Tax Policy, Risk and Entrepreneurial Choice – Empirical Evidence from Germany

INAUGURAL-DISSERTATION

zur Erlangung des akademischen Grades
eines Doktors der Wirtschaftswissenschaft

des Fachbereichs Wirtschaftswissenschaft
der Freien Universität Berlin

vorgelegt von

Dipl.-Wi.-Ing. Frank M. Fossen
geboren am 7.9.1976 in Köln
wohnhaft in Berlin

eingereicht im März 2008

Erstgutachter: Prof. Viktor Steiner, FU Berlin und DIW Berlin

Zweitgutachter: Prof. Giacomo Corneo, FU Berlin

Datum der Disputation: 23.06.2008

Preface

I have had the opportunity to write this dissertation thesis as a research associate at the Public Economics Department of the German Institute for Economic Research (DIW Berlin) and as a PhD candidate at the Free University of Berlin. In this stimulating environment I received great support and advice from my supervisors and colleagues.

First of all, I would like to thank my principle supervisor Viktor Steiner for his guidance and his constant encouragement and support. I have benefited immensely from discussing my work with him and from the helpful comments and advice he gave me during every stage of my dissertation project. I am also grateful to my second supervisor Giacomo Corneo for being available for discussion and providing valuable comments.

Two chapters of my dissertation thesis result from joint work. I would like to thank my co-authors Stefan Bach (chapter 2) and Viktor Steiner (chapter 3) for the fruitful and enjoyable collaboration.

Moreover, I want to thank Marco Caliendo and Alexander Kritikos. I benefited extraordinarily from joint work with them in other research projects, which are not part of this dissertation thesis.

I am grateful to my colleagues and friends at the DIW Berlin for creating a motivating, supportive and enjoyable working atmosphere. Stefan Bach, Hermann Buslei, and Nadja Dwenger, who have been my team-mates in a research project for the Federal Ministry of Finance, were primary addresses for all my questions and doubts related to my research, together with Katharina Wrohlich and Peter Haan. The same applies to Michal Myck, Arne Uhlendorff, Rainald Borck, Hans Baumgartner, Johannes Geyer, Daniela Glocker, Kai-Uwe Müller, Richard Ochmann, Erika Schulz, and Pio Baake, who have always been available for discussion, as well as the other colleagues at the DIW Berlin.

Sitting in a two-person office has the inestimable advantage of having someone closely available to share ideas, problems, and coffee. In particular I benefited from stints of Fabien

Dell, Ronny Freier, Hendrik Schmitz, Juliane Parys, and Dirk Hofmann. Furthermore, I would also like to thank Nicole Scheremet and Gert Dreiberg for their important help with text documents and data conversions.

Thanks also go to participants at several conferences who commented on my work, especially to the participants of the seminar series “BeNA” (Berlin Network of Labour Market Researchers), where I had the opportunity to present several parts of my research at an early stage.

I want to give special thanks to my parents Horst and Marlene Fossen and to my sister Annette Fossen for their invaluable encouragement and support. I also thank Oxana Sarana for her critical reading, and most of all for motivating and supporting me. Moreover, I am grateful to my friends who helped me settle in Berlin.

Last not least, I would like to thank the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) for financial support of the project “Tax Policy and Entrepreneurial Choice” (STE 681/7-1).

Contents

Chapter 1: Introduction

1.1 Motivation

The factors that induce people to start up or close small entrepreneurial ventures have received increasing attention among academics and politicians alike recently. Entrepreneurs are argued to introduce new products and new technology, enter new markets and keep the market economy innovative, dynamic and competitive. Moreover, small firms are often regarded as an engine for the creation of new jobs, and self-employment as a means to escape unemployment. This has made entrepreneurship a key topic especially in countries with a high unemployment rate. In Germany, for example, slow economic growth and high unemployment have been attributed to a lack of start-ups: "In Germany, too few companies are being born. [..] What is lacking are [..] small entrepreneurial start-ups that have been the secret of so much development in Britain, America and elsewhere" (The Economist 2006). In a systematic review of 57 recent journal articles and discussion papers on entrepreneurship, Van Praag and Versloot (2007) concluded that in comparison to non-entrepreneurs, entrepreneurs create relatively much employment, foster productivity growth and commercialise high quality innovations. The literature reviewed also found that entrepreneurial firms produce spillovers that positively affect employment growth rates of other companies in the same region in the long run.

