteristics of defaulters, they identify mostly middle-class households. They report that the typical “middle-class filers” earned a regular income prior to the recession. Due to sudden unemployment they were no longer able to service their debt, hence facing financial difficulties. Surprisingly, however, Fieldhouse et al. (2012) document that cyclical movements in consumer-debt-to-income ratios as well as mortgage-debt-to-income ratios show a slightly negative or no correlation with insolvencies. They conclude that high debt levels do not simply suggest higher insolvency rates and that borrowing is pro-cyclical.

Garrett and Wall (2014) investigate the link between personal insolvencies and economic conditions. They use state-level data for the US, arguing that local economic conditions represent the relevant environment that matters for a household’s economic situation. In line with Fieldhouse et al. (2012), they argue that labour market conditions rather than actual GDP growth are relevant for cyclical movement in personal bankruptcies.⁵ They find that the length of a recession is key to whether bankruptcies are pro- or counter-cyclical. Longer recessions cause more households to face financial difficulties as they are more likely to suffer from one or perhaps even multiple adverse shocks and have to endure such shocks for a longer period of time.

The subsequent section provides some theory by emphasising the link between an economy’s financial system, insolvency laws and household debt.

⁵Therefore, they determine their own state-level recessions, as NBER recession dates are deemed to be not appropriate.

4.3 On the Link between Financial Systems, Insolvency Laws and Household Debt

Petitions in bankruptcy can be filed when debtors are unable to meet their liabilities.⁶ The number of petitions per year varies strongly across countries and depends on various factors. While negative shocks such as unemployment or unexpected expenses are unanimously identified as major drivers in the literature (see also Section 4.2), they are unable to explain prevailing varieties. Previous research has emphasised the role of institutions such as a country's legal origin and related mechanisms of contract enforcement (Berkovich and Israel, 1999; Djankov et al., 2007; Jappelli et al., 2008; Duygan-Bump and Grant, 2009). They determine how informational problems are dealt with in creditor-debtor relationships and thus shape an economy's financial system.

Economic theory categorises financial systems into bank-based and market-based systems (for a survey on the literature see Allen and Gale, 2001). While in bank-based systems credit contracts are typically based on stable long-term relationships between debtors and house banks (*relationship lending*), transactional contracts dominate in market-based systems, relying on the market as coordination mechanism (*arm's length lending*).⁷ The underlying contract culture of the respective financial system reflects the relationship among lenders and borrowers and shapes lending practices accordingly, as reflected in the conditions of concluded contracts⁸. Whereas premature termination of relational contracts is generally very costly and, in case of unforeseen contingencies, contract conditions are typically renegotiated, transactional lending implies that contracts are more likely to be changed during its term, but leaving the option to terminate agreements⁹. This translates into comparatively high aggregate short-term debt and comparatively low aggregate long-term debt in market-oriented systems. The reverse holds true for bank-based financial systems which reveal a comparatively high long-term-to-short-term debt ratio.¹⁰ With dominating short-term contracts, households' financial situation becomes

⁶In technical terms agents are insolvent when they cannot repay obligations on time, i.e. it refers to an agents financial state. Bankruptcy is defined as the legal process that helps to restructure debt. In this paper, we use the terms insolvency and bankruptcy interchangeably.

⁷The US and the UK are usually classified as market-based financial systems, and Germany and Japan as bank-based financial systems (see for instance Allen and Gale, 2001).

⁸That bank lending differs in market-based and bank-based financial systems is also confirmed by Kaufmann and Valderrama (2008).

⁹In the sense of Hirschman's differentiation between exit and voice, relational contracts refer to the former and transactional contracts to the latter.

¹⁰For the empirical analysis we consider the structure of debt as a proxy for the respective financial systems.

more volatile as economic conditions largely dictate new terms and contract conditions. During an economic downturn, debtors face larger difficulties to handle negative shocks, increasing their probability to default (e.g. Bolton et al., 2013). The type of the financial system can also be identified by means of the external finance premium. Due to informational asymmetries between lenders and borrowers a financing gap arises between the costs of internal and external funds. Unless a loan is fully collateralised, lenders protect themselves against opportunistic behaviour by collecting information about borrowers' creditworthiness (e.g. Rajan, 1992; Boot and Thakor, 1997). This leads to agency costs which appear in loan contracts as a premium. Agency costs decrease with the duration of a creditor-debtor relationship, because lenders gain an informational advantage as opposed to short-term relationships. The external finance premium should therefore be lower in bank-oriented systems. Although research on the latter dominates with respect to firm financing, Bernanke and Gertler (1989) explicitly refer to households in their seminal contribution as well. The significance becomes even more evident in an economy where house prices can be used as collateral to borrow against, as put forward by Aoki et al. (2004) for the case of the UK¹¹. In such a setting, lenders mitigate risk by demanding collateral, reducing agency costs and accordingly the external finance premium (e.g. Bernanke and Gertler, 1989).

In case insolvency becomes inevitable, bankruptcy regulations come into play. The link between financial systems and bankruptcy laws has been formalised in a principal-agent framework by Berkovich and Israel (1999). Their analysis suggests that developed countries with a bank-based financial system should have a creditor friendly bankruptcy law, whereas market-based financial systems, should have a pro-debtor insolvency law. For bank-based financial systems, they propose a creditor chapter only because creditor rights are low. For market-based financial systems they propose a dual chapter code which enables both, creditors and debtors to commence bankruptcy, because creditor rights are strong.¹²

An objective of bankruptcy laws is to reduce coordination problems between creditors who want to collect debt (Jackson, 1986). A further objective is to set optimal incentives in the ex ante sense, i.e prevent debtors from over-borrowing. Given this, with debtor

¹¹See also Muellbauer and Murphy (1994, 1997)

¹²That creditor rights tend to be low in countries with bank-based and high in market-based financial systems has also been confirmed empirically by LaPorta et al. (1997) (for a more detailed link between law and finance see also LaPorta et al. (1998)).

friendly regulations in place, debtors are more prone to moral hazard. Debtor friendly regulations can be characterised by a relatively fast and unbureaucratic discharge of financial obligations and relatively high exemptions in case of default, whereas the opposite holds true for creditor friendly regulations. In this context, informal values and norms often tend to be related to formal ones, shaping social sanctions of filing for bankruptcy accordingly. Indeed, the social stigma attached to insolvency is a crucial factors determining incentives (Efrat, 2006). The rising number of insolvencies in most economies suggests declining social sanctions throughout the last century, and particularly during the last two decades. Yet, variations remain and informal sanctions, such as loss of reputation, are closely associated with the degree of creditor or debtor friendliness of an insolvency law (see for instance Efrat, 2006; Sousa, 2014). Social punishment remains higher in creditor friendly economies, which additionally shapes decisions of potential defaulters.

Given the institutional background, we hypothesise that debtor friendly laws lead to a higher number of households' petitions to default. These effects should be amplified during recessions as households are more vulnerable and rather exposed to adverse shocks. Put, differently, we expect petitions to file for insolvency to behave pro-cyclical and to be more pronounced in market-based economies with debtor friendly bankruptcy laws.

4.4 Background on Personal Insolvency Regulations

This section provides background information on personal insolvency regulations. It begins with a short overview of the purpose of insolvency laws and then describes the procedures in Germany and the UK. These countries are interesting as their approaches to deal with private households' over-indebtedness are very heterogeneous. While the German legislation is rather concerned about debt restructuring as expressed in a relatively long-lasting insolvency period, UK legislations are more directed towards a fast discharge of residual debt acting as an insurance for unfortunate debtors. The two countries' traditions can roughly be considered as representative for the continental European and the Anglo-Saxon personal insolvency systems. Section 4.3 has discussed the link between the type of financial systems and respective insolvency regulations. Whereas Germany matches the characteristics of a bank-oriented system, the tradition in the UK is based on market orientation (Allen and Gale, 2001).

Until the 1990s, the concept of debt relief did not exist in continental European legal systems (see for instance Niemi, 2012)). However, resulting from the sharp rise in household debt following financial market deregulation, the laws of many European countries have become more forgiving towards default since then. Numerous amendments show that they still struggle with finding an optimal balance between creditor protection and an insurance against the “new social risk of consumer over-indebtedness” (Heuer, 2013, p. 2). The social stigmata connected to the negative perception of personal bankruptcy gets more and more dissolved and is increasingly considered as a social insurance in many countries.¹³ That notwithstanding, personal bankruptcy laws still differ strongly, even within the European Union as we exemplify on the basis of the legal systems in Germany and the UK.

The next two sections provide an overview of these countries personal insolvency laws.

4.4.1 Personal Insolvency Laws in Germany

Resulting from an increase in the number of private households suffering from overwhelming debt, a new insolvency statute for consumers was developed in 1994 and came into force in 1999¹⁴. As mentioned above, prior to that individuals had not been considered in the insolvency regulation and only firms had the legal right to default on their debt. Compared to firms, legal procedures for household defaults are subject to a more simplified procedure which proceeds in the following steps. Prior to requesting a legal insolvency procedure, it is compulsory for debtors to attempt an *out-of-court settlement* (§305 InsO). In case the settlement was not effective, a *judicial settlement* procedure opens where debtors have to provide a settlement plan listing all debts and assets. If the court and creditors with the highest claims agree to the settlement plan, all other creditors with low claims are voted down. In case there is no agreement, the *insolvency proceedings* open and the debtor’s estate is liquidated and proceedings are distributed among the creditors. After six years of good behavioural conduct and good faith, debtors can be discharged from residual debt (§§286-303 InsO).

¹³In ancient times, bankruptcy had a very punitive character, treating debtors as criminals (Tabb, 1991, p. 8). The word bankruptcy derives from bench-breaking, in latin: “banka” and “rupta”, which was the main punishment for merchants that could not repay their debt in the middle ages.

¹⁴Until 1998 the *Konkursordnung* from 1877 and the *Vergleichsordnung* from 1935 were in place.

Due to a reform of the personal insolvency law in July 2014, a debtor who has paid at least 35% of total debt can already get discharged of residual debt after three years. The aim of this reform was to facilitate an earlier “fresh start” for unfortunate debtors (see also table E.2).

4.4.2 Personal Insolvency Laws in the UK

In the UK, the *Insolvency Act* and *Insolvency Rules* (1986) regulate personal and corporate bankruptcy. Whereas the insolvency law regulates only companies (*Companies Act 2006*), personal insolvencies are covered by the *bankruptcy law* with separate regional bankruptcy regulations for England & Wales, Northern Ireland, and Scotland. Despite some minor differences, all three regimes are rather debtor friendly, and bankrupt individuals can receive discharge from debt within less than twelve months. However, if the debtor acted strategically (e.g. in the sense of moral hazard or strategic default), restrictions reach up to 15 years before a discharge.

In England & Wales insolvent households have several options to get their debt restructured. Alternatives to filing for bankruptcy include for instance “Debt Management Plans”, “Administration Orders” or “Individual Voluntary Arrangements” (IVA) (Part VIII of the *Insolvency Act 1986*). For all alternatives debt gets restructured through arrangements between the insolvent household and the respective creditors. Moreover, since April 2009, insolvent households whose liabilities remain below a certain threshold (15.000 £) have been given the opportunity to apply for a “Debt Relief Order” (DRO). With the aim to impede social exclusion of households at the lower end of the income and wealth distribution, DROs may work as an insurance against poverty traps: They are only eligible for individuals with very little wealth (<300 £) and low disposable income (<50 £per month) (Chapter 4 of the *Tribunals, Courts and Enforcement Act 2007*)¹⁵. Northern Ireland has also introduced DROs in June 2011, whereas Scotland has introduced LILAs (in Q2-2008), as a solution for “Low Income Low Asset” households, which are very similar to DROs.

¹⁵For more detailed information see also: <https://www.gov.uk/options-for-paying-off-your-debts/overview>

Contrary to the German law, debtors in the UK can choose from these alternatives. The “bankruptcy option” (Part IX of the Insolvency Act 1986) is the one which is closest to German insolvency: insolvent households can either declare themselves bankrupt, their creditors can declare debtors bankrupt or, if debtors do not adhere to a previously arranged IVA, an insolvency practitioner can apply to declare them bankrupt. Once a bankruptcy order by a court is issued against them, the bankrupt individual has to officially explain his or her situation, assets will be governed by a court-appointed trustee and sold to repay the creditors, he or she has to adhere to certain bankruptcy restrictions and the case will be made public in the “Individual Insolvency Register”.¹⁶ After twelve months, remaining liabilities and the bankruptcy restrictions are typically released, though, assets from the estate can still be used to pay the remaining debt off. In Scotland and Northern Ireland, insolvency procedures are very similar.¹⁷ Scottish insolvency law uses the term *Sequestration*.

TABLE 4.1: Features of consumer insolvency laws across countries

Country	GER	UK		
		ENG & WLS	NIR	SCT
Debt relief	after 6 years §§286ff InsO	12 months	12 months	12 months
Reforms	1 July 2014 Proceeding: 3 years*	DRO (Q2- 2009)	DRO (Q3-2011)	LILA (Q2-2008)
Main Source	German Insolvency Regulation	Part IX of the Insolvency Act 1986	DETI Insolvency Service	Office for the Accountant in Bankruptcy (AiB)

Source: Country Specific Insolvency Laws.

*If 35% of debt has already been discharged.

¹⁶In Germany, data privacy protection prohibits a public register.

¹⁷For a more detailed description see <http://www.aib.gov.uk/debt> for Scotland and <http://www.nidirect.gov.uk/what-happens-when-you-become-bankrupt/> for Northern Ireland.

4.4.3 German versus UK Personal Insolvency Procedures

Comparing the German and the British approach to dealing with over-indebted individuals, two main differences can be identified. The first one is the benevolence towards debtors in the UK as expressed for instance in the relatively uncomplicated procedure and short duration before residual debt gets discharged, as opposed to Germany where debtors have to go through a longer and more bureaucratic process to finally get resolved from remaining debt.

The second difference emerges from the variety of options to dealing with over-indebtedness in the UK. Debtors are given the right to choose their own solution when they face difficulties to meet financial obligations. To restrain debtors with assets from opting for official bankruptcy, and hence, debt discharge, authorities in the UK are pursuing the “can pay, should pay” approach, encouraging debtors to repay liabilities by means of informal debt management tools (e.g. McKenzie Skene and Walters, 2006). At the same time overextended households who are living with a subsistence income are given the opportunity to receive relatively unbureaucratic and fast discharge from debt, as also shown by the recent reforms with the amendments of debt relief tools for households with little income and wealth (DROs in England and Wales and Northern Ireland, and LILAs in Scotland). German households on the contrary, have only one possibility namely to default legally. In this process however, an informal debt settlement approach between debtors and creditors is mandatory before going to court.

4.5 Data and Descriptive Statistics

To empirically investigate how personal insolvencies and insolvency petitions are affected by economic conditions and the role of insolvency laws therein, we build a data-set consisting of Germany and the UK with times series ranging from 2003-2014. All data is quarterly. Both economies were affected differently by the 2007-2008 financial crisis. The economic downturn was not only more severe in the UK, but also more prolonged (see also Figure F.1). According to data from ECRI (European Cycle Research Institute), the great recession in Germany lasted from Q2-2008 until Q1-2009 and in the UK from Q2-2008 until Q1-2010.

Similarly, macroeconomic conditions such as unemployment and inflation are different in both countries during the period under scrutiny. Most macroeconomic variables are drawn from *Eurostat* or the *OECD (Main Economic Indicators)* database (Table G). Figure F.2 depicts unemployment rates: in Germany, unemployment was highest in Q1-2005, with 11,5 %, and constantly decreased thereafter, mainly as a result of the “Agenda 2010”, an extensive structural reform of the German labour market and the social system¹⁸. In the aftermath of the crisis, there was a short but minor increase in unemployment again. Unemployment in the UK behaves in the opposite way, with very low rates before the crisis (4,55 % evidence in Q2-2005), steadily increasing thereafter and reaching a peak in Q3-2011. The more distant the crisis, the more does unemployment decline again. Differences can also be observed for inflation rates (see Figure F.3 and Table 4.2). Whereas time series look similar for both countries before the crisis, inflation rates are higher for the UK thereafter. Overall, inflation is lower Germany, including even a short deflationary period in 2009.

House prices are reported in quarterly changes of house price indices. From Tables 4.2, we can see that the volatility of house prices in the UK is very high compared to Germany. In particular the spread of house price changes between 2003 and 2009 is exceptionally high in the UK (see also Figure F.4). The exceptionally low volatility of house prices in Germany has also been described by Belke (2010). Aoki et al. (2004) provide an explanation of house prices for the UK. They emphasise special characteristics such as their role as collateral to borrow against, rendering credit subject to their volatility. House prices began to decrease sharply end of 2007 until Q2-2009, and then started to increase again. The observed weakness in housing markets has put additional pressure on financially fragile home-owners. Given this, Nielsen et al. (2010) report that the proportion of households with a loan-to-value ratio over 75 % was very high end of 2009 compared to 2007.

These reported different economic developments in particular during the recession are deemed to put additional strain on the sustainability of household debt as they influence credit market conditions. Under adverse economic developments one should expect

¹⁸In the course of the Agenda 2010, new instruments of labour market policy were introduced and the labour markets and social benefits and unemployment benefits were combined. Moreover, since the reform long-term unemployed are forced to accept any job offer which is deemed to be reasonable for them (Goecke and Schröder, 2013)

indebted households to be exposed to possibly even multiple or more severe shocks, inducing them to default earlier.

Data on personal insolvencies for Germany are extracted from the *Statistische Bundesamt (destatis)*. We look at two different variables. First, the numbers of petitions to file for insolvency (*InsolPet*) and actual filings (*Insol*). Because insolvency regulations vary strongly between Germany and the UK (see Section 4.4), we compare those elements of the insolvency laws that are most similar. Resulting from the different procedures, one has to be very careful and precise with the interpretation. Our definition of petitions to file (*InsolPet*) includes all available data on petitions in both countries.¹⁹ Actual insolvencies (*Insol*) comprise only the cases which appear before a court and no settlement is achieved. Table G provides a more detailed description on how the respective variables are composed.²⁰ Data for the UK is drawn from the *Insolvency Service* by the British government. As described in Section 4.4.2, personal bankruptcy is regulated in three different regions, England & Wales, Scotland and Northern Ireland. Despite the local separation, the insolvency regulations are qualitatively the same across all regions. As other time series data is only available for the UK as a whole, we sum up the numbers from the respective regions to create the variables for our analysis. From Figure F.5 which displays (actual) personal insolvencies in the single regions, one can see that England & Wales account for the largest share, followed by Scotland and Northern Ireland respectively.²¹ Figure F.6 displays the absolute number of insolvencies as well as petitions since 2004 in both countries. One can see that in absolute numbers both, petitions and actual filings are higher in Germany. However, accounting for the size of the population (approx. 81,1 mio. in Germany²² and approx. 64,6 mio. in the UK²³), relative values of petitions to file are slightly higher for the UK than for Germany. Actual insolvencies remain lower, which can be ascribed to the different insolvency procedures in the two countries. This has to be evaluated with care though, as data exclude Out-of-Court settlements in Germany and debt-management plans as well as administration

¹⁹Unfortunately, data for Out-of-Court settlements in Germany is not available. For the UK, data on debt management plans is not available.

²⁰Note that, from January - August 2011, courts in the Saarland (the smallest German Bundesland) have reported only low numbers of insolvencies, which were added to the statistics in September 2011. Data during that time period therefore has to be interpreted with care.