Consequently, governments in Germany and elsewhere have implemented various policies to promote entrepreneurship. Tax policy is frequently suggested to be used as a stimulating instrument. While start-up subsidy programmes are usually targeted at the unemployed, tax policy may additionally provide incentives for dependently employed people to enter self-employment.

Do taxes really play a role in the decision to be an entrepreneur? How large are possible effects of specific tax reforms? Extensive research exists on the individual determinants of being an entrepreneur, but the influence of taxes is less understood and controversial. A better

understanding of the impact of taxes on self-employment is crucial to evaluate the efforts of promoting entrepreneurship by means of tax policy. This dissertation thesis provides the first microeconometric study of the influence of income tax reforms on the self-employment decision in Germany. Methodologically it combines microsimulation, an ex-post evaluation of recent German tax reforms, and ex-ante simulations of hypothetical future tax policies.

Theoretical models about the impact of taxes on entrepreneurship predict a positive or a negative relationship between taxes and entrepreneurial activity, depending on the tax system and the assumptions concerning the agents' risk attitudes. In their classic article Domar and Musgrave (1944) assumed risk-averse individuals and a proportional tax. In the presence of full loss offset, i.e. entrepreneurs may deduct losses against income from other sources (or periods), taxes serve as an insurance against income risk and may thus encourage entrepreneurship. Another explanation for a possible positive link between income taxes and self-employment may be better tax avoidance and evasion opportunities available to the self-employed in comparison to employees (Cullen and Gordon 2002). Contrarily, Gentry and Hubbard (2000) argued under the assumption of risk-neutrality that progressive taxes with imperfect loss offset reduce the expected after-tax returns from risky projects and thus make entry into entrepreneurship less attractive (success tax). Even if the tax system treats income from wage employment and self-employment differently, the theoretical ambiguity remains. Using a portfolio choice model, Bruce (2002) illustrated that the effect of a differential tax treatment on an individual's time allocation between self-employed and dependent employment depends on individual preferences over returns and risk.

Germany provides an interesting case for empirical investigations. Several major tax reforms implemented in the recent past are the first reason. The tax reform 2000 which came into effect in several steps between 2001 and 2005 significantly decreased both the income tax burden and the progressivity of the German income tax schedule. Two other reforms in 1994 and 1999/2000 reduced the top marginal income tax rate exclusively for income from trade business. The latter two reforms are special, as they constituted a change in the marginal tax rate which did not apply to the alternative state of dependent employment. A second reason, which makes Germany an interesting case, is that the concerns about a lack of entrepreneurship in Germany are coupled with a lively debate about possible future tax reforms. Reform options for the local business tax have been debated for decades, and an intensive discussion about the introduction of flat tax policies has developed recently.

Given the theoretical ambiguity concerning the influence of income taxes on entrepreneurship, it remains an empirical question how the tax policies in the recent past influenced entrepreneurial choice. Likewise, policy advice with regard to tax reforms in the future requires empirical evidence. Nevertheless, empirical studies of tax effects on entrepreneurial choice are scarce internationally and almost non-existent for Germany. The available empirical literature will be reviewed briefly in the corresponding chapters.

A first focus of this dissertation thesis is on the fiscal and distributional effects of five general reform options for the local business tax in Germany (chapter 2). A subgroup of entrepreneurs would face an increase in their effective marginal tax rate on profit income due to these reforms. This leads to the main research question of this thesis, which the remaining chapters deal with: What is the impact of changes of the income tax schedule on entrepreneurial choice? Chapter 3 provides an ex-post analysis of the two German income tax reforms of 1994 and 1999/2000, which are exploited as natural experiments. In chapter 4 I develop and estimate a structural microeconometric model of transitions between dependent employment and self-employment. In chapter 5 the estimated model is used for ex-ante simulations of the effects of three hypothetical income tax policies for Germany – a repeal of the tax reform 2000 and two hypothetical flat tax scenarios. Chapter 6 provides a summary of the results from the different chapters and a conclusion.