²¹Over time some amendments have been made to the single laws, particularly creating advantages for households with little or no wealth: debt relief orders (DRO) (as described in Section 4.4.2) have been introduced in Q2-2009 in England and Wales, in Q3-2011 in Northern Ireland. In Scotland, LILAs (low-income-low-assets) were introduced in Q2-2008.

²²Destatis.

²³ONS.

orders in the UK. Turning now to the development of insolvencies over time, one can see from Figure F.6 that insolvency petitions and actual filings are strongly correlated, yet the difference between the two variables is larger for the UK. This may be explained by the different procedures to deal with overindebtedness in the two countries. Note that a careful interpretation is required though, as we define proxies due to restrained data availability on informal procedures²⁴. For Germany we observe a sharp increase until mid-2006. This is mostly attributable to the fact that a law regulating personal insolvencies was only introduced in 1999, and households got used to this opportunity to default only gradually over time. Interestingly, during the financial crisis insolvencies decreased again and increased only slightly thereafter. The picture looks different for the UK: from 2003 onwards personal filings increased and fell between mid-2006 until mid-2007, rising thereafter and throughout the great recession, and reaching a peak in mid-2010. Apart from the crisis, this peak could possibly also be ascribed to the introduction of LILAS in Scotland in 2008 and DROs in England and Wales in April 2009 which prevented many households from filing before that date, expecting an easier and less bureaucratic procedure with the amendments. After 2010, the number of defaults dropped steadily (see also Figure F.5), and increased only slightly again in 2011, which could also be partially due to the introduction of DROs in Northern Ireland.

Figure F.9 depicts interest rates: Short-term interest rates decrease immediately after the crisis, with lowest levels in 2013 in the UK (0,49 %) and Q4-2014 in Germany (0,08 %). Long-term interest rates decrease rather gradually with lowest levels in Q3-2012 in the UK (1,68 %) and in Q4-2014 in Germany (0,7 %). Throughout the whole time period, long-term interest rates in the UK are higher than in Germany; short-term interest rates were also higher in the UK before the crisis, while the opposite is true during 2010 until the end of 2011. Figure F.10 displays key ratios related to interest rates: the spread of long-term and short-term interest rates (*IR_Spread*), the interest rate coverage ratio (*IRC*) reflecting households ability to service their debt, and a proxy for the external finance premium on long-term/housing debt (*Wedge*), i.e. the wedge between an average of various lending and policy rates. For a detailed description of calculations see Table G. Whereas the debt-to-income ratio behaves the differently for Germany and for the UK (Figure F.7), the interest rate coverage ratio increases for both countries prior to the crisis and decreases thereafter, mostly due to the sharp drop in interest rates in both

²⁴Due to a lack of data for Out-of-Court settlements in Germany and because petitions and insolvencies are strongly correlated, we attribute a higher meaning to actual insolvencies in Germany

TABLE 4.2: Descriptive Statistics, Germany and the UK

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>Insol_DE</i>	48	26981.38	5897.885	12819	33664
<i>InsolPet_DE</i>	48	28602.900	5791.116	14631	35309
<i>GDP_Real_diff_DE</i>	48	1622.039	13125.75	-34181.11	23297
<i>Unempl_DE</i>	48	7.773	2.111	4.770	11.500
<i>Debt_LT_DE</i>	48	1462928	20751.52	1431930	1519615
<i>Debt_ST_DE</i>	48	80028.940	9387.584	65416	102712
<i>i_LT_DE</i>	48	3.019	1.095	0.700	4.34
<i>i_ST_DE</i>	48	1.919	1.458	0.08	4.98
<i>Debt_Inc_DE</i>	48	2.961	0.279	2.520	3.504
<i>HP_Index_Old_DE</i>	48	102.796	4.831	97	113.700
<i>IRC_DE</i>	48	7.5140	3.899	1.022	13.326
<i>IR_Spread_DE</i>	48	1.099	0.863	-0.720	2.520
<i>LTST_Debt_DE</i>	48	18.472	2.101	13.809	22.011
<i>Wedge_DE</i>	48	1.536	1.3123	-1.167	3.867
<i>Infl_DE</i>	48	1.663	0.799	-0.433	3.267
<i>Insol_UK</i>	48	17089.150	5323.729	7421	27027
<i>InsolPet_UK</i>	48	24360.400	7814.845	8232	36299
<i>GDP_Real_diff_UK</i>	48	-74.967	16453.500	-44005.740	18554.600
<i>Unempl_UK</i>	48	6.296	1.333	4.550	8.450
<i>Debt_LT_UK</i>	48	1165762	187843.400	740796	1384942
<i>Debt_ST_UK</i>	48	190656.300	16043.350	152825	216388
<i>i_LT_UK</i>	48	3.767	1.058	1.680	5.210
<i>i_ST_UK</i>	48	2.818	2.155	0.490	6.310
<i>Debt_Inc_UK</i>	48	3.334	0.533	2.359	4.270
<i>HP_Index_Old_UK</i>	48	167.898	19.212	123.400	207.079
<i>IRC_UK</i>	48	10.394	4.160	4.099	18.999
<i>IR_Spread_UK</i>	48	0.949	1.373	-1.520	3.450
<i>LTST_Debt_UK</i>	48	5.949	0.962	4.665	7.972
<i>Wedge_UK</i>	48	-0.255	3.553	-5.124	3.778
<i>Infl_UK</i>	48	2.513	0.988	0.900	4.800

Source: Destatis, ONS, OECD, Eurostat. Own calculations: Debt-to-income ratio (*Debt_Inc*), Interest-rate ratio (*IR_Ratio*), Interest rate coverage ratio (*IRC*), Long-term-to-short-term-debt ratio (*LTST_Debt*), Wedge.

countries, yet, with a higher mean for the UK. The external finance premium is higher for the UK, confirming the dominance of market-based financial system features.

Data on household indebtedness (long-term and short-term debt) is drawn from the OECD Statistics database. Figures F.7 and F.8 show the debt-to-income ratio (*Debt_Inc*) and the ratio of long-term-to-short-term debt (*LTST_Debt*), respectively. Both ratios behave completely contrary for the two countries. The debt-to-income ratio in Germany

slightly decreases over time, while we observe a sharp increase in the UK up to 2007, followed by a slight decrease thereafter. This sharp increase prior to the crisis in the UK coincides with a rising number of insolvencies thereafter. One reason might be that prior to the financial crisis, household debt was relatively more sustainable. Another reason might be the above described amendments to the bankruptcy regulation. The long-term-to-short-term debt ratio is substantially lower in the UK than in Germany pointing to different debt structures of market-based and bank-based economies with short-term loans predominating in the UK and long-term loans in Germany. The respective contract cultures are mirrored in high long-term debt in Germany and high short-term debt in the UK. In this respect, it is also interesting to take a more detailed view at the structure of private household debt. According to the bank lending survey of the Bank of England (Banking Statistics, January 2014), only 36 % of households in the UK hold mortgage debt, while 52 % hold unsecured debt of which 35,82 % constitutes credit card debt and 64,17 % are instalment or other personal loans. In Germany, outstanding mortgage debt amounts up to 78,99 % (in March 2014), instalment loans to 13,97 % and other personal loans to 11,30 % (Deutsche Bundesbank, Bankstatistik).

The structure of debt with dominating long-term contracts in Germany and dominating unsecured short-term credit in the UK may reflect the credit conditions in the respective countries. The Bank of England, Banking Statistics (January 2014) also include information about the lenders: while only 67,18 % of unsecured consumer loans are granted by monetary financial institutions, 32,82 % are managed by other, so-called “Consumer Credit Grantors” that provide (unsecured) credit to consumers²⁵. Whereas usury in Germany is legally regulated (§138 BGB, §291, Abs. 1, 2 StGB), there is no formal regulation in the UK and shadow banks can charge usurious interest rates for credit²⁶. This can be particularly harmful for potentially poor debtors who may have no alternative to cover liquidity problems.

²⁵Data is from the “Monthly Survey of Consumer Credit Grantors” which is conducted by the ONS.

²⁶In November 2013 a change in the law (Banking Reform Bill) has been announced. See <https://www.gov.uk/government/news/government-to-cap-payday-loan-costs>

4.6 Empirical Analysis

4.6.1 Factor Analysis

We conduct a factor analysis to minimise the number of independent variables in our model. Many variables that might influence personal insolvencies are naturally correlated. By identifying correlated variables and concentrating them in factors, we circumvent multicollinearity in the regressions. The macroeconomic variables accounted for in the factor analysis are GDP growth, the unemployment rate, inflation, and the house price index (of pre-owned dwellings). Variables representing households' financial status are the interest rate coverage ratio, the ratio of long-term-to-short-term debt and the debt-to-income ratio. Credit conditions consist of the interest rate spread between long-term and short-term interest rates and the wedge between an average of mortgage lending rates and the central bank policy rate as a proxy for the external finance premium (see also Section 4.5).

We receive three factors with eigenvalues larger than one for both countries²⁷. For Germany these three factors cumulatively explain 66,99 % and for the UK, 70,96 % of the total variance. For both countries we get nine factors in total, explaining 100 % of the total variance. However, six factors have eigenvalues below one. The resulting screecharts are displayed in Figure 4.1, showing a kink after the third eigenvalue, and hence, additionally confirming the extraction of three factors for both countries (Backhaus et al., 2010, p.359).

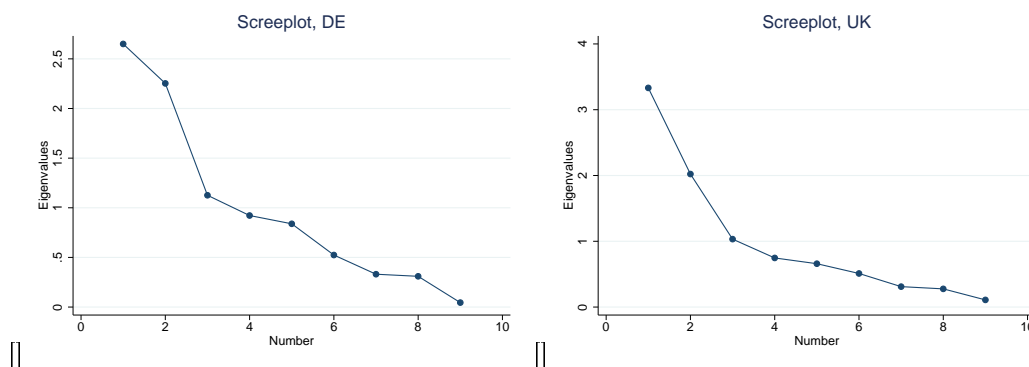


FIGURE 4.1: Screeplot after factor loading of eigenvalues for (a) DE and (b) UK

²⁷According to the Kaiser criterion, factors with eigenvalues larger than one should be preserved.

The retained three factors are then rotated to facilitate the interpretation.²⁸ Table 4.3 and Figure 4.2 present the rotated factor loadings from an orthogonal²⁹ varimax rotation. We begin by describing the factors for Germany and turn to the UK thereafter. As insolvencies are central to our analysis, we make a connection already. Factor 1 for Germany explains 24,67 % of the total variance and reveals a strong positive correlation with the proxy for the external finance premium and the interest rate spread. We refer to this factor as *financial fragility factor* as both variables point to unfavourable credit conditions. Unfavourable changes in credit conditions have adverse effects on those who require external finance and hence affect their financial fragility. An increase in this factor may therefore be associated with an increase in personal insolvencies. Factor 2 explains 22,19 % of total variance and correlates positively with the interest rate coverage ratio, the long-term-to-short-term debt ratio and inflation and negatively with the debt-to-income ratio. It reflects *households' financial situation*. Its components are somewhat ambiguous, though, in particular the strong positive correlation of the interest rate coverage ratio, which reflects the ability to service one's debt, as all other components point to rather favourable credit conditions. One explanation follows from the composition of the interest rate coverage ratio, as can be seen from Table G. Nominal interest rates are in the numerator, hence inflation enters indirectly (via the Fisher relation). In this respect, higher inflation may very well be linked to a high interest rate coverage ratio. Another explanation follows from the sharp drop in both long-term and short-term interest rates in the course of the great recession which additionally distorts the value of the interest rate coverage ratio (see Figure F.9). Factor 3 reveals a positive correlation with the unemployment rate and the house price index (although, relatively weak) and a negative correlation with GDP growth, explaining 20,13 % of total variance. High unemployment and weak growth pose a strain to *macroeconomic stability* and insolvencies may therefore become more likely.

With regard to the UK, factor 1 explains 36,19 % of total variance and correlates positively with the debt-to-income ratio, the interest rate spread and the proxy for the external finance premium, and negatively with GDP growth, the house price index and the interest rate coverage ratio. Like in Germany's factor 2, the interest rate coverage ratio

²⁸Note that the rotated factors explain less variance than original factors which are computed to be optimal.

²⁹We choose an orthogonal rotation of the axis which leaves the angles and distances unchanged (Harman, 1976, p.290)

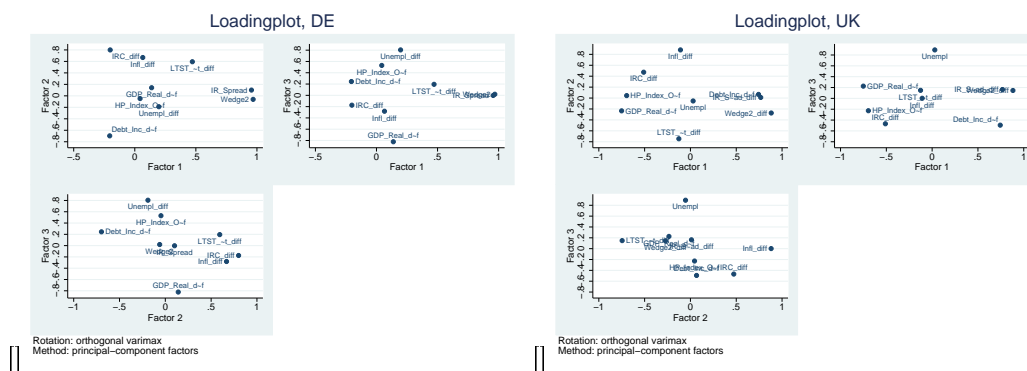


FIGURE 4.2: Loadingplots for (a) DE and (b) UK

TABLE 4.3: Rotated Factor Loadings

Variable	F 1 (DE)	F 2 (DE)	F 3 (DE)	F 1 (UK)	F 2 (UK)	F 3 (UK)
Unempl	0.1972	-0.1896	0.8043	0.0292	-0.0536	0.8934
GDP_Real	0.1379	0.1412	-0.8223	-0.7513	-0.2345	0.2258
Debt_Inc	-0.2053	-0.6972	0.2445	0.7434	0.0667	-0.4938
HP_Index	0.0432	-0.0474	0.5300	-0.6960	0.0447	-0.2282
IRC	-0.2014	0.8000	-0.1745	-0.5103	0.4732	-0.4685
IR_Spread	0.9552	0.1006	-0.0027	0.7673	0.0112	0.1630
LTST_debt	0.4713	0.5940	0.1950	-0.1264	-0.7456	0.1482
Wedge	0.9689	-0.0614	0.0193	0.8821	-0.2736	0.1453
Infl	0.0655	0.6680	-0.2816	-0.1089	0.8809	0.0015

Strongest correlations of the variables with the respective factors are marked in bold. DE: all factors in differences, except the IR_Spread and Wedge. UK: all factors in differences, except the unemployment rate. The factors which are not in differences exhibit stationary time series.

Unit root tests (Dickey-Fuller, DF-GLS, KPSS).

seems to be out of place. Yet, the correlation with this factor is markedly weaker compared to the other variables the factor correlates with. Due to the dominance of the other variables, the composition of this factor points to *financial and macroeconomic fragility*. Factor 2 explains 18,83 % of total variance and correlates with variables that may reflect *borrowing conditions and behaviour* in a broad sense. It reveals a positive correlation with the inflation rate and a negative correlation with the long-term-to-short-term debt ratio. A low long-term-to-short-term debt ratio suggests an increase of short-term relatively to long-term debt. In this respect, borrowers benefit from higher inflation as it reduces the real burden of debt. Finally, Factor 3 captures high *unemployment*, explaining 15,93 % of the variance. As negative income shocks act as an additional threat for borrowers, we expect this factor to be positively associated with defaults. Although, the main goal of the factor analysis is the reduction of independent variables, the result itself is very interesting, as it reflects country specific characteristics. Despite some similarity

of the three factors across the two countries, we also observe striking differences. These differences are not surprising, as we have already described in Section 4.5 that financial and macroeconomic conditions varied strongly for Germany and the UK, in particular during the period under scrutiny.

4.6.2 Dynamics of Personal Insolvencies

This section presents our estimation strategy and discusses the results. We employ a SUR-TAR model for two reasons: the SUR model allows us to capture shocks hitting both countries. More precisely, it allows for correlation of error terms across countries, while dependent and independent variables remain country-specific. The rationale behind this is that we face growing economic interconnectedness, while being interested in insolvency dynamics in each of the countries. The TAR model (threshold auto-regression) accounts for nonlinearities in time series and is applied as we investigate two differing regimes, namely the dynamics of insolvencies during the crisis period and during “normal” times. Moreover, we allow asymmetric effects by distinguishing between higher and lower levels of insolvencies compared to the previous period. To the best of our knowledge, a combination of the two models has not been applied before.

Thus to analyse the dynamics of insolvencies in Germany and the UK, we test whether a rise in the level of insolvencies compared to the preceding period behaves differently than a drop in the level of insolvencies compared to the preceding period and whether these dynamics change during the crisis. In a first step, we analyse petitions for insolvencies and in a second step, actual insolvencies.³⁰ We first run the following SUR-TAR model for petitions for Germany

$$\begin{aligned}
 InsolPet_t = & \beta_0 + \beta_1 InsolPet_{t-1}^+ + \beta_2 InsolPet_{t-1}^- + \beta_3 InsolPet_{t-1}^+ * Rec_{t-1} \\
 & + \beta_4 InsolPet_{t-1}^- * Rec_{t-1} + \beta_5 Rec_t + \beta_6 Fact1_{t-1} + \beta_7 Fact2_{t-1} \\
 & + \beta_8 Fact3_{t-1} + \beta_9 Trend_t + \beta_{10} Trend_t^2 + \beta_{11} Out_i + \epsilon_t.
 \end{aligned} \tag{4.1}$$

³⁰Note that both variables are not perfectly comparable for Germany and the UK due to differing procedures to handle insolvencies (see Section 4.4). Yet, we apply a fairly good proxy as described in Section 4.5.

and for the UK

$$\begin{aligned}
InsolPet_t = & \beta_0 + \beta_1 InsolPet_{t-1}^+ + \beta_2 InsolPet_{t-1}^- + \beta_3 InsolPet_{t-1}^+ * Rec_{t-1} \\
& + \beta_4 InsolPet_{t-1}^- * Rec_{t-1} + \beta_5 Rec_t + \beta_6 Fact1_{t-1} + \beta_7 Fact2_{t-1} \\
& + \beta_8 Fact3_{t-1} + \beta_9 D.Insol_t + \beta_{10} Out_i + \epsilon_t.
\end{aligned} \tag{4.2}$$

And the following for actual insolvency filings for Germany

$$\begin{aligned}
Insol_t = & \beta_0 + \beta_1 Insol_{t-1}^+ + \beta_2 Insol_{t-1}^- + \beta_3 Insol_{t-1}^+ * Rec_{t-1} \\
& + \beta_4 Insol_{t-1}^- * Rec_{t-1} + \beta_5 Rec_t + \beta_6 Fact1_{t-1} + \beta_7 Fact2_{t-1} \\
& + \beta_8 Fact3_{t-1} + \beta_9 Trend_t + \beta_{10} Trend_t^2 + \beta_{11} Out_i + \epsilon_t,
\end{aligned} \tag{4.3}$$

and the UK

$$\begin{aligned}
Insol_t = & \beta_0 + \beta_1 Insol_{t-1}^+ + \beta_2 Insol_{t-1}^- + \beta_3 Insol_{t-1}^+ * Rec_{t-1} \\
& + \beta_4 Insol_{t-1}^- * Rec_{t-1} + \beta_5 Rec_t + \beta_6 Fact1_{t-1} + \beta_7 Fact2_{t-1} \\
& + \beta_8 Fact3_{t-1} + \beta_9 D.Insol_t + \beta_{10} Out_i + \epsilon_t,
\end{aligned} \tag{4.4}$$

where t refers to the time subscript, $t = 1, \dots, T$. The models differ slightly for the two countries as described below. The dependent variables $InsolPet_t$ and $Insol_t$ refer to the number of insolvency petitions and actual insolvencies, and $(InsolPet_{t,i}^+/Insol_{t,i}^+)$ and $(InsolPet_{t,i}^-/Insol_{t,i}^-)$ to previous periods higher and lower levels in the number of petitions and actual insolvencies, respectively. As outlined in the previous section, a range of explanatory variables are bundled in factors retrieved from a factor analysis to resolve the problem of multicollinearity ($Fact_j$ with $j = 1, 2, 3$). It is important to note that they are not the same across countries (see Section 4.6.1). $D.Insol_t$ is a dummy controlling for changes in insolvency laws, i.e. introduction of DROs in the UK. For Germany, we impose a trend, linear ($Trend_t$) and squared ($Trend_t^2$), to account for the steep increase in insolvencies until 2006. Out_i controls for outliers of the residuals³¹. ϵ_t is the error term. The model includes two interaction terms: increases or reductions in the level of insolvencies (petitions) during the recession (Rec_t).

Results for Insolvency Petitions: Table 4.4 displays the estimation results for insolvency petitions as dependent variable. Post estimation, the Breusch-Pagan test confirms

³¹There is one outlier in each country: DE 2006-Q4 and UK 2010-Q4.

the choice of the SUR model as the null hypothesis of no correlation is rejected (see bottom of Table 4.4). Our test for asymmetry in higher or lower levels of insolvency petitions suggests that there is no statistically significant difference between the two variables. Hence, we can reduce the model by reuniting them in one variable. Therefore, we proceed with the following model for Germany

$$\begin{aligned} InsolPet_{t,i} = & \beta_0 + \beta_1 InsolPet_{t-1} + \beta_2 InsolPet_{t-1} * Rec_{t-1} \\ & + \beta_3 Rec_t + \beta_4 Fact1_{t-1} + \beta_5 Fact2_{t-1} + \beta_6 Fact3_{t-1} \\ & + \beta_7 Trend_t + \beta_8 Trend_t^2 + \beta_9 Out_i + \epsilon_t. \end{aligned} \quad (4.5)$$

and the UK

$$\begin{aligned} InsolPet_{t,i} = & \beta_0 + \beta_1 InsolPet_{t-1} + \beta_2 InsolPet_{t-1} * Rec_{t-1} \\ & + \beta_3 Rec_t + \beta_4 Fact1_{t-1} + \beta_5 Fact2_{t-1} + \beta_6 Fact3_{t-1} \\ & + \beta_7 D.Insol_t + \beta_8 Out_i + \epsilon_t, \end{aligned} \quad (4.6)$$

Table 4.5 contains the estimation results of Equation (4.5, first column) and (4.6, second column). Again, the Breusch-Pagan supports the SUR estimation. One can see that the coefficients for insolvency petitions in the UK (see column 1) are substantially higher than in Germany (see column 2). This is also confirmed by the post estimation tests, where we cannot reject the hypothesis that petitions in the UK are more persistent than in Germany. The point estimate of the interaction term is not statistically significant, hence, the dynamic behaviour of insolvencies does not change during recessions. The dummy for recessions is not significant in any of the two countries (i.e. there is no level effect). Regarding the control variables, we find that two factors are significant in the UK, whereas none has an impact in Germany. An increase in Factor 1, which represents financial and macroeconomic fragility in the UK, increases the number of petitions. A rise in unemployment (the third factor correlates only with unemployment) increases insolvency petitions (see column 1, Table 4.5). The strong effect of unemployment on personal insolvencies is in line with the findings in Fieldhouse et al. (2012) for Canadian data.

TABLE 4.4: Model SUR TAR (Insolvency Petitions)

	(1) Insolvency Petitions, UK	(2) Insolvency Petitions, DE
$InsolPet_{t-1}^+$	0.9149*** (0.0331)	0.6162*** (0.0902)
$InsolPet_{t-1}^+ * Rec_{t-1}$	0.9306*** (0.0428)	0.6122*** (0.0923)
$InsolPet_{t-1}^-$	0.9013*** (0.0309)	0.6244*** (0.0866)
$InsolPet_{t-1}^- * Rec_{t-1}$	0.9183*** (0.0390)	0.6367*** (0.0915)
Rec_t	-172.8813 (931.3679)	-297.6867 (776.1812)
$Factor1_{t-1}$	564.1376*** (200.9201)	-269.8749 (338.7104)
$Factor2_{t-1}$	37.5115 (185.5886)	-157.9945 (112.7489)
$Factor3_{t-1}$	787.1635*** (290.694)	572.3173 (358.3942)
Dummy Insol	-1521.584*** (562.1402)	
$Trend$		518.6304*** (156.9716)
$Trend^2$		-9.0244*** (2.5351)
Outlier Resid.	-1285.221 (998.0213)	3311.452*** (850.7593)
Constant	3316.585*** (749.5833)	5501.77*** (1081.996)
Observations	46	46
R squared	0.9784	0.9681
Breusch-Pagan (p-value)		0.0039
$H_0 : InsolPet^+ = InsolPet^-$ (p-value)	0.4803	0.4630

Interaction terms are reported as marginal effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS standard errors for the SUR model in parentheses. National statistics services etc., own calculations.

TABLE 4.5: Model SUR TAR (Insolvency Petitions)

	(1) Insolvency Petitions, UK	(2) Insolvency Petitions, DE
$InsolPet_{t-1}$	0.8989*** (0.0314)	0.6563*** (0.1043)
$InsolPet * Rec_{t-1}$	0.9243*** (0.0376)	0.6274*** (0.1053)
Rec_t	-109.7327 (842.5042)	246.1669 (834.8318)
$Factor1_{t-1}$	533.305** (209.0455)	-37.0138 (378.9272)
$Factor2_{t-1}$	13.85372 (162.7508)	-23.3731 (124.1226)
$Factor3_{t-1}$	802.7183*** (296.3648)	141.1905 (389.4258)
Dummy Insol	-1600.301*** (576.2282)	
$Trend$		469.7064*** (179.7967)
$Trend^2$		-8.3145*** (2.9125)
Outlier Resid.	-1146.18 (1042.41)	3182.8090*** (965.9978)
Constant	3499.107*** (753.0018)	4947.566*** (1288.735)
Observations	46	46
R squared	0.9778	0.9620
Breusch-Pagan (p-value)		0.0177
$H_0 : InsolPet^{UK} = InsolPet^{DE}$ (p-value)		0.0186
$H_0 : InsolPet^{UK} > InsolPet^{DE}$ (p-value)		0.9907

Interaction terms are reported as marginal effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS standard errors for the SUR model in parentheses. National statistics services etc., own calculations.

TABLE 4.6: Model SUR TAR (Actual Insolvencies)

	(1) Actual Insolvencies, UK	(2) Actual Insolvencies, DE
$Insol_{t-1}^+$	0.8996*** (0.0366)	0.6644*** (0.0953)
$Insol_{t-1}^+ * Rec_{t-1}$	0.8571*** (0.0396)	0.6635*** (0.1000)
$Insol_{t-1}^-$	0.9064*** (0.0347)	0.6998*** (0.0961)
$Insol_{t-1}^- * Rec_{t-1}$	0.9138*** (0.0376)	0.6839*** (0.0967)
Rec_t	2443.178*** (719.9906)	29.6874 (791.1254)
$Factor1_{t-1}$	18.7184 (165.5709)	-341.5436 (437.0277)
$Factor2_{t-1}$	-1.896284 (109.2011)	-114.4499 (124.471)
$Factor3_{t-1}$	451.8393** (211.6719)	599.7476 (375.1325)
Dummy Insol	-1281.916*** (378.706)	
$Trend$		443.7841*** (165.7544)
$Trend^2$		-7.3569*** (2.68047)
Outlier Resid.	-1884.286*** (729.7241)	3613.586*** (918.0354)
Constant	2173.513*** (608.1504)	3105.022*** (1116.5)
Observations	46	46
R squared	0.9810	0.9702
Breusch-Pagan (p-value)		0.1414
$H_0 : Insol^+ = Insol^-$ (p-value)	0.6622	0.0021
$H_0 : Insol_{DE}^- > Insol_{DE}^+$ (p-value)	-	0.9989
$H_0 : Insol_{UK}^+ > Insol_{DE}^+$ (p-value)		0.9907
$H_0 : Insol_{UK}^- > Insol_{DE}^-$ (p-value)		0.9811

Interaction terms are reported as marginal effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS standard errors for the SUR model in parentheses. National statistics services etc., own calculations.

Results for Actual Insolvencies: Turning now to actual insolvencies, the estimation results reported in Table 4.6 deviate from those for petitions in several aspects. First, in contrast to the UK, we find lower levels of insolvencies in the previous period being significantly more persistent than higher ones for Germany. Second, the p-value for the Breusch-Pagan test is relatively high (0.1414), suggesting that the SUR estimation is not an optimal choice. However, for the sake of comparability across countries and as country specific regressions do not alter the outcome, we do not change the estimation strategy.

Apart from that, there are only minor deviations compared to the results for petitions. Defaults are more persistent in the UK than in Germany, which is true for both higher and lower levels as reported at the bottom of Table 4.6. Surprisingly, the dummy for the recession is highly significant in the UK for actual filings (level effect), i.e. we do observe an increase in actual insolvencies during the recession. In contrast, we do not find an impact of the recession in Germany. Contrary to insolvency petitions, exclusively the third factor in the UK is significant. Thus, unemployment is a relatively robust factor driving financial difficulties. The results for Germany are in line with those for petitions: neither the recession nor any of the factors affect defaults. The next section provides an interpretation of the results. We begin by analysing the observed persistence of insolvencies and turn to outside (macro)economic influences thereafter.

4.6.3 Interpretation of Results

Persistence of Insolvencies: Persistence is defined as a tendency to show rather small changes over time. After adverse economic developments that cause a rise in insolvencies, the effects may be either long-lasting or short-lived. Apart from the effect on insolvencies themselves there may be also feedback effects on the economy. Put differently, after an external shock it takes longer for time series to return to their previous level.

That time series in the UK are more persistent than in Germany is not surprising, given the nature of the underlying market-based financial system on the one hand, and the social acceptance of filing for insolvency on the other. The first argument is supported by May et al. (2004) who report that bankruptcies in the UK are mainly caused by unsecured short-term debt which is British households main instrument of consumption smoothing as we have shown in Section 4.5. The comparatively high proportion of short-term debt

in the UK may explain the observed higher persistence as overlapping short-term credit contracts may induce relatively more households to default on their debt with a higher frequency. This may cause an “avalanche” of insolvencies. Regarding the second point, literature with a close proximity to sociology and jurisprudence emphasises that, as legal benevolence towards debtors increased over time, filing for personal insolvency became increasingly accepted in a society (e.g. Efrat, 2006; Sousa, 2014). Thus, higher persistence in the UK may be also explained by a lower inhibition level to file for bankruptcy, resulting from the long history of insolvency laws compared to Germany. While British households might be more familiar with the instrument of debt relief and dealing with over-indebtedness publicly, German households are less “used” to it, and hence rather back away from their default option, as insolvency for individuals and related debt relief were only introduced in 1999.³²

Whereas in the UK we find no signs of asymmetries in the dynamics of insolvencies, for Germany we observe that a reduction of actual insolvencies is more persistent. This implies that once the number of insolvencies decreases, it remains relatively longer at a lower level, whereas an increase in insolvencies is less long-lasting. The sharp rise in insolvencies after the enforcement of the regulation in 1999, which constitutes a non-recurring event, was followed by a slight downward movement (see Figure F.6). Although we controlled for the observed increase by imposing a trend, this downward movement might not have been (fully) captured. However, we do not find asymmetric effects for petitions in Germany. While our variable for petitions in Germany comprises all applications to default legally, actual insolvencies refer to those cases which enter an official insolvency procedure. The deviations of petitions and actual filings may be ascribed to procedural effects in general and to the authorities who decide about the approval or rejection of an insolvency petition in particular. That judges’ lenience matters for the outcome of an insolvency proceeding has also been found by Blazy et al. (2011) (for the case of France though).³³

³²In the UK, official consumer bankruptcy dates back to 1986, IVAs (Individual Voluntary Arrangements) however existed already in the early nineteenth century (e.g. McKenzie Skene and Walters, 2006).

³³An alternative force driving the asymmetries in the dynamics may be changes in the assistance for court fees in September 2006 (Judgement by the German Federal Supreme Court of Justice Az. XI ZB 24/06)³⁴. Courts were no longer allowed to reject a proposal if an applicant was unable to reimburse the legal costs of the procedure. Debtors have to be given the opportunity to defer their payments (§4a InsO).

Reaction to Business Cycle Developments: Surprisingly, we find no effect of a recession on petitions for insolvencies, neither for Germany nor the UK. For the case of actual insolvencies in the UK, a recession has a significant effect though. While the rather market-based system with dominating short-term debt and the pro-debtor insolvency regulation certainly play a role here, different insolvency procedures hinder perfect comparability. In Sections 4.4 and 4.5 we described the respective procedures of filing and the definitions of the two dependent variables. Actual filings comprise those cases which appear before a court and which eventually receive debt relief. British households can choose from a variety of options to deal with their burden of debt, while German households have only the one option of official default.³⁵ The severity and the duration of the recession, which also may have induced further adverse events, may have driven British households into serious repayment difficulties. The observation that actual filings increased in the UK during recessionary times, while petitions did not, suggests that relatively more households opted for the “official bankruptcy procedure” where residual debt is discharged, while alternative options (which are included in the variable for petitions) aiming to help debtors to manage their liabilities and, ideally, to repay it, were possibly not practicable or insufficient. Indeed, the first factor, representing financial and macroeconomic fragility, and the third factor, representing unemployment, have a significant effect on petitions; the third factor is also significant for the case of actual insolvencies in the UK. Thus, unemployment, which increased sharply during the crisis and remained at a higher level thereafter (see also Section 4.5), is very robust as a driver for insolvencies.

Moreover, Nielsen et al. (2010) report that British households suffered from tightening credit conditions in 2009, in particular those with high loan-to-value ratios. Lenders tightened particularly unsecured credit, although also for secured debt scoring criteria became tougher. The combination of multiple adverse effects may explain the different reactions during the crisis between petitions and actual defaults in the UK.

In general, (macro)economic conditions tend to influence neither petitions nor actual insolvencies of German households as neither the recession nor any of the factors show a significant effect. This may be explained by less debtor friendly conditions with respect to debt discharge, on the one hand, as households might be rather reluctant to default.

³⁵This option is subject to a mandatory out-of-court settlement before the petition. Subsequently, the petition might still be rejected, for instance owing to the lack of assets.

On the other hand, in a bank-based financial system, with predominantly long-term relationships between lenders and borrowers, debtors are protected from sudden changes in credit conditions. In this regard, Bolton et al. (2013) find that relationship lenders provide more favourable continuation terms during a crisis. An alternative explanation may be that individuals who are not creditworthy may be refused credit in the first place. This would imply that those owing debt remain able to service it even during the recessionary times. Clearly, the duration and severity of the latter is of crucial importance in this regard, but also the lower incentive to file for bankruptcy due to the creditor friendly insolvency law.

4.7 Conclusion

In this paper we studied the dynamics of personal insolvencies in Germany and in the UK. The two European economies differ with respect to their financial systems as well as their legal approaches to deal with overindebted individuals.

Our findings can be summarised as follows: personal insolvencies are more persistent in the UK and outside macroeconomic and financial conditions have an effect on the vulnerability of British households, while German households remain largely unaffected by business cycle dynamics. Yet, the financial crisis had solely an impact on actual insolvencies in the UK, leaving petitions untouched. We argued that official bankruptcy was households' preferred instrument to dealing with debt during the recession as they were left with no other option to coping with their debt otherwise than getting it discharged. The severity and the relatively long duration of the recession in the UK compared to Germany may have contributed to this development. Our results further suggest an asymmetric effect of a rise in the levels of insolvencies as opposed to a reduction of the latter, with the reduction being more persistent. This is mostly ascribed to the non-recurring event of the enforcement of the German insolvency regulation which may not have been fully captured by the imposed trend. That asymmetry is rejected for petitions in Germany may be explained by procedural effects at court.

The architecture of insolvency procedures, which is closely connected to an economy's financial system and hence its credit culture, determining not only the amount of aggregate

debt, but also the relation between unsecured short-term and secured long-term loans, are considered as important drivers for both, petitions as well as actual insolvencies.

A drawback of our analysis is, that data across countries is not perfectly comparable due to institutional differences. Nevertheless, analysing these differences is interesting by itself. Future research could focus on these institutional differences in more detail. In particular, the role of judges in the insolvency process could be focused upon as this might explain differences between petitions and actual insolvencies and should be considered more closely, in particular for the case of Germany. Unfortunately, data availability on personal insolvencies in Europe in general is difficult, as respective regulations were only introduced at the end of the 1990s. Other countries could be interesting to analyse in case such data becomes available. Unfortunately for insolvencies in Germany is only available from 2003 onwards and marked by soaring insolvencies until 2006. Longer time series could be more revealing with respect to insolvency dynamics in general. Another focus could also be to study cross-sectional differences within Germany (and also in other countries of course), not only with respect to insolvencies but also with respect to borrowing behaviour.