1.2 Contributions and Main Findings

The local business tax (*Gewerbesteuer*) as the main tax revenue source of local governments in Germany is the topic of chapter 2. The long-lasting debate about this tax has given rise to fundamentally different reform proposals. They range from a substantial broadening of the tax base in the sense of an origin-based value-added tax to a pure profit tax that could be implemented as a surcharge on the corporation and personal income taxes. An investigation of local business taxation systems in OECD countries shows that the whole spectrum between these two extremes can be found in practice. I use the newly developed microsimulation model BizTax for the business sector in Germany to analyse the first round fiscal and distributional effects of the general (revenue neutral) reform options identified. Additionally, the impact of the actual business tax reform 2008 is quantified. The microsimulation model is based on a representative sample of official local business tax and personal income tax files

for 2001. The reform proposals analysed include the extension of the local business tax to farmers and liberal professionals (*Freiberufler*), which represent a sub-group of the self-employed defined by their professions (e.g. physicians, lawyers, architects, and journalists) who are exempted from Germany's local business tax today. I illustrate that due to the lump sum deductibility of the local business tax from the personal income tax, liberal professionals and farmers would face a moderate increase in their effective marginal tax rates only in municipalities which impose high local business tax multipliers. Regarding the distribution of local business tax revenues, I show that today's high concentration on corporations with high profits and on cores of agglomeration in western Germany decreases if the tax base is broadened by integrating more taxpayers and by including more elements of value added.

In chapter 3, the distinction between the liberal professionals and the other self-employed, who are tradesmen (*Gewerbetreibende*), remains focus. I analyse two income tax reforms of 1994 and 1999/2000 in Germany as "natural experiments". These reforms introduced a differential tax treatment by reducing the marginal income tax rate for tradesmen with income above a certain threshold. The two conditions for belonging to the treatment group – being a tradesman versus a liberal professional and earning an income exceeding the threshold – allows applying a "difference-in-difference-in-difference" identification strategy to estimate the effects of the tax rate reductions. The primary analysis is based on the microcensus, the official representative yearly cross-sectional household survey in Germany. I estimate the impact of the reforms on the probability of being self-employed and the probabilities of entry into and exit out of self-employment. Additionally, the effects on the transition probabilities into and out of self-employment are estimated using hazard rate models based on the SOEP, a representative yearly panel survey of German households. The results obtained from the large microcensus dataset indicate that the exclusive tax rate reduction increased the probability of being self-employed for the treatment group. The supplementary analyses of the probabilities of entries and exits did not yield significant results, but tentatively suggest that the increase in the self-employment rate due to the reform may be triggered by a decrease in the exit rate out of self-employment. Using the much smaller SOEP dataset, the estimated effects of the two reforms on the hazards of entry and exit are insignificant due to large standard errors.

After this first evidence indicating that income taxes have an influence on the self-employment rate, the purpose of chapter 4 is to improve the understanding of the effects by

developing and estimating a structural model. In a model of occupational choice, higher expected after-tax earnings attract people to self-employment, while more risky net earnings deter risk-averse individuals. The chapter starts with an empirical analysis of the expected value and variance of income in self-employment and dependent employment. I account for selection into these states with a two-step estimation procedure. Net income is approximately calculated using an estimated tax function. Based on individually estimated first and second moments of net income, structural models of transition probabilities between dependent employment and self-employment and vice versa are estimated. The models include the standard Arrow-Pratt measure of relative risk aversion as a structural parameter. The analysis is based on the waves 1984-2005 of the SOEP. The transition probabilities are in general found to be significantly elastic with respect to both the first and the second moments of net income in the two alternative employment states. The elasticities also have the expected signs: Higher expected earnings in self-employment relative to dependent employment increase the probabilities of becoming and remaining self-employed, whereas a higher relative variance in earnings decreases these probabilities. This can also be inferred from the estimated coefficient of relative risk aversion which indicates that agents are moderately risk-averse. The results are similar when looking at cumulative transition probabilities over longer time periods. Thus, entrepreneurial choice is at least in part determined by a trade-off between monetary returns and risk, which confirms models by Kanbur (1982) and Kihlstrom and Laffont (1979). This result is further supported by my finding that both the expected value and the variation coefficient of hourly net earnings are on average higher in self-employment than in wage employment in Germany, at least after the initial years in self-employment have passed.

A tax reform, i.e. a change in the progressive tax code, influences both the expected value and the variance of after-tax earnings in the two alternative employment states. As these moments of net earnings enter the structural transition models, these models predict that tax policy affects the probability of choosing self-employment. Thus, the models are suitable for ex-ante evaluations of the impact of certain (including hypothetical) tax reforms on self-employment.

Consequently, in chapter 5 I apply the estimated structural models to simulate the effects of three hypothetical tax reform scenarios for Germany on transitions into and out of self-employment. The first scenario