Appendix A

Appendix to Chapter 2

Overview and Transmission Channels of the Model

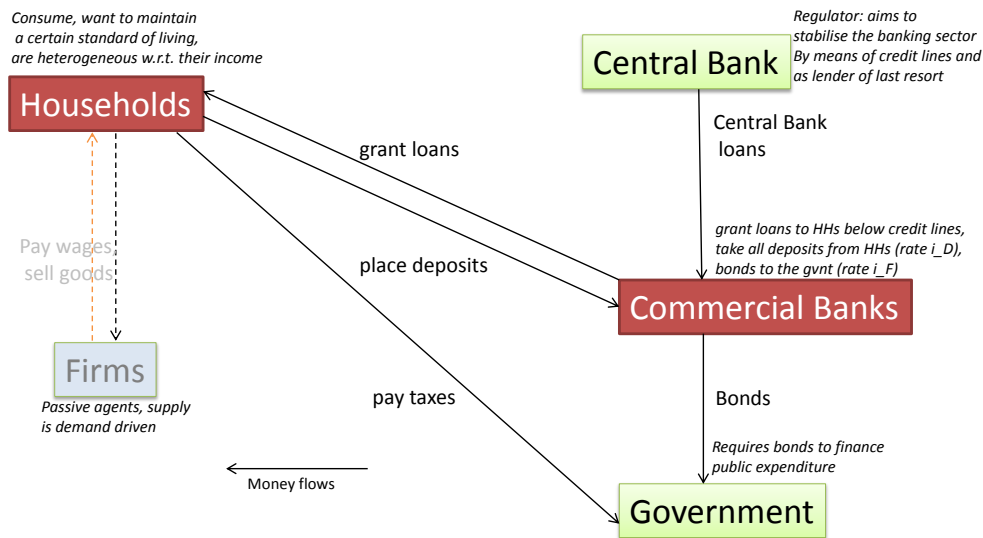


FIGURE A.1: Model overview

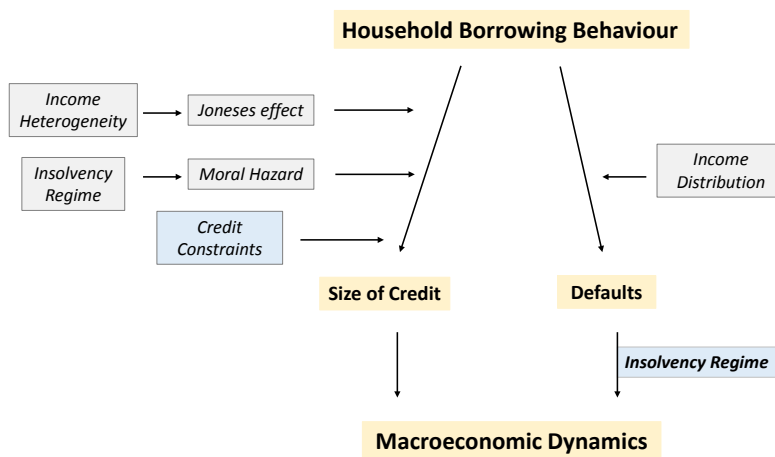


FIGURE A.2: Transmission Channels of the Model

Appendix B

Appendix to Chapter 2

Static Analysis of the Model

To obtain a better understanding of simulation results, it is useful to look at a static version of the model in more detail.

Heterogeneous Consumption Function

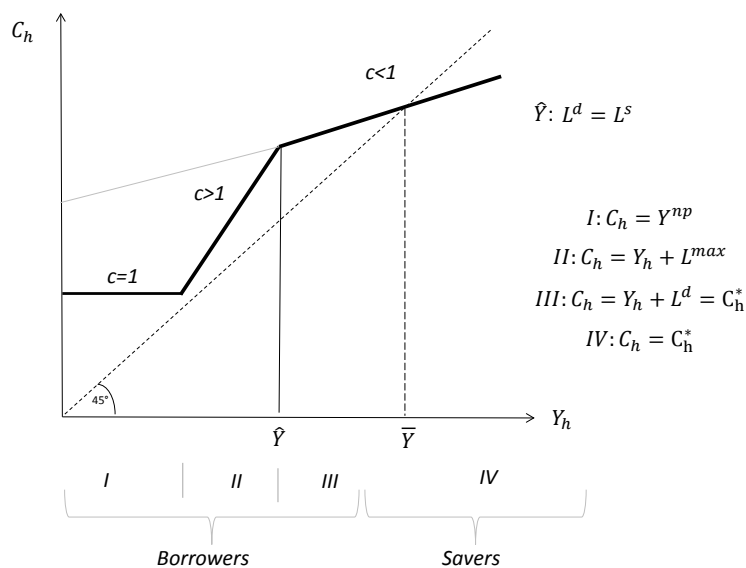


FIGURE B.1: Consumption Heterogeneity

We observe four different types of consumers, altering the slope of the standard Keynesian consumption function. The first type is a household who previously filed for insolvency and hence, falls back on minimum income, which he fully eats up. This renders the marginal propensity to consume equal to one, $c = 1$ (Type I in Figure B.1). If a household's loan demand is larger than loan supply, it is credit constrained and its marginal propensity to consume is larger than one, $c > 1$ (Type II in Figure B.1). \hat{Y} represents a turning point, where a household is no longer credit constrained but still spends more than disposable income, i.e. marginal propensity to consume is still larger than one $c > 1$ (Type III in Figure B.1). Households of Type III take up debt, but as loan supply exceeds loan demand, the required amount of credit is granted. Households of Type IV accumulate deposits and therefore the marginal propensity to consume is smaller than one, $c < 1$. Depending on the parameter values of γ_1 and γ_2 , households earning below average income, i.e. left of \bar{Y} , can also be savers, depending on the distance

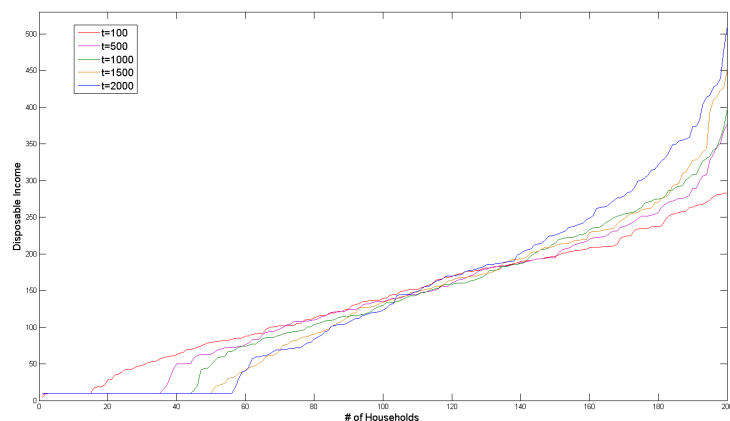
of their disposable income from the average. For the aggregate consumption function, we get accordingly

$$C = \sum_{h=1}^{H_1} (Y_h^{np}) + \sum_{h=H_1+1}^{H_2} (Y_h + L_h^{max}) + \sum_{h=H_2+1}^{H_3} (Y_h + L_h^d) + \sum_{h=H_3+1}^{H_4} (\gamma_1 Y_h + \gamma_2 \bar{C} - \gamma_3 i_D - \gamma_4 i_L). \quad (\text{B.1})$$

Appendix C

Appendix to Chapter 2

FIGURE C.1: Changing Income Distribution (Uniform), without credit constraints



Endogenous Evolution of the Income Distribution

Another feature of the model is that the distribution of income changes over the course of the simulation and that the gap between rich and poor household broadens. Figure C.1 shows how disposable income of the households on the upper part of the distribution increases over time, while the share of poor households who have to live on minimum consumption increases likewise.

Appendix D

Appendix to Chapter 3

The Complete Model

Households

Households, $h = \{1, \dots, H\}$, receive income Y_{ht} , composed of wage income Y_{ht}^W , non-wage income Y_t^{NW} and taxes T_{ht} .

$$Y_{ht} = Y_{ht}^W + Y_t^{NW} - T_{ht} \quad (\text{D.1})$$

Wage income is exogenously given at $t = 0$.

$$\begin{aligned} Y_{ht}^W &= \eta_{ht} Y_t \\ \eta_{ht} &= \eta_{ht-1} + u_{ht} \end{aligned} \quad (\text{D.2})$$

with $Y_t = \text{GDP}$; η_{ht} = parameter of income distribution with $\sum \eta_{ht} = 1$ and an idiosyncratic shock uniformly distributed on the support $(0, h_u)$. Income is distributed according to a Generalised Pareto distribution, where the cumulative distribution function of a random variable N is:

$$P(N \leq \eta) = \begin{cases} 1 - \left(1 + \frac{\zeta(\eta - \mu)}{\sigma}\right)^{-1/\zeta} & \text{for } \zeta \neq 0 \\ 1 - \exp\left(-\frac{\eta - \mu}{\sigma}\right) & \text{for } \zeta = 0 \end{cases} \quad (\text{D.3})$$

with μ = location parameter, σ = scale parameter, ζ = shape parameter.

Non-wage income: $Y_{ht}^{NW} = i_{Dt-1} D_{ht-1}$ or $Y_{ht}^{NW} = -i_{Lt-1} L_{ht-1}$, depending on whether the household saves or dissaves.

Taxes are $T_{ht} = \tau(Y_{ht}^W + i_{Dt-1} D_{ht-1})$

D_h = Deposits

L_h = Loans

Desired consumption C_t^* is:

$$C_{ht}^* = \gamma_1 Y_{ht-1} + \gamma_2 \bar{C}_{t-1} - \gamma_3 i_{Dt} - \gamma_4 i_{Lt} \quad (\text{D.4})$$

γ_1 = marginal propensity to consume out of disposable income

γ_2 = parameter of the Joneses effect

γ_3, γ_4 = reaction coefficients for the lending and borrowing rate, respectively.

$\gamma_j \in (0, 1)$ for $j = 1, 2, 3, 4$.

With the median economy-wide consumption of the last period

$$\bar{C}_{t-1} = \frac{1}{2}(C_{\frac{h}{2}, t-1} + C_{\frac{h}{2}+1, t-1}). \quad (\text{D.5})$$

and upward-looking consumption preferences

$$\gamma_2 = \begin{cases} \gamma_2 & \text{if } \frac{Y_{ht-1}}{\frac{1}{2}(Y_{\frac{h}{2}, t-1} + Y_{\frac{h}{2}+1, t-1})} \leq 1 \\ 0 & \text{if } \frac{Y_{ht-1}}{\frac{1}{2}(Y_{\frac{h}{2}, t-1} + Y_{\frac{h}{2}+1, t-1})} > 1 \end{cases} \quad (\text{D.6})$$

We have four types of consumers. They either save, borrow or neither or are bankrupt.

Loans and deposits have a duration of one period.

- **Type 1:** $D_{ht-1} = L_{ht-1} = BG_{ht} = 0$ with $BG_h = \text{cash}$; $Y_{ht} > Y_{ht,j}^{np}$

$$Y_{ht} = (1 - \tau)Y_{ht}^W. \quad (\text{D.7})$$

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } Y_{ht} \geq C_{ht}^* \\ C_{ht}^* & \text{if } C_{ht}^* > Y_{ht} \text{ \& } L_{ht}^d \leq L_{ht}^{\max} \\ Y_{ht} + L_{ht}^{\max} & \text{if } L_{ht}^d > L_{ht}^{\max}. \end{cases} \quad (\text{D.8})$$

with

$$L_{ht}^d = C_{ht}^* - Y_{ht} \geq 0, \quad (\text{D.9})$$

$$L_{ht} = \min(L_{ht}^d, L_{ht}^{\max}). \quad (\text{D.10})$$

$$D_{ht} + BG_{ht} = Y_{ht} - C_{ht}^* \text{ if } Y_{ht} - C_{ht}^* > 0 \quad (\text{D.11})$$

Cash holdings are a fixed proportion, $\kappa < 1$, of savings

$$BG_{ht} = \kappa D_{ht} \quad (\text{D.12})$$

For deposits (2.9), this implies

$$D_{ht} = \frac{Y_{ht} - C_{ht}^*}{1 + \kappa}$$

- **Type 2:** $D_{ht-1} > 0$ and hence $BG_{ht-1} > 0$, and $L_{ht-1} = 0$; and $Y_{ht} > Y_{ht,j}^{np} \rightarrow$ (“SAVER”).

$$Y_{ht} = (1 - \tau)(Y_{ht}^W + i_{Dt-1}D_{ht-1}). \quad (\text{D.13})$$

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht} + D_{ht-1}(1 + \kappa) \\ C_{ht}^* & \text{if } C_{ht}^* > Y_{ht} + D_{ht-1}(1 + \kappa) \text{ \& } L_{ht}^d \leq L_{ht}^{\max} \\ Y_{ht} + D_{ht-1}(1 + \kappa) + L_{ht}^{\max} & \text{if } L_{ht}^d > L_{ht}^{\max} \end{cases} \quad (\text{D.14})$$

with

$$L_{ht}^d = C_{ht}^* - Y_{ht} - D_{ht-1} \geq 0. \quad (\text{D.15})$$

$$L_{ht} = \min(L_{ht}^d, L_{ht}^{\max}) \quad (\text{D.16})$$

Accumulation of deposits if

$$D_{ht} + BG_{ht} = Y_{ht} - C_{ht}^* - D_{ht-1} - BG_{ht-1} > 0 \quad (\text{D.17})$$

- **Type 3:** $D_{ht-1} = BG_{ht-1} = 0$ and $L_{ht-1} > 0$; and $Y_{ht} > Y_{ht,j}^{np} \rightarrow$ (“BORROWER”).

$$Y_{ht} = (1 - \tau)Y_{ht}^W - L_{ht-1}i_{Lt-1}. \quad (\text{D.18})$$

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht} - L_{ht-1} \\ Y_{ht} - L_{ht-1} & \text{if } C_{ht}^* > Y_{ht} - L_{ht-1} \geq Y_{ht,j}^{np} \\ Y_{ht,j}^{np} & \text{if } C_{ht}^* > Y_{ht} - L_{ht-1} < Y_{ht,j}^{np} \end{cases} \quad (\text{D.19})$$

with non-pledgeable income

$$Y_{ht,j}^{np} = \theta Y_{ht} \quad \text{with } 0 < \theta < 1 \quad (\text{D.20})$$

$$D_{ht}(1 + \kappa) = Y_{ht} - L_{ht-1} - C_{ht}^* \geq 0 \quad (\text{D.21})$$

Bankrupt households are excluded from credit markets:

$$L_{ht} = 0 \quad \text{if} \quad Y_{ht} - L_{ht-1} \leq Y_{ht,j}^{np} \quad (\text{D.22})$$

- **Type 4:** $D_{ht-1} \geq 0$ and hence $BG_{ht-1} \geq 0$, and $L_{ht-1,j} = L_{ht-1,j}$; and $Y_{ht} = Y_{ht,j}^{np} \rightarrow$ (“BANKRUPT”). Although bankrupt households can only accumulate deposits in very rare cases, for instance after profiting from a positive wage shock, this rather unlikely, but theoretically possible option is included in the formalisation. Income of an insolvent household is

$$Y_{ht} = \theta Y_{ht,j} = \theta[(1 - \tau)Y_{ht}^W + i_{Dt-1}D_{ht-1}]. \quad (\text{D.23})$$

$$C_{ht} = \begin{cases} C_{ht}^* & \text{if } C_{ht}^* \leq Y_{ht,j}^{np} + D_{ht-1} \\ Y_{ht,j}^{np} & \text{if } C_{ht}^* > Y_{ht,j}^{np} + D_{ht-1} \end{cases} \quad (\text{D.24})$$

Deposits amount to

$$D_{ht}(1 + \kappa) = C_{ht}^* - Y_{ht,j}^{np} - D_{ht-1}(1 + \kappa) \geq 0 \quad (\text{D.25})$$

Households’ insolvency period, $j = 1, \dots, J$, continues until $j = J$.

$$Y_{ht+1} = \begin{cases} Y_{ht+1,j}^{np} & \text{if } Y_{ht} = Y_{ht,j}^{np} \quad \& \quad j < J \\ Y_{ht+1} & \text{if } Y_{ht} = Y_{ht,j}^{np} \quad \& \quad j = J \end{cases} \quad (\text{D.26})$$

Consumption preferences differ in debtor and creditor friendly economies.

$$\gamma_2 = \begin{cases} \gamma_2^{DF} & \text{if } J^{DF} \\ \gamma_2^{CF} < \gamma_2^{DF} & \text{if } J^{CF} \end{cases} \quad (\text{D.27})$$

The Financial Sector

The financial sector consists of commercial banks and the central bank. We refer to commercial banks as “the bank”, which is representative for a consolidated banking sector.

The balance sheet constraint of the commercial bank is

$$L_t^s + B_t^s = D_t^d + F_t^d \quad (\text{D.28})$$

with

L_t^s = loan supply to H

B_t^s = loan supply to the government

D_t^d = deposit demand of the bank

F_t^d = demand for central bank money

Interest rates on loans, i_{Lt} , and deposits, i_{Dt} , are set by the bank following the policy rate

$$i_{Ft} = i_{Ft-1} + \phi\epsilon_t \quad (\text{D.29})$$

set by the central bank, with $\epsilon_t = \epsilon_{t-1} + \nu_t$ and ν_t drawn from a normal distribution with support $\nu \sim N(0, \sigma_\nu^2)$. The interest rate pattern is

$$\begin{aligned} i_{Lt} &= \beta i_{Ft} & \beta &\geq 1 \\ i_{Dt} &= \Psi i_{Ft} & \Psi &\leq 1 \\ i_{Bt} &= i_{Ft}. \end{aligned} \quad (\text{D.30})$$

i_{Bt} = interest rates on government bonds (no mark-up)

B_t^s = loan supply to the government

D_t^d = deposit demand of the bank

F_t^d = demand for central bank money

The bank accepts all deposits from households.

$$D_t^d = \sum_{h=1}^H D_{ht}. \quad (\text{D.31})$$

Public debt bears no risk, hence government bonds are always granted

$$B_t^s = B_t. \quad (\text{D.32})$$

This does not apply for private debt. Loans are considered to be risky if

$$L_{ht} (1 + i_{Lt}) > Y_{ht+1}$$

Because the bank can only seize a share of defaulted households income, $Y_{ht} - Y_{ht,j}^{np}$, losses are even higher

$$\mathfrak{L}_{ht} = L_{ht} (1 + i_{Lt}) - \left(Y_{ht+1} - Y_{ht+1,j}^{np} \right)$$

\Leftrightarrow

$$L_{ht} (1 + i_{Lt}) \leq \left(Y_{ht+1} - Y_{ht+1,j}^{np} \right).$$

As the bank only knows the household's previous income, it takes the latter as a proxy.

Thus, a bank that wants to avoid any loss, imposes the following credit constraint

$$L_{ht}^{\max} \leq \frac{\left(Y_{ht-1} - Y_{ht-1,j}^{np} \right)}{1 + i_{Lt}}. \quad (\text{D.33})$$

The bank additionally distinguishes between below median and above median income households, following λ which is set by the central bank and can be interpreted a parameter that mirrors current economic conditions.

$$L_{ht}^{\max} = \lambda \frac{\left(Y_{ht-1} - Y_{ht-1,j}^{np} \right)}{1 + i_{Lt}} \quad (\text{D.34})$$

where

$$\lambda = \begin{cases} \lambda_1 & \text{if } \frac{Y_{ht-1}}{\text{median} \sum Y_{ht-1}} < 1 \\ \lambda_2 > \lambda_1 & \text{if } \frac{Y_{ht-1}}{\text{median} \sum Y_{ht-1}} \geq 1 \end{cases} \quad (\text{D.35})$$

Lending behaviour towards private households is

$$L_t^s = \min \left(L_{ht}^d, L_{ht}^{\max} \right) \quad (\text{D.36})$$

Central bank loans are required whenever deposits are not sufficient to cover lending. The bank's cashflow at the beginning of each period is

$$CF_t^B = x_{Ht} + B_{t-1}(1 + i_{Ft-1}) - \sum D_{ht-1}(1 + i_{Dt-1}) - F_{t-1}(1 + i_{Ft-1}) \quad (\text{D.37})$$

$$x_{Ht} = \sum_{h=1}^H x_{ht} \quad (\text{D.38})$$

where x_{ht} represents actual loan repayments of households, and x_{Ht} aggregate repayments

$$x_{ht} = \begin{cases} L_{ht-1}(1 + i_{Lt-1}) & \text{if } (1 - \theta)Y_{ht-1} \geq L_{ht-1}(1 + i_{Lt-1}) \\ (1 - \theta)Y_{ht-1} & \text{if } (1 - \theta)Y_{ht-1} < L_{ht-1}(1 + i_{Lt-1}) \\ (1 - \theta)Y_{ht-1} & \text{if } Y_{ht-1} = Y_{ht-1,j}^{np} \quad \& \quad j < J. \end{cases} \quad (\text{D.39})$$

If the bank's cashflow becomes negative, CF_t^- , the central bank acts as a lender of last resort and absorbs any losses to maintain financial sector stability.

The central bank's balance sheet is

$$BG_t^s - BG_{t-1}^s = (F_t^d - F_{t-1}^d) + CF_t^- \quad (\text{D.40})$$

The supply of cash in the economy changes whenever the bank has a negative cashflow, CF_t^- , resulting from unsustainable lending. Positive bank cashflows, CF_t^+ , act as an additional revenue for the government.

The Government

The government balance sheet is

$$B_t - B_{t-1} = G_t + B_{t-1}i_{Ft-1} - (T_{Ht} + CF_t^+) \quad (\text{D.41})$$

CF_t^+ denotes a positive bank cashflow and

$$T_{Ht} = \sum_{h=1}^H T_{ht} \quad (\text{D.42})$$

Government expenditure are

$$G_t = G \quad (\text{D.43})$$

rendering public borrowing the residual.

Macroeconomics

It is assumed that firms seek to adjust current production flexibly to current aggregate demand, and that deviations follow exclusively from random shocks

$$Y_t = Y_t^d + \rho_t \quad (\text{D.44})$$

ρ_t is a temporary stochastic shock drawn from a uniform distribution, $[\underline{\rho}, \bar{\rho}]$, and with: $\sum \rho_t = 0$.

Aggregate demand is

$$Y_t^d = \sum_{h=1}^H C_{ht} + \bar{G} \quad (\text{D.45})$$

where aggregate household consumption consists of four different subtypes of consumers

$$\sum_{h=1}^H C_{ht} = \sum_{h=1}^{H_1} Y_{ht,j}^{np} + \sum_{h=H_1+1}^{H_2} (Y_{ht} + L_{ht}^{max}) + \sum_{h=H_2+1}^{H_3} (Y_{ht} + L_{ht}^d) + \sum_{h=H_3+1}^{H_4} (\gamma_1 Y_{ht} + \gamma_2 \bar{C}_{t-1} - \gamma_3 i_{Dt} - \gamma_4 i_{Lt}). \quad (\text{D.46})$$

Taking equation (??) and equation (??) together renders as the time path for aggregate production

$$Y_t = \sum_{h=1}^H C_{ht} + \bar{G} + \rho_t \quad (\text{D.47})$$

Appendix E

Appendix to Chapter 3

Personal Insolvency Laws and Income Distribution in five selected EU Countries

In this section, we provide some descriptive statistics on personal insolvency laws and varying income distribution in the EU. As there is an ongoing discussion about a harmonisation of insolvency laws in the EU, we seek to shed some light on existing heterogeneities. The analysis of income distribution is based on data from the Eurosystem Household Finance and Consumption Survey (HFCS) as well as on data drawn from country specific insolvency regulations. The HFCS is a national representative, decentralised but harmonised survey which is governed by the ECB and conducted by the respective national central banks of the Eurosystem. The first wave of interviews took place between 2008 and 2010, depending on the respective countries (table E.1). The descriptive analysis covers five countries, namely France, Germany, Italy, the Netherlands and Spain. We selected those countries as their legal systems exhibit strong variations and therefore are subject to the problems mentioned in the paper.

The main advantage of the HFCS is that it provides *harmonised* microlevel data¹ on household finances and consumption, including detailed information on household income as well as assets and liabilities.² This unique data set therefore allows us to derive income and wealth distribution among households in the respective countries. Table E.1 gives a detailed overview on wealth and income distribution in the single countries. While the wealth share of the top 5% is extremely large Spain (70,13%), followed by France with 45,64% and Germany with 36,91%, it is relatively low in Italy with 15,36% and extremely low in the Netherlands with 3,51%. Households on the bottom of the wealth distribution, i.e. the poorest 20%, have even negative wealth in the Netherlands and in Spain. As wealth is calculated as total assets minus total liabilities, one explanation might be the housing bubble in Spain and its subsequent fall in house prices (as survey data for Spain is from 2008). Another explanation, which might be more applicable for the Netherlands, follows from high debt of poor households due to the fear of social exclusion. This is also

¹Note that survey data has several methodological issues and that inequality measures can deviate from other data, in particular from macro data. First, micro data covers only a share of the population and the possibility to include those holding a significant share of income is first low, and second varies strongly across countries. Moreover, rich households tend to under-report their income (for taxation reasons). The same applies to the other end of the scale. Poorest households are often under-represented (see for instance Andreasch and Lindner (2014)).

²It also contains information about a households educational background, employment situation as well as some demographic factors.

TABLE E.1: HFCS - Countries of Analysis, calculation with survey sample weights, unconditional on holding debt

	(1)	(2)	(3)	(4)	(5)
	France	Germany	Italy	Netherlands	Spain
Year	2010	2010	2010	2009	2008
Debt-to-income ratio (mean)* ¹⁾	0,592	0,562	2,473	3,063	1,021
Debt-to-assets ratio (mean)* ¹⁾	0,266	0,478	0,128	0,528	0,260
Outstanding debt (mean)	66.970	84.153	40.892	138.256	106.037
Consumer loan (mean)	27.018	12.099	16.206	36.768	56.736
% share of consumer loans (mean)	40,34	14,38	39,63	26,59	53,51
Outstanding debt (median)	21.441	30.000	13.000	102.000	40.000
Consumer loan (median)	6.400	4.000	5.600	12.669	7.300
% share of consumer loans (median)	29,84	13,33	43,07	12,42	18,25
Gini Net Wealth* ²⁾	0,68	0,72	0,59	0,55	0,56
Gini Income* ³⁾	0,38	0,42	0,39	0,31	0,41
<i>Wealth share of</i>					
the top 5 %	45,64	36,91	15,36	3,51	70,13
the 5th quintile	75,06	67,53	45,68	35,89	87,87
the 4th quintile	14,44	19,28	28,61	40,42	6,81
the 3rd quintile	7,22	8,56	18,88	16,56	3,87
the 2nd quintile	3,07	4,53	6,28	8,09	1,45
the 1st quintile	0,19	0,07	0,53	-0,97	-0,01
<i>Income share of</i>					
the top 5 %	32,34	30,53	8,58	6,08	36,11
the 5th quintile	56,85	65,85	31,42	50,58	57,61
the 4th quintile	18,78	18,58	26,94	30,84	15,65
the 3rd quintile	12,73	8,62	19,17	13,14	12,58
the 2nd quintile	8,03	4,73	14,83	4,27	8,56
the 1st quintile	3,40	2,21	7,61	1,14	5,60
% of HHs with higher expenses than income	n.a.	10,12	7,57	12,10	14,87
% ever denied credit	17,84	14,82	n.a.	12,32	13,34
% due to perceived cc.	7,56	4,29	n.a.	4,12	0,74
% of HHs with negative net worth	2,63	5,55	1,13	6,84	1,98
Observations	15.006	3.565	7.951	1.301	6.197

Source: HFCS (Household Finance and Consumption Survey), First Wave

*1)Debt-to-income ratios are calculated as the ratio of total liabilities over total income (dl1000/di2000); debt-to-assets ratio is calculated as total liabilities over total assets (dl1000/da3001). Note that both measures are calculated for all households (as opposed to only accounting for indebted households); for our purpose this is more suitable as we are interested in aggregate levels.

*2) Gini on net wealth and *3) income are calculated with the respective variables from the survey (di2000 and dn3001)

The HFCS includes probability as well as frequency weights, which we use for descriptive statistics as well as for calibration.

TABLE E.2: Features of consumer insolvency laws across five selected EU countries

Country	Debt relief	Out-of-court settlement**	Garnishment	Main Source
France	max. 8 years* (discretionary)	Yes (in addition)	Depends CC § L312-2	Code de la consommation, §§ 330 -1ff
Germany	automatically after 6 years	Yes (in addition)	yes approx. 0.4	German Insolvency Regulation
Italy	no discharge (new law planned 2012/13)	-	-	Legge Fallimentare
Netherlands	3 years, FW §358 min. 1, max. 5 years	yes	n.a.	The Dutch Bankruptcy Act
Spain	no discharge, but possibly a reduction of debt (max. 50 %)	Yes (only)	-	Ley 22-2003 de 9 julio, Concursal

Source: Country Specific Insolvency Laws

*But still very creditor friendly, as in case of "good faith" (L330-1) and without formal alternatives, debtors can be released from debt earlier (This proceeding has been introduced in 2003/2004, and reformed in 2010); ** high involvement of the insolvency court (discretionary proceedings)

supported by the data on income distribution, as households in the lowest quintile also earn least in the Netherlands (1,14% of total income) and have easiest access to credit (as reported below). Credit might work as a measure to compensate lack of income. Very low incomes are also reported for German households in the lowest quintile (2,21%), followed by France (3,40%), Spain (5,60%) and Italy (7,61%). On the other end of the scale, i.e. the richest 20%, households earn highest incomes in Germany with 65,85% of total income and lowest in Italy with 31,42% of total income. Data on income has to be interpreted with care though, as unfortunately the survey provides only information on gross income and although taxing systems are relatively similar across countries, differences remain.³ On the whole, evidence suggests that the countries are far from being uniform. Therefore it is crucial to scrutinise their income and wealth distribution as well as level of debt in greater detail before evaluating insolvency procedures. Income distribution is also shown in figures E.2 and E.3 confirming our observations. As a measure of income and wealth inequality we have calculated the Gini coefficient of the respective variables. As before mentioned, the Gini on income has to be interpreted with care as we have only data on gross income. Gini on income inequality pre-tax can vary strongly from post-tax.⁴ Regarding the Gini on wealth, one can see that Spain performs

³Maximum income tax rates are: 24-52% (6 brackets) in Spain, 0 - 45% (6 brackets) in France, max. 45% in Germany and Italy 23-43% (5 brackets) and 36,52 - 52% (4 brackets) in the Netherlands (Source: European Commission, "Taxes in Europe - Tax reforms" database (TEDB/TAXREF)).

⁴Note that other surveys such as the SOEP or SILC usually account for post tax income and hence obtain different results for Gini.

a lot better as opposed to the Gini on income. In fact, wealth is distributed relatively equally with 0,56, right after the Netherlands (0,55). Wealth distribution in Italy follows thereafter with 0,59, and France and Germany perform worst with a Gini on wealth 0,68 and 0,72 respectively. Figures E.5 and E.6 display mean and median income, total assets and total wealth of the respective countries. In line with the above reported negative wealth rates, Dutch households have highest average (and median) liabilities while in Germany and Italy (median) liabilities seem to be relatively low. On the other hand, Dutch households hold, together with Spanish households, the highest average amount of assets. From table E.1, we can also see that outstanding overall debt is highest in the Netherlands, yet only 26,59% (mean) or 12,42% (median) are unsecured consumer loans. Germany reveals also very low shares of consumer loans. Contrasting France with relatively low aggregate debt, consumer loans constitute 40,34%(mean) (29,84% median) of the latter. The same applies for Italy. Spain also reveals relatively high aggregate average (not median!) debt, consumer loans amount to 53,51% (mean) (18,25% median) of overall debt. Spain has the highest number of households whose expenses exceed income (14,87%) followed by the Netherlands with 12,10% and Germany with 10,2%. Italy has fewest over-indebted households (7,57%). Access to credit seems to be easiest in the Netherlands where only 12,32% of the households were credit constrained, followed by Spain with 13,34% and Germany with 14,82%. In France most households were turned down when applying for credit (17,84%). Unfortunately the survey does not cover household insolvencies. Turning now to the countries' legal insolvency frameworks, we look at country specific respective laws. The French "*Code de la Consommation*" (*CC*), "*Loi sur le surendettement*" (1990), the German "*Insolvenzordnung*" (*InsO*) (1994, in effective since 1999), the Italian "*Legge Fallimentare*", the Dutch "*Faillissementswet*" (*FW*) which extended insolvency regulations in 1998 by adding consumer bankruptcy and the Spanish "*Ley 22-2003 de julio, Concursal*". Their insolvency laws differ with respect to discharge of residual debt, regulations on out-of-court settlements and with respect to garnishment laws. In France, personal insolvencies are treated very discretionary. There are several possible solutions for insolvent households and judges decide about repayment conditions (Blazy et al., 2011)⁵. The maximum amount is eight years though. In Germany remaining liabilities of a honest debtor are discharged six years after the opening of insolvency proceedings. However, since 2012, debtors can reduce

⁵Moreover, French law provides a legal loophole as it has a very debtor friendly insolvency law for firms. Delinquent households therefore often "start" a small business in order to default under firm insolvency law.

the insolvency period to three years if they are able to repay 25% of their debt. Italy is the most restrictive country as it does not allow any discharge of private households. Debtors might be liable until the end of their life's. Spain is also very restrictive as it does not foresee complete discharge of debt. Moreover, personal insolvency procedures are only settled through an out-of-court solution, the "Code of good practice", according to which indebted households have the opportunity to receive a reduction of debt with a maximum of 50 percent. Insolvency law in the Netherlands is very flexible, depending on a debtors behaviour (so called "good will"), debt is discharged after one to five years, while three years is most common. Note that some countries have a separate law for consumer insolvency while others simply extended corporate bankruptcy law.

FIGURE E.1: Income distribution across countries

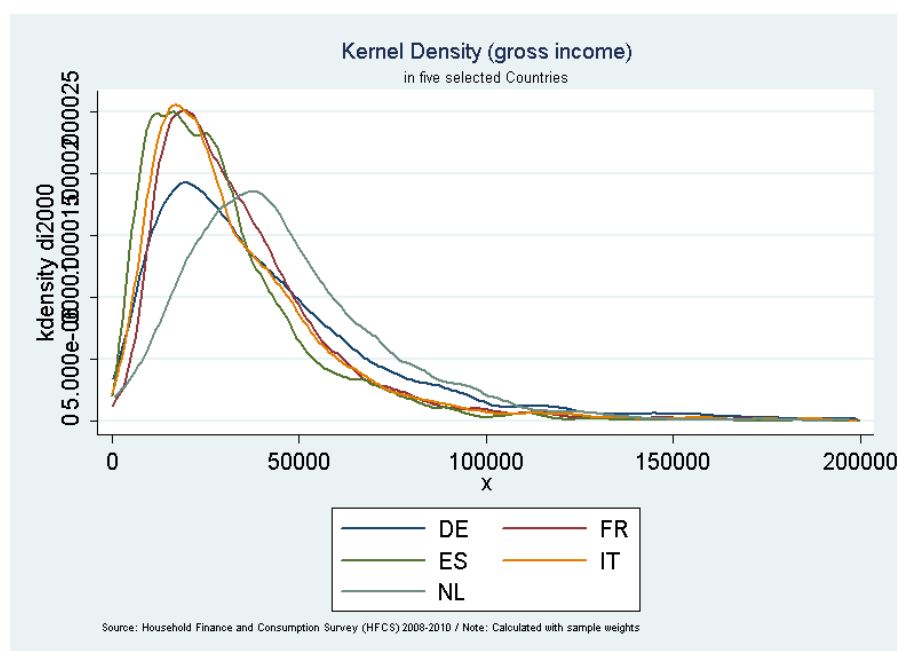


FIGURE E.2: Wealth distribution across countries

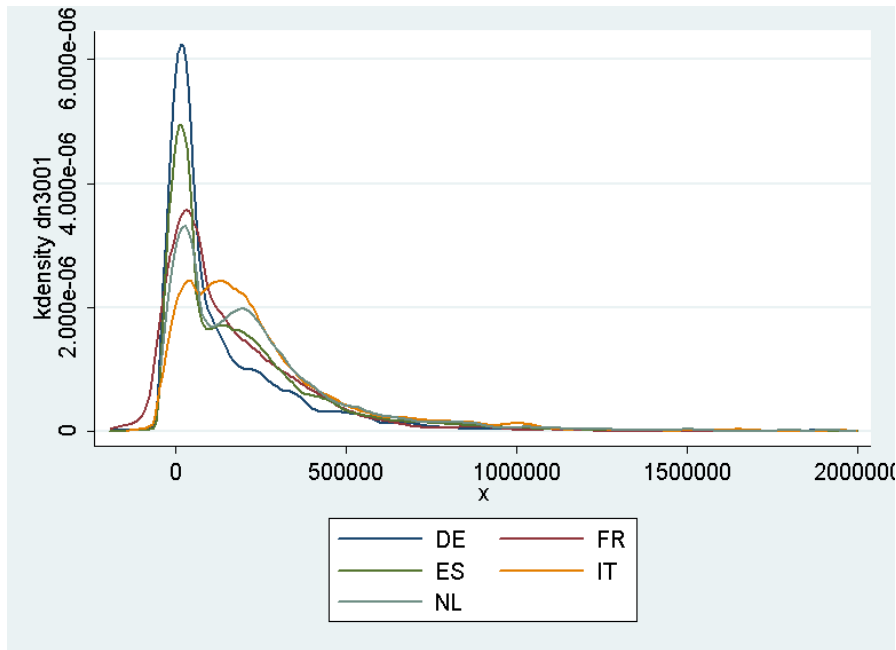


FIGURE E.3: Income distribution across countries

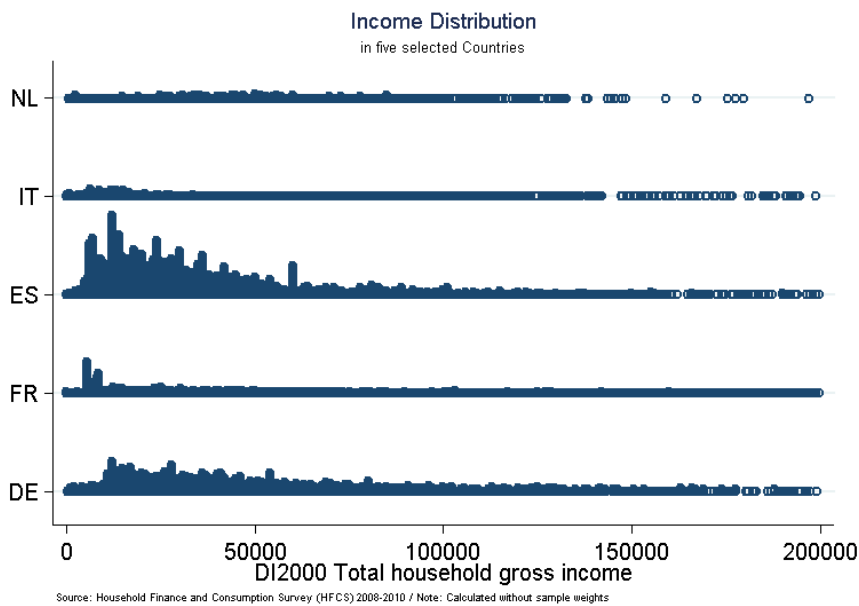


FIGURE E.4: Wealth Distribution across countries, Lorenz curve

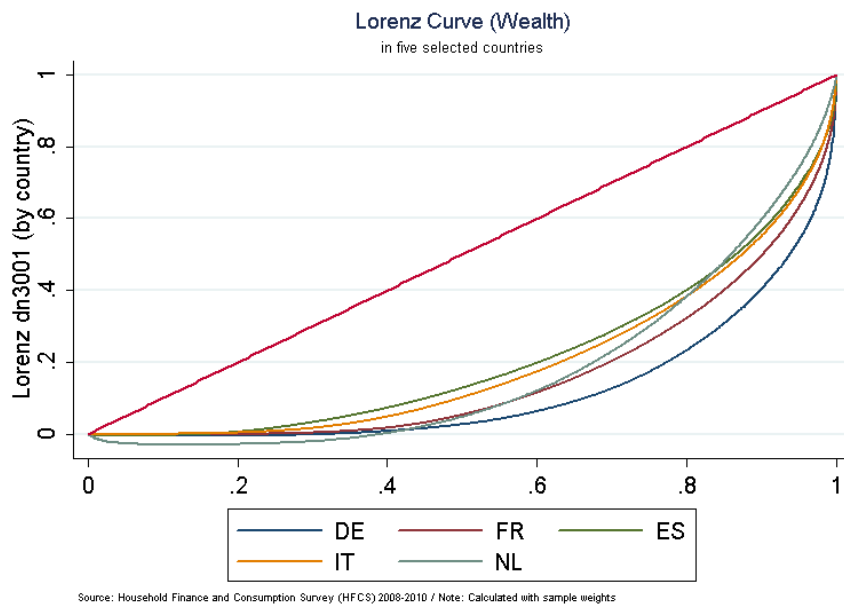


FIGURE E.5: Household finance 1

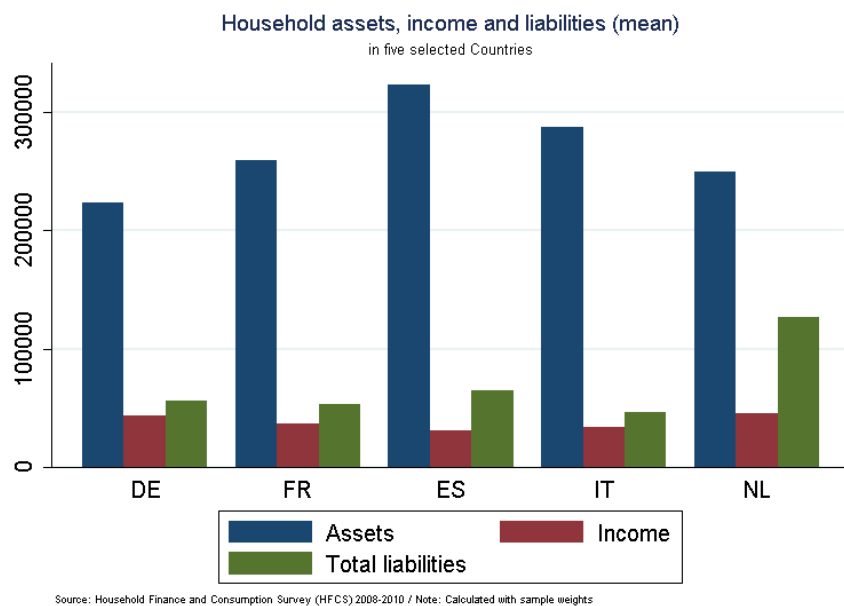
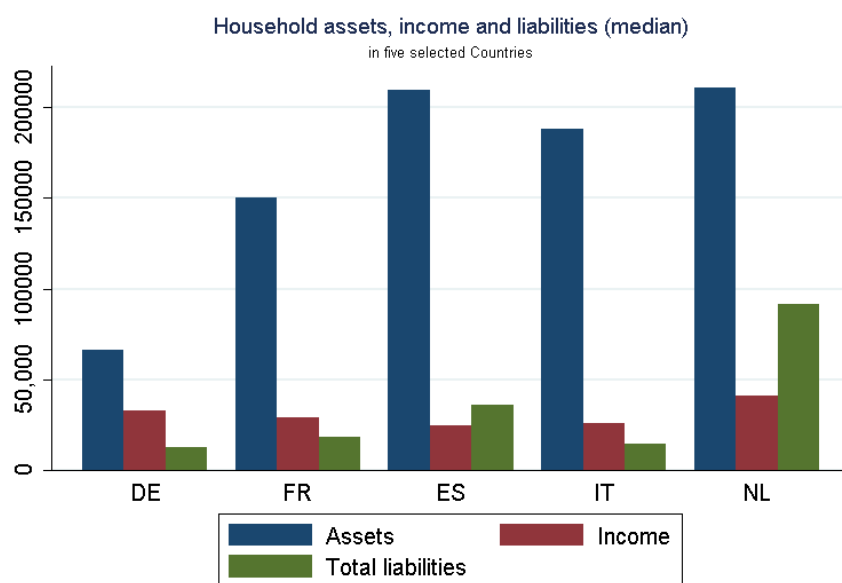


FIGURE E.6: Household finance 2

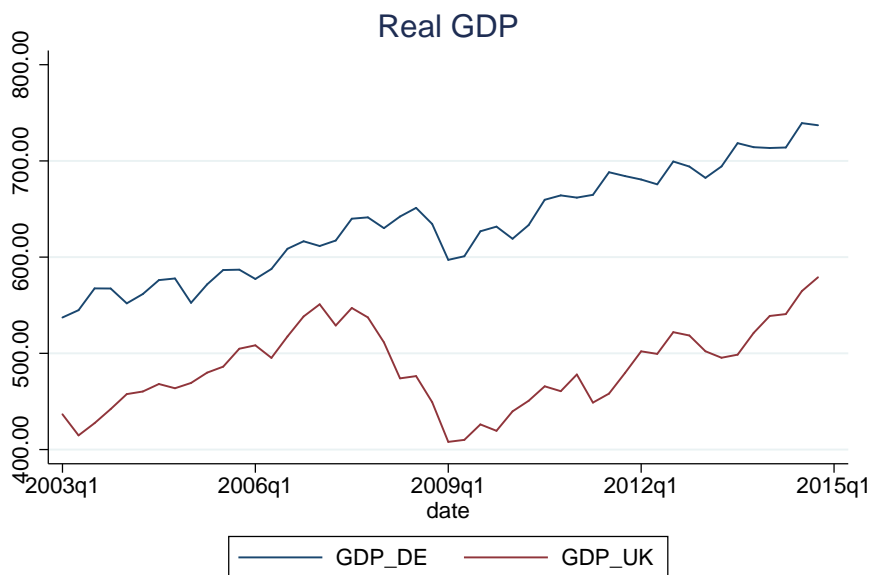


Source: Household Finance and Consumption Survey (HFCS) 2008-2010 / Note: Calculated with sample weights

Appendix F

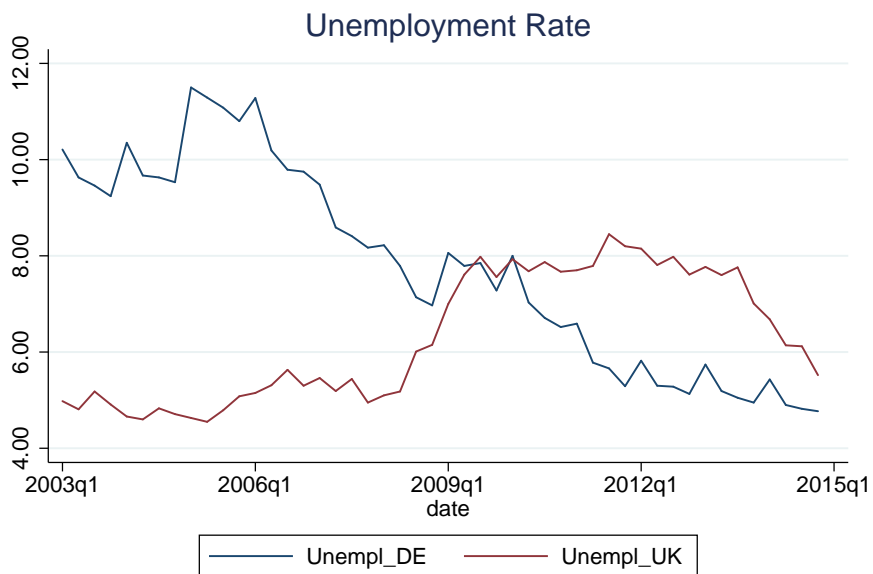
Appendix to Chapter 4

Figures to Chapter 4



Source: Eurostat, current market prices, S.A., in billion Euros.

FIGURE F.1: Real GDP



Source: Main Economic Indicators, OECD, in %.

FIGURE F.2: Unemployment Rate



FIGURE F.3: Inflation Rate

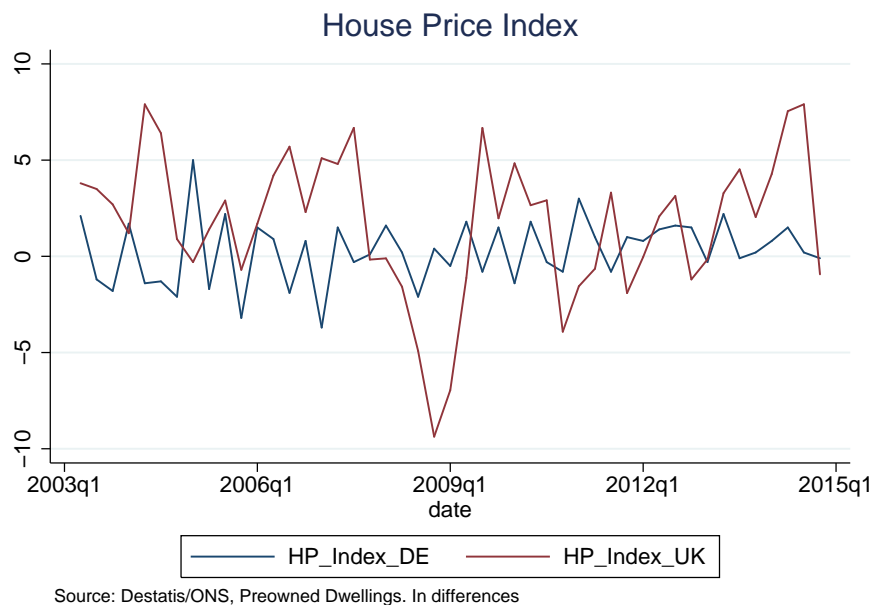
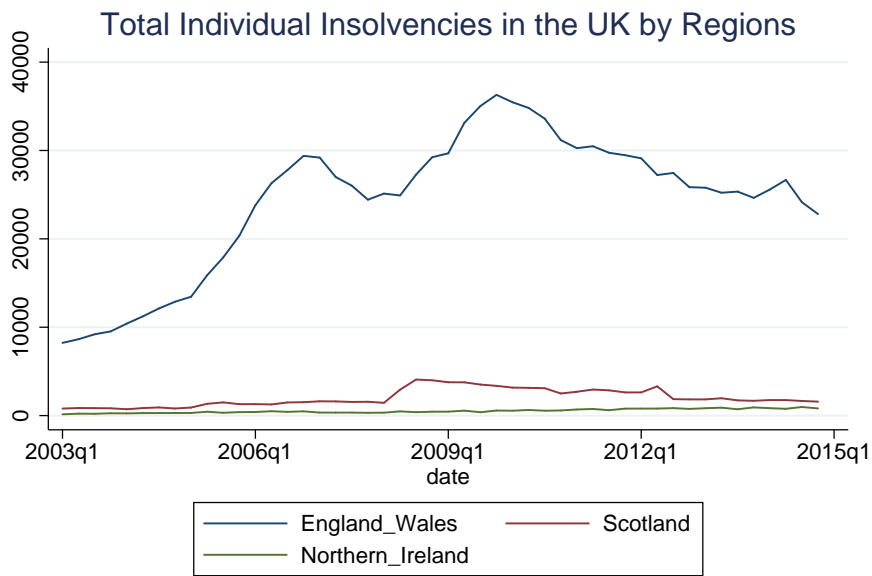
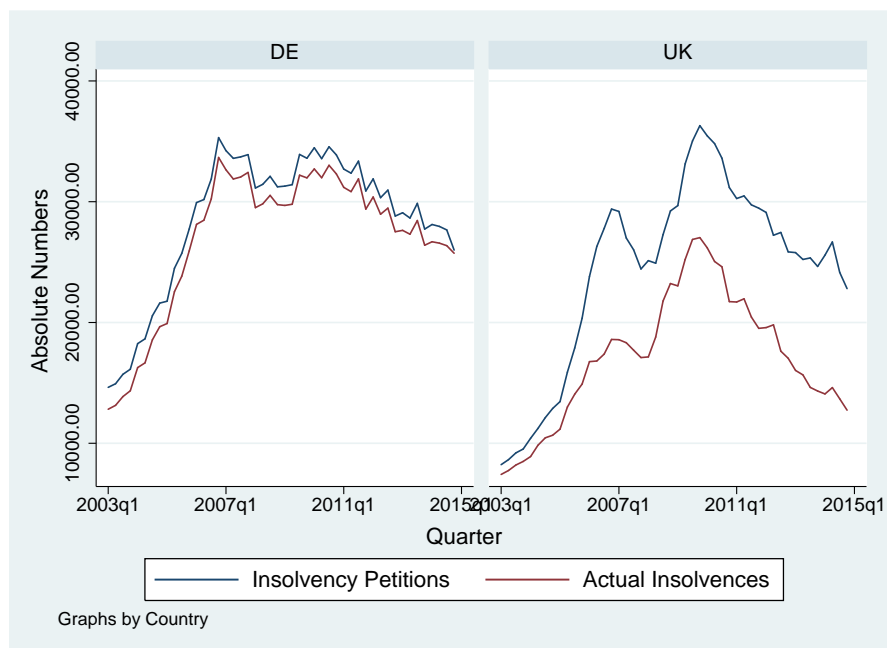


FIGURE F.4: HP Index (Pre-owned dwellings), quarterly differences.



Source: UK Insolvency Service.

FIGURE F.5: Total Individual Insolvencies in the UK by Regions



Graphs by Country

FIGURE F.6: Insolvency Petitions, Actual Insolvencies

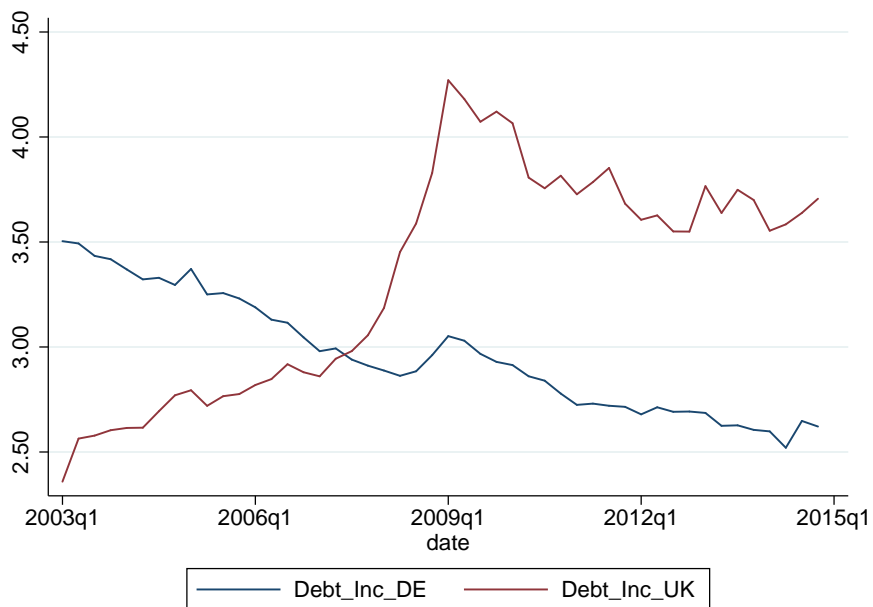
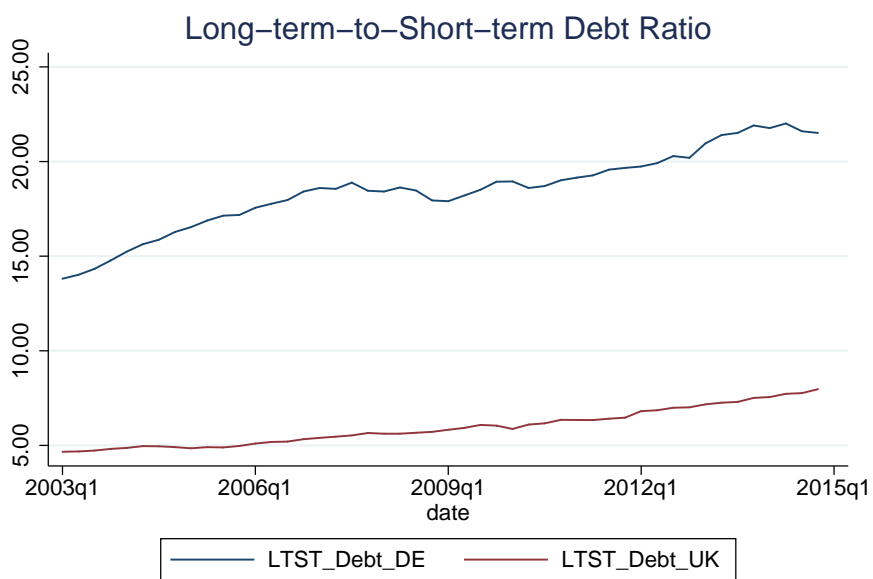


FIGURE F.7: Debt-to-Income Ratio



Source: OECD, Own calculations

FIGURE F.8: Long-term-to-short-term Debt Ratio

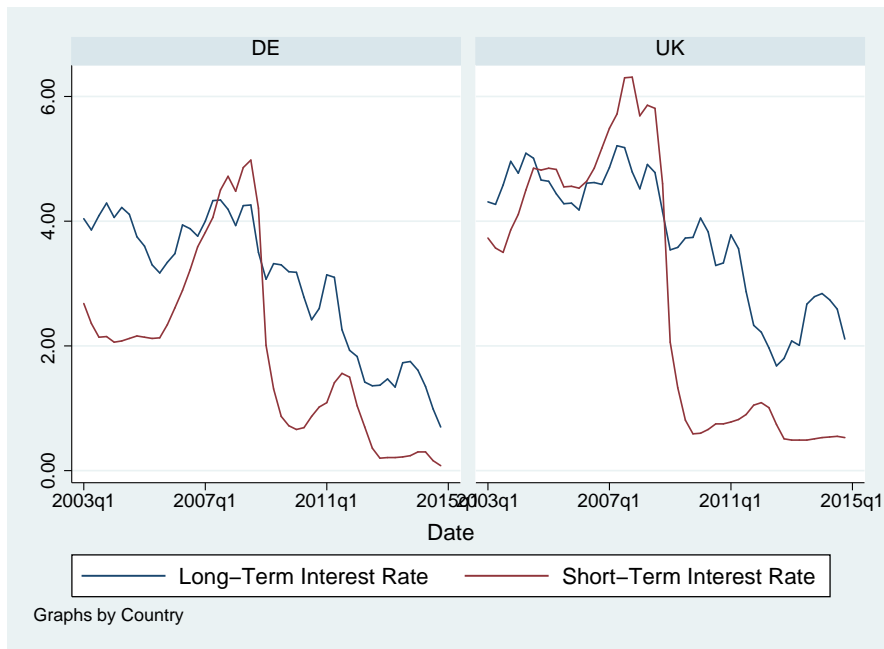


FIGURE F.9: Interest Rates

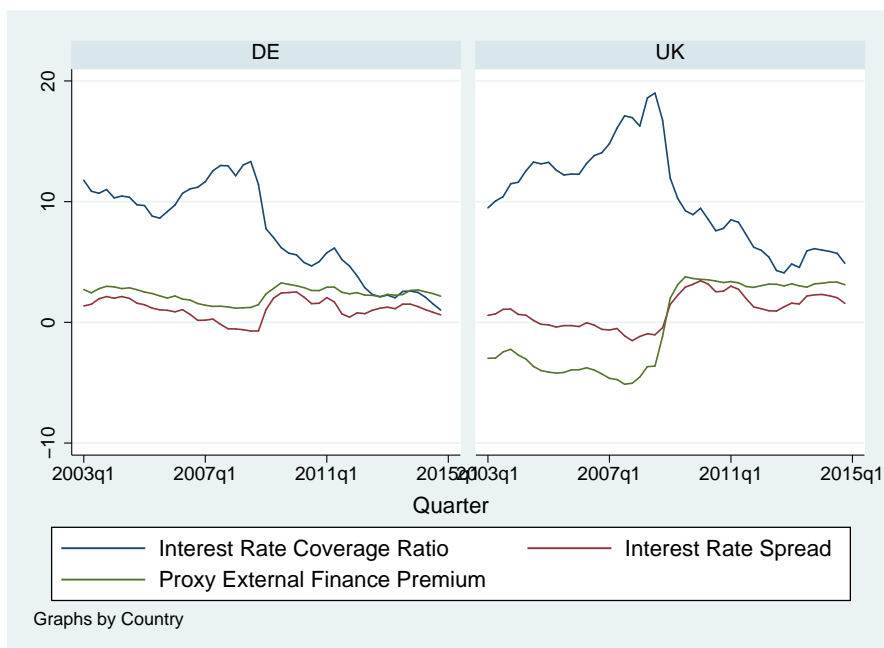


FIGURE F.10: Interest Rate related Ratios

Appendix G

Appendix to Chapter 4

Description of the Variables used in Chapter 4

TABLE G.1: Description of Variables

Variable	Unit	Description & Source
Insol_pet	Levels	DE: includes all cases where out-of-court settlements failed; including settlements reached before court and cases rejected due to lack of assets; sum of monthly data; UK: (composed of England and Wales, Scotland and Northern Ireland) - IVAs+DROs+bankruptcies.
Insol_actual	Levels	Actual insolvencies for DE: cases that are settled at court, UK: without IVAs. Source: Destatis/ Insolvency Service Official Statistics
Unempl	%	Unemployment rate. Source: Main Economic Indicators, OECD.
Infl	%	Inflation rate. Source: Bundesbank (ESZB Zeitreihen)
Debt_LT	EUR/GBP, mio.	Long-term loans (Including Bills of Exchg.) to domestic households. Source: OECD (S.A. by the authors).
Debt_ST	EUR/GBP, mio.	DE: Short Term Loans (Including Bills of Exchg) to Domestic Household, Consumer Credit, Euro, UK: Unsecured Lending, Overdraft Lending, Amounts Outstanding. Source: OECD (S.A. by the authors)
i_LT	%	Long-term interest rates ¹ . Per cent per annum. Source: OECD, Monetary and Financial Statistics (MEI).
i_ST	%	Long-term interest rates. Per cent per annum. Source: OECD, Monetary and Financial Statistics (MEI).
HP_Index_Old	Index	House price Index (pre-owned dwellings). Source: Destatis/ONS.
Income	EUR, mio.	Net disposable income; (S.A. by the authors).
Self-constructed Ratios		
Debt_Inc	Ratio	Debt-to-income ratio (average long-term and short-term debt).
Wedge	Ratio	Wedge between the policy rate and the proxies for lending rates (average of bank lending rates without consumer credit).
LTST_Debt	Ratio	Long-term to short-term debt ratio.
IR_Spread	Ratio	Interest rate spread (Spread between long-term and short-term interest rates).
IRC	Ratio	Interest rate coverage ratio: interest rate * Debt / disp. income (amount of debt paid out of disposable income, measures the ability to repay one's debt).

Mio. = Million.

¹Data refer to the par yield for bonds with a maturity of 10 years. A par yield is the interest rate (coupon) which a hypothetical stock would have to bear for its price to equal its face value. Only conventional dated stocks with a significant amount in issue and having more than one year maturity are used. This excludes index-linked and irredeemable stocks, stocks with existing conversion options and stocks with possible alternative redemption dates.

Bibliography

- Abel, Andrew B.**, “Asset Prices under Habit Formation and Catching Up with the Joneses,” *American Economic Review*, May 1990, *80* (2), 38–42.
- Adler, Barry, Ben Polak, and Alan Schwartz**, “Regulating Consumer Bankruptcy: A Theoretical Inquiry,” Yale School of Management Working Papers ysm128, Yale School of Management November 1999.
- Ahlquist, John S. and Ben Ansell**, “Does Inequality induce more borrowing? Electoral Institutions and Responses to Economic Polarization,” 2014.
- Akerlof, George A.**, “Social Distance and Social Decisions,” *Econometrica*, September 1997, *65* (5), 1005–1028.
- **and Rachel E. Kranton**, “Economics And Identity,” *The Quarterly Journal of Economics*, August 2000, *115* (3), 715–753.
- **and –**, “Identity and Schooling: Some Lessons for the Economics of Education,” *Journal of Economic Literature*, December 2002, *40* (4), 1167–1201.
- **and –**, “Identity and the Economics of Organizations,” *Journal of Economic Perspectives*, Winter 2005, *19* (1), 9–32.
- **and –**, *Identity Economics: How Our Identities Shape Our Work, Wages, and Well-Being*, Princeton University Press, 2010.
- Allen, Franklin and Douglas Gale**, “Comparative Financial Systems: A Survey,” Center for Financial Institutions Working Papers 01-15, Wharton School Center for Financial Institutions, University of Pennsylvania April 2001.

- Alpizar, Francisco, Fredrik Carlsson, and Olof Johansson-Stenman**, “How much do we care about absolute versus relative income and consumption?,” *Journal of Economic Behavior & Organization*, March 2005, 56 (3), 405–421.
- Andreasch, Michael and Peter Lindner**, “Micro and macro data A comparison of the Household Finance and Consumption Survey with Financial Accounts in Austria,” *ECB Working Paper Series*, 2014, (1673).
- Aoki, Kosuke, James Proudman, and Gertjan Vlieghe**, “House prices, consumption, and monetary policy: a financial accelerator approach,” *Journal of Financial Intermediation*, October 2004, 13 (4), 414–435.
- Ariely, Dan**, *Predictably Irrational*, Harper Collins, 2008.
- , “The end of rational economics,” *Harvard Business Review*, 2009, July-August.
- Arnold, Eva A. and Nadja König**, “Personal Insolvency Dynamics in Germany and the UK - A SUR-TAR Approach,” 2015.
- Ashraf, Quamrul, Boris Gershman, and Peter Howitt**, “Banks, Market Organization, and Macroeconomic Performance: An Agent-Based Computational Analysis,” 2011.
- Assenza, T., D. Delli Gatti, and M. Gallegati**, “Heterogeneity and Aggregation in a Financial Accelerator Model,” CeNDEF Working Papers 07-13, Universiteit van Amsterdam, Center for Nonlinear Dynamics in Economics and Finance 2007.
- Athreya, Kartik**, “Fresh start or head start? Uniform bankruptcy exemptions and welfare,” *Journal of Economic Dynamics and Control*, November 2006, 30 (11), 2051–2079.
- Athreya, Kartik B.**, “Default, insurance, and debt over the life-cycle,” *Journal of Monetary Economics*, May 2008, 55 (4), 752–774.
- Atkinson, A. and S. Morelli**, “Inequality and banking crises: A first look,” in “Paper prepared for the Global Labour Forum in Turin organised by the International Labor Organization.” 2010.
- Attanasio, Orazio, Erik Hurst, and Luigi Pistaferri**, “The Evolution of Income, Consumption, and Leisure Inequality in The US, 1980-2010,” Working Paper 17982, National Bureau of Economic Research April 2012.

- Axelrod, Robert**, “Agent-based Modeling as a Bridge Between Disciplines,” in Leigh Tesfatsion and Kenneth L. Judd, eds., *Handbook of Computational Economics*, Vol. 2 of *Handbook of Computational Economics*, Elsevier, 00 2006, chapter 33, pp. 1565–1584.
- Bacchetta, Philippe and Stefan Gerlach**, “Consumption and credit constraints: International evidence,” *Journal of Monetary Economics*, October 1997, *40* (2), 207–238.
- Backhaus, Klaus, Bernd Erichson, Wulff Plinke, and Rolf Weiber**, *Multivariate Analysemethoden: Eine anwendungsorientierte Einführung*, 13 ed., Springer, 2010.
- Bagliano, F.-C. and G. Bertola**, *Models for Dynamic Macroeconomics*, Oxford University Press, 2007.
- Barba, Aldo and Massimo Pivetti**, “Rising household debt: Its causes and macroeconomic implications - a long-period analysis,” *Cambridge Journal of Economics*, 2009, *33* (1), 113–137.
- Battiston, Stefano, Domenico Delli Gatti, Mauro Gallegati, Bruce Greenwald, and Joseph E. Stiglitz**, “Credit chains and bankruptcy propagation in a production network,” *Journal of Economic Dynamics & Control*, 2007, *31* (6), 2061–2084.
- , – , – , – , – , **and** – , “Liaisons dangereuses: Increasing connectivity, risk sharing, and systemic risk,” *Journal of Economic Dynamics and Control*, 2012, *36* (8), 1121–1141.
- Bebchuk, Lucian Arye**, “The ex ante costs of violating absolute priority in bankruptcy,” *Journal of Finance*, 2002, *57*, 445–460.
- Bekaerta, Geert, Campbell R. Harvey, and Christian Lundblad**, “Does financial liberalization spur growth?,” *Journal of Financial Economics*, 2005, *77* (1), 3–55.
- Belabed, Christian, Thomas Theobald, and Till van Treeck**, “Income Distribution and Current Account Imbalances,” INET Research Notes 36, Institute for New Economic Thinking (INET) November 2013.
- Belke, Ansgar**, “Die Auswirkungen der Geldmenge und des Kreditvolumens auf die Immobilienpreise - Ein ARDL-Ansatz für Deutschland,” *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 2010, *230* (2), 138–162.

- Berg, . and J.D. Ostry**, “Inequality and Unsustainable Growth: Two Sides of the same Coin?,” *IMF Staff Discussion Note*, 2011, 8.
- Berkovich, Elzar and Ronen Israel**, “Optimal Bankruptcy Laws across Different Economic Systems,” *The Review of Financial Studies*, 1999, 12 (2), 347–377.
- Bernanke, Ben and Mark Gertler**, “Agency Costs, Net Worth, and Business Fluctuations,” *American Economic Review*, March 1989, 79 (1), 14–31.
- Bernanke, Ben S.**, “The financial accelerator and the credit channel: a speech at a conference on The Credit Channel of Monetary Policy in the Twenty-first Century, Federal Reserve Bank of Atlanta, Atlanta, Georgia, June 15, 2007,” Speech 2007, Board of Governors of the Federal Reserve System (U.S.) 2007.
- Bernanke, Ben S and Mark Gertler**, “Inside the Black Box: The Credit Channel of Monetary Policy Transmission,” *Journal of Economic Perspectives*, Fall 1995, 9 (4), 27–48.
- Berthold, Norbert and Alexander Brunner**, “Wie ungleich ist die Welt? Eine empirische Analyse,” *Perspektiven der Wirtschaftspolitik*, 2011, 12 (4), 372–396.
- Blazy, Rs, Bertrand Chopard, Eric Langlais, and Ydriss Ziane**, “Personal Bankruptcy Law, Fresh Starts, and Judicial Practice,” *EconomiX Working Papers 2011-15*, University of Paris West - Nanterre la Dnse, EconomiX 2011.
- Bolton, Patrick, Xavier Freixas, Leonardo Gambacorta, and Paolo Emilio Mistrulli**, “Relationship and Transaction Lending in a Crisis,” Working Paper 19467, National Bureau of Economic Research September 2013.
- Boot, Arnoud W A and Anjan V Thakor**, “Financial System Architecture,” *Review of Financial Studies*, 1997, 10 (3), 693–733.
- Bordo, Michael D. and Christopher M. Meissner**, “Does Inequality Lead to a Financial Crisis?,” Working Paper 17896, National Bureau of Economic Research March 2012.
- Brandolini, Andrea**, “Measurement of income distribution in supranational entities the case of the European Union,” *Banca D'Italia, temi di discussion del Servizio Studi*, April 2007, (No. 623).

- Browning, Martin and Annamaria Lusardi**, “Household Saving: Micro Theories and Micro Facts,” *Journal of Economic Literature*, 1996, 34 (4), pp. 1797–1855.
- Carbone, Enrica and John Duffy**, “Lifecycle consumption plans, social learning and external habits: Experimental evidence,” *Journal of Economic Behavior & Organization*, 2014, 106, 413–427.
- Cardaci, Alberto**, “Inequality, household debt and financial instability: an agent-based perspective,” 2014.
- Carroll, Christopher D.**, “Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis,” *The Quarterly Journal of Economics*, February 1997, 112 (1), 1–55.
- Chatterjee, Satyajit and Grey Gordon**, “Dealing with consumer default: Bankruptcy vs garnishment,” *Journal of Monetary Economics*, 2012, 59, Supplement (0), S1 – S16. Supplement issue: October 15-16 2010 Research Conference on ‘Directions for Macroeconomics: What did we Learn from the Economic Crises’ Sponsored by the Swiss National Bank (<http://www.snb.ch>).
- Chmelar, Ales**, “Household Debt and the European Crisis,” *ECRI Research Report*, June 2013, 14.
- Cohen-Cole, Ethan, Burcu Duygan-Bump, and Judit Montoriol-Garriga**, “Forgive and Forget: Who get Credit after Bankruptcy and Why?,” *Boston Reserve Bank, Working Paper No. QAU09-2*, 2009.
- Constantinides, George M.**, “Habit Formation: A Resolution of the Equity Premium Puzzle,” *Journal of Political Economy*, 1990, 98 (3), pp. 519–543.
- Cynamon, Barry Z. and Steven M. Fazzari**, “Household Debt in the Consumer Age: Source of Growth–Risk of Collapse,” *Capitalism and Society*, October 2008, 3 (2), 1–32.
- and –, “Inequality and Household Finance during the Consumer Age,” Economics Working Paper Archive wp752, *Levy Economics Institute, The February* 2013.
- D., Slovic P. Kahneman and A. Tversky**, *Judgment under Uncertainty: Heuristics and Biases*, Cambridge University Press; First Edition., 1982.

- Dabla-Norris, E., K. Kochhar, N. Suphaphiphat, F. Ricka, and E. Tsounta,** “Causes and Consequences of Income Inequality: A Global Perspective,” *IMF Staff Discussion Note*, June 2015, 13.
- Davydenko, Sergei A. and Julian R. Franks,** “Do Bankruptcy Codes Matter? A Study of Defaults in France, Germany and the UK,” *Journal of Finance*, 2008, *LXIII* (2), 565–608.
- Deaton, Angus,** “Saving and Liquidity Constraints,” NBER Working Papers 3196, National Bureau of Economic Research, Inc December 1989.
- Debelle, Guy,** “The Macroeconomic Implications of rising Household Debt,” *BIS Working Papers*, 2004, *No 153*.
- Demirgüunt, A. and E. Detragiache,** “Financial liberalization and financial fragility,” *IMF Working Paper*, 1998, 83.
- Djankov, Simeon, Caralee McLiesh, and Andrei Shleifer,** “Private credit in 129 countries,” *Journal of Financial Economics*, May 2007, *84* (2), 299–329.
- Dobbie, Will and Jae Song,** “Debt Relief and Debtor Outcomes: Measuring the Effects of Consumer Bankruptcy Protection,” *American Economic Review (forthcoming)*, 2014.
- Dosi, Giovanni, Giorgio Fagiolo, Mauro Napoletano, and Andrea Roventini,** “Income distribution, credit and fiscal policies in an agent-based Keynesian model,” *Journal of Economic Dynamics and Control*, 2013, *37* (8), 1598–1625.
- Drechsel-Grau, M. and K. D. Schmid,** “Saving behavior under upward looking comparisons in Germany, 1995-2011,” *IMK Working Paper - Macroeconomic Policy Institute*, 2013, (118).
- Drechsel-Grau, Moritz and Kai D. Schmid,** “Consumption and savings decisions under upward-looking comparisons,” *Journal of Economic Behavior & Organization*, 2014, *106* (0), 254–268.
- Duesenberry, James,** *Income, Saving and the Theory of Consumer Behavior*, Harvard University Press, Cambridge, Massachusetts., 1949.
- Duygan-Bump, Burcu and Charles Grant,** “Household Debt Repayment Behaviour: What Role do Institutions Play?,” *Economic Policy*, January 2009, *24* (57), 107–140.

- Dynan, Karen E., Jonathan Skinner, and Stephen P. Zeldes**, “Do the Rich Save More?,” *Journal of Political Economy*, April 2004, 112 (2), 397–444.
- Efrat, Rafael**, “The Evolution of Bankruptcy Stigma,” *Theoretical Inquiries in Law*, 2006, 7 (2).
- Fagiolo, Gioglio and Andrea Roventini**, “Macroeconomic Policy in DSGE and Agent-Based Models,” *Working Paper Series, Department of Economics, University of Verona*, 2012, 7.
- Fay, Scott, Erik Hurst, and Michelle J. White**, “The Household Bankruptcy Decision,” *American Economic Review*, June 2002, 92 (3), 706–718.
- Fieldhouse, David, Igor Livshits, and James MacGee**, “Income Loss and Bankruptcies over the Business Cycle,” *OSB Working Paper*, 2012.
- Fischer, Thomas**, “Inequality and Financial Markets - A Simulation Approach in a Heterogeneous Agent Model,” in “Managing Market Complexity - The Approach of Artificial Economics,” Springer, 2013.
- Flynn, E.**, “Bankruptcy by the Numbers,” *Bankruptcy Institute Journal*, 1999, 18 (1526).
- Frank, Robert H., Adam Seth Levine, and Oege Dijk**, “Expenditure Cascades,” *Review of Behavioral Economics*, January 2014, 1 (1-2), 55–73.
- Franks, Julian R., Kjell G. Nyborg, and Walter N. Torous**, “A Comparison of US, UK, and German Insolvency Codes,” *Financial Management*, 1996, 25 (3), pp. 86–101.
- Franzini, Maurizio**, “Why Europe Needs a Policy on Inequality,” *Intereconomics*, November/December 2009, 44 (6).
- Fredriksen, Kaja Bonesmo**, “Income Inequality in the European Union,” *OECD Economics Department Working Papers*, 2012, (No. 952).
- Friedman, Milton**, *A Theory of the Consumption Function*, Princeton University Press, 1957.
- Gali, Jordi**, “Keeping up with the Joneses: Consumption Externalities, Portfolio Choice, and Asset Prices,” *Journal of Money, Credit and Banking*, 1994, 26 (1), pp. 1–8.

- Garotte, Daniel, Jimena Llpois, and Javier Valles**, “Private Sector Deleveraging CChannel: An International Comparison,” *Bank of Spain, Economic Bulletin*, November 2013.
- Garrett, Thomas A. and Howard J. Wall**, “Personal Bankruptcy Cycles,” *Macroeconomic Dynamics*, 10 2014, 18, 1488–1507.
- Gatti, D. Delli, M. Gallegati, B. Greenwald, A. Russo, and J. Stiglitz**, “Business fluctuations and bankruptcy avalanches in an evolving network economy,” *Journal of Economic Interaction and Coordination*, November 2009, 4 (2), 195–212.
- Gatti, Domenico Delli, Corrado Di Guilmi, Edoardo Gaffeo, Gianfranco Giulioni, Mauro Gallegati, and Antonio Palestrini**, “A new approach to business fluctuations: heterogeneous interacting agents, scaling laws and financial fragility,” *Journal of Economic Behavior & Organization*, April 2005, 56 (4), 489–512.
- , **Eduardo Gaffeo, Mauro Gallegati, Gianfranco Giulioni, and Antonio Palestrini**, *Emergent Macroeconomics – An Agent-Based Approach to Business Fluctuations*, Berlin, Milan, Heidelberg, New York: Springer, 2008.
- , **Mauro Gallegati, Bruce Greenwald, Alberto Russo, and Joseph E. Stiglitz**, “The financial accelerator in an evolving credit network,” *Journal of Economic Dynamics and Control*, September 2010, 34 (9), 1627–1650.
- , **Saul Desiderio, Eduardo Gaffeo, Pasquale Cirillo, and Mauro Gallegati**, *Macroeconomics from the bottom-up*, Springer Milan, 2011.
- Gerhard, Maria**, “Consumer Bankruptcy Regimes and Credit Default in the US and Europe - A comparative study,” *CEPS Working Document*, 2009, 218.
- Grauwe, Paul De**, “DSGE Modelling: When Agents are imperfectly informed,” *ECB Working Paper Series No. 897*, 2008.
- Gross, David B. and Nicolas S. Souleles**, “An Empirical Anaylsis of Personal Bankruptcy and Delinquency,” *The Review of Financial Studies*, 2002, 15 (1), 319–347.
- Grössl, Ingrid and Ulrich Fritsche**, “Default Option, Risk-Aversion and Household Borrowing Behaviour,” *DEP Discussion Papers Macroeconomics and Finance Series*, 2007, 5.

- and —, “The Store-of-Value-Function of Money as a Component of Household Risk Management,” *DIW Berlin Discussion Papers*, 2007, 660.
- H., Pimpertz J. Schäfer H. Goecke and C. Schröder**, “Zehn Jahre Agenda 2010: Eine empirische Bestandsaufnahme ihrer Wirkungen,” *IW policy papers*, 2013, 7.
- Han, Song and Wenli Li**, “Household Borrowing after Personal Bankruptcy,” *Journal of Money, Credit and Banking*, March-April 2011, 43 (No.2-3).
- Harman, H.H.**, *Modern factor analysis*, Chicago: The University of Chicago Press., 1976.
- Heuer, J.-O.**, “Social Inclusion and Exclusion in European Consumer Bankruptcy Systems,” *Presentation at the International Conference "Shifting to Post-Crisis Welfare States in Europe—Long-Term and Short-Term Perspectives" by NordForsk and the Nordic Centres of Excellence NordWel, 4-5 June, Berlin (Germany)*, 2013.
- Heuer, Jan-Ocko**, “Rules and Norms of Consumer Insolvency and Debt Relief - A Comparison and Classification of Personal Bankruptcy Systems in 15 Economically Advanced Countries.” PhD dissertation, Bremen International Graduate School of Social Sciences 2014.
- Himmelstein, D.U., E. Warren, D. Thorne, and S. Woolhandler**, “Illness and Injury as Contributors to Bankruptcy,” *Health Affairs*, 2005, 24, 63–73.
- Iacoviello, Matteo**, “Household Debt and Income Inequality: 1963-2003,” *Journal of Money, Credit and Banking*, 2008, 40 (5), 929–965.
- IMF**, “Dealing with Household Debt,” *World Economic Outlook: Growth Resuming, Danger Remain*, April 2012.
- Jackson, Thomas H.**, *The Logic and Limits of Bankruptcy Law*, Harvard University Press, 1986.
- Jagtiani, Julapa and Wenli Li**, “Credit Access After Consumer Bankruptcy Filing: New Evidence,” *Federal Reserve Bank of Philadelphia, Supersedes Working Paper No. 13-24*, 2014.
- Jappelli, T., M. Pagano, and M. Di Maggio**, “Households’ indebtedness and financial fragility,” *Journal of Financial Management, Markets and Institutions*, January 2013, (1), 23–46.

- Jappelli, Tullio, Marco Pagano, and Marco di Maggio**, “Households’ Indebtedness and Financial Fragility,” CSEF Working Papers 208, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy October 2008.
- Jentzsch, Nicola and Amparo San Josestra**, “Consumer credit markets in the United States and Europe,” in “The Economics of Consumer Credit,” Cambridge, Mass. [u.a.] : MIT Press, 2008, chapter 2, pp. 27–62.
- Kahneman, Daniel**, “Maps of Bounded Rationality: Psychology for Behavioral Economics,” *American Economic Review*, December 2003, 93 (5), 1449–1475.
- Kaiser, Kevin**, “European Bankruptcy Laws: Implications for Corporations Facing Financial Distress,” *Financial Management*, 1996, 25 (3).
- Kaufmann, Sylvia and Maria Teresa Valderrama**, “Bank lending in Germany and the UK: are there differences between a bank-based and a market-based country?,” *International Journal of Finance & Economics*, 2008, 13 (3), 266–279.
- Kilborn, Jason J.**, “Comparative Consumer Bankruptcy,” *Carolina Academic Press*, August 2007.
- Kirman, Alan**, “The Economic Crisis is a Crisis for Economic Theory,” *CEPr Economic Studies*, 2010, 56 (4), 498–535.
- Kirman, Alan P.**, “Economies with Interacting Agents,” Discussion Paper Serie A 500, University of Bonn, Germany October 1995.
- König, Nadja**, “Household Debt and Macrodynamics - How do Income Distribution and Insolvency Regulations interact?,” 2015.
- **and Ingrid Grössl**, “Catching up with the Joneses and Borrowing Constraints: An Agent-based Analysis of Household Debt,” Macroeconomics and Finance Series 201404, Hamburg University, DEP (Socioeconomics) Discussion Papers, Macroeconomics and Finance Series June 2014.
- Krueger, Dirk and Fabrizio Perri**, “Does income inequality lead to consumption equality? evidence and theory,” Staff Report 363, Federal Reserve Bank of Minneapolis 2005.
- LaPorta, Rafael, Florencio Lopez de Silanes, Andrei Shleifer, and Robert W. Vishny**, “Legal Determinants of External Finance,” NBER Working Papers 5879, National Bureau of Economic Research, Inc January 1997.

- , **Florencio Lopez de Silanes, Andrei Shleifer, and Robert W. Vishny**, “Law and Finance,” *Journal of Political Economy*, December 1998, *106* (6), 1113–1155.
- Leland, Hayne E.**, “Saving and Uncertainty: The Precautionary Demand for Saving,” *The Quarterly Journal of Economics*, 1968, *82* (3), 465–473.
- Levy, Moshe and Sorin Solomon**, “New evidence for the power-law distribution of wealth,” *Physica A*, 1997, *242*, 90–94.
- Livshits, Igor, James MacGee, and Michelle Tertilt**, “Consumer Bankruptcy: A Fresh Start,” *American Economic Review*, March 2007, *97* (1), 402–418.
- , – , and – , “Accounting for the Rise in Consumer Bankruptcies,” *American Economic Journal: Macroeconomics*, 2010, *2* (2), 165–93.
- Lucas, R.E.**, “Expectations and the Neutrality of Money,” *Journal of Economic Theory*, 1972, *4*, 103–124.
- Ludvigson, Sydney**, “Consumption And Credit: A Model Of Time-Varying Liquidity Constraints,” *The Review of Economics and Statistics*, August 1999, *81* (3), 434–447.
- Lusardi, Annamaria**, “On the Importance of the Precautionary Saving Motive,” *The American Economic Review*, 1998, *88* (2), pp. 449–453.
- Mankiw, N. Gregory and Ricardo Reis**, “Sticky Information: A Model of Monetary Nonneutrality and Structural Slumps,” NBER Working Papers 8614, National Bureau of Economic Research, Inc December 2001.
- and – , “Sticky Information Versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve,” NBER Working Papers 8290, National Bureau of Economic Research, Inc May 2001.
- and – , “Sticky Information in General Equilibrium,” NBER Working Papers 12605, National Bureau of Economic Research, Inc October 2006.
- May, Orla, Merxe Tudela, and Garry Young**, “British household indebtedness and financial stress: a household-level picture,” *Bank of England Quarterly Bulletin*, 2004, *Q4*, 414–428.
- McDonald, James**, “Some Generalized Functions for the Size Distribution of Income,” *Econometrica*, 1984, *52* (3), 647–63.

- Mian, Atif and Amir Sufi, "Household Leverage and the Recession of 2009-09," *IMF Economic Review*, 2010, 58 (1), 74–117.
- and —, *House of Debt*, University Of Chicago Press, 2014.
- Miller, John H. and Scott E. Page, *Complex adaptive systems, an introduction to computational models of social life*, Vol. Princeton, NJ [u.a.], Princeton Univ. Press, 2007, Princeton University Press, 2007.
- Modigliani, Franco and Richard H. Brumberg, "Utility analysis and the consumption function: an interpretation of cross-section data," in "Post-Keynesian Economics," in Kenneth K. Kurihara, ed., New Brunswick, NJ. Rutgers University Press., 1954.
- Muellbauer, John and Anthony Murphy, "Explaining regional consumption in the UK," Working Papers 199429, School of Economics, University College Dublin December 1994.
- and —, "Booms and Busts in the UK Housing Market," *The Economic Journal*, 1997, 107 (445), 1701–1727.
- Muth, J.F., "Rational Expectations and the Theory of Price Movements," *Econometrica*, 1961, 29, 315–335.
- Nielsen, M., S. Pezzini, K. Reinold, and R. Williams, "The financial position of British households: evidence from the 2010 NMG Consulting survey," *Bank of England Quarterly Bulletin*, 2010, Q4, 333–345.
- Niemi, Johanna, "Consumer Insolvency in the European Legal Context," *Journal of Consumer Policy*, 2012, 35, 443–459.
- Niemi-Kiesilainen, Johanna, "Changing Directions in Consumer Bankruptcy Law and Practice in Europe and USA," *Journal of Consumer Policy*, 1997.
- , "Consumer Bankruptcy in Comparison: Do We Cure a Market Failure or a Social Problem," *Osgoode Hall Law Journal*, 1999, 37 (1/2).
- Picklands, J., "Statistical Inference Using Extreme Order Statistics," *The Annals of Statistics*, 1975, 3, 119–131.
- Piketty, Thomas, *Capital in the Twenty-First Century*, Harvard University Press, 2014.

- **and Emmanuel Saez**, “Income Inequality in the United States,” *Quarterly Journal of Economics*, 2003, Vol. *CXVIII* (1).
- Porter, Katherine**, “The Pretend Solution: An Empirical Study of Bankruptcy Outcomes,” *Texas Law Review*, 2011, *90:103*, 103–162.
- Povel, Paul**, “Optimal “soft” or “tough” bankruptcy procedures,” *Journal of Law, Economics, and Organization*, 1999, *15*, 659–684.
- Rajan, R.**, *Fault Lines: How Hidden Fractures Still Threaten The World Economy*, Princeton University Press, 2010.
- Rajan, Raghuram G.**, “Insiders and Outsiders: The Choice between Informed and Arm’s-Length Debt,” *Journal of Finance*, September 1992, *47* (4), 1367–400.
- **and Luigi Zingales**, “Financial Dependence and Growth,” *American Economic Review*, June 1998, *88* (3), 559–86.
- Ranciere, R., A. Tornell, and F. Westermann**, “Decomposing the effects of financial liberalization: Crises vs. Growth,” *Journal of Banking & Finance*, 2006, *30* (12), 33313348.
- Rubaszek, Michal and Dobromil Serwa**, “The determinants of credit in a household life-cycle model,” *ECB Working Paper Series*, 2012, *1420*.
- Russo, Alberto, Luca Riccetti, and Mauro Gallegati**, “Increasing Inequality and Financial Fragility in an Agent Based Macroeconomic Model,” MPRA Paper 51528, University Library of Munich, Germany June 2013.
- Sandmo, A.**, “The Effect of Uncertainty on Saving Decisions,” *Review of Economic Studies*, 1970, *37* (3), 353–360.
- Schmid, Kai D. and Moritz Drechsel-Grau**, “Habits and Envy: What Drives the Consumption Behavior of U.S. Households? Evidence from PSID, 1999-2009,” IMK Working Paper 123-2013, IMK at the Hans Boeckler Foundation, Macroeconomic Policy Institute 2013.
- Simon, Herbert A.**, “Theories of decision making in economics and behavioural science,” *American Economic Review*, 1959, *49*, 3, 253 – 283.

- Sims, Christopher A.**, “Implications of rational inattention,” *Journal of Monetary Economics*, April 2003, 50 (3), 665–690.
- Skene, Donna McKenzie and Adrian Walters**, “Consumer Bankruptcy Law Reform in Great Britain,” *The American Bankruptcy Law Journal*, 2006, 80, 477–522.
- Sousa, Michael D.**, “Bankruptcy Stigma: A Socio-Legal Study,” *American Bankruptcy Law Journal*, February 2014, 87.
- Stiglitz, Joseph E. and Mauro Gallegati**, “Heterogeneous Interacting Agent Models for Understanding Monetary Economies,” *Eastern Economic Journal*, 2011, 37, 6–12.
- Sullivan, T., Elizabeth W., and J.L. Westbrook**, *The Fragile Middle Class: Americans in Debt*, Yale University Press, 2000.
- Tabb, Charles Jordan**, “The Historical Evolution of the Bankruptcy Discharge,” *American Bankruptcy Law Journal*, 1991, Vol. 65, 325–71.
- Tesfatsion, ACE**: *A Constructive Approach to Economic Theory*, Handbook of Computational Economics: Agent-Based Computational Economics,
- Tong, H.**, “On a Threshold Model,” in “Pattern Recognition and Signal Processing,” Amsterdam: Sijhoff and Nordhoff., 1978.
- , *Threshold Models in Non-Linear Time Series Analysis*, New-York, Springer Verlag, 1983.
- Tversky, Amos, Paul Slovic, and Daniel Kahneman**, “The Causes of Preference Reversal,” *American Economic Review*, March 1990, 80 (1), 204–17.
- Uhlig, Harald and Lars Ljungqvist**, “Tax Policy and Aggregate Demand Management under Catching Up with the Joneses,” *American Economic Review*, June 2000, 90 (3), 356–366.
- vanTreeck, Till**, “Did inequality cause the U.S. financial crisis?,” *Journal of Economic Surveys*, 2014, 28 (3), 421–448.
- Veblen, Thorstein**, *The Theory Of The Leisure Class :An Economic Study of Institutions*, New York: Penguin Books., 1899.
- Wang, Hungjen and Michelle White**, “An Optimal Personal Bankruptcy System and Proposed Reforms,” *Journal of Legal Studies*, 2000, XXXI(1), 255–286.

- Warren, Elizabeth .**, “Financial collapse and class status: Who goes bankrupt?,” *Osgoode Hall Law Journal*, 2003, *41(1)*, 115–147.
- Wessels, Bob**, “On the Future of European Insolvency Law,” in “INSOL Europe Academic Forum’s 5th Edwin Coe lecture” 2012.
- White, Michelle**, “Bankruptcy and Consumer Behavior: Theory and Evidence From the U.S.,” in Richard Disney Giuseppe Bertola and Charles Grant, eds., *The Economics of Consumer Credit*, MIT Press, 2006.
- White, Michelle J.**, “Why it Pays to File for Bankruptcy: A Critical Look at the Incentives Under U.S. Personal Bankruptcy Law and a Proposal for Change,” *The University of Chicago Law Review*, 1998, *65 (3)*, 685–732.
- , “Consumer Bankruptcy in the USA and in France,” *Economie publique/Public Economics*, 2006, *18 (19)*, 3–27.
- , “Abuse or Protection? Consumer Bankruptcy Reform under BAPCPA,” *Economie publique, Public economics*, 2007.
- , “Bankruptcy Reform and Credit Cards,” *National Bureau of Economic Research (NBER)*, 2007, (Working Paper 13265).
- Zeldes, Stephen P**, “Consumption and Liquidity Constraints: An Empirical Investigation,” *Journal of Political Economy*, April 1989, *97 (2)*, 305–46.

Selbstdeklaration

Kapitel 2 basiert auf der gemeinsamen Arbeit mit Prof. Dr. Ingrid Grössl (König and Grössl, 2014). Während die Idee für das agentenbasierte Modell mit dem Fokus auf Haushaltsverschuldung in einem solchen Kontext von Nadja König stammt, wurde das Modell gemeinsam erstellt. Ingrid Grössl ist dabei insbesondere für die Inhalte des Financial Sector, für die Stock-Flow Consistency des Modells und die Aggregation verantwortlich. Nadja König ist für die Programmierung mithilfe der Software `Matlab` und die Durchführung der Simulationen verantwortlich.

Eigenleistung für Kapitel 2:

- Konzept/Planung: 50%
- Durchführung: 50%
- Manuskripterstellung: 50%

Kapitel 3 der präsentierten Arbeit wurde von Nadja König in Alleinautorenschaft erstellt. Die Eigenleistung liegt bei 100%.

Kapitel 4 basiert auf der gemeinsamen Arbeit mit Eva A. Arnold (Arnold and König, 2015). Während Eva A. Arnold für die ökonometrische Methodik zuständig ist, ist Nadja König für die Idee und die Verschriftlichung verantwortlich. Das Sub-Kapitel mit dem Titel *Empirical Analysis* resultiert aus gemeinsamer Arbeit beider Autoren.

Eigenleistung für Kapitel 4:

- Konzept/Planung: 90%
- Durchführung: 80%
- Manuskripterstellung: 95%

Erklärung

Hiermit erkläre ich, Nadja König, dass ich keine kommerzielle Promotionsberatung in Anspruch genommen habe. Die Arbeit wurde nicht schon einmal in einem früheren Promotionsverfahren angenommen oder als ungenügend beurteilt.

Ort/Datum: _____

Unterschrift: _____

Eidesstattliche Versicherung

Ich, Nadja König, versichere an Eides statt, dass ich die Dissertation mit dem Titel *“Essays on Private Household Debt: Borrowing Behaviour, Insolvency Laws and Macrodynamics”* selbständig und bei einer Zusammenarbeit mit anderen Wissenschaftlerinnen oder Wissenschaftlern gemäß den beigefügten Darlegungen nach §6 Abs. 3 der Promotionsordnung der Fakultät Wirtschafts- und Sozialwissenschaften der Universität Hamburg vom 24. August 2010 verfasst habe. Andere als die angegebenen Hilfsmittel habe ich nicht benutzt.

Ort/Datum: _____

Unterschrift: _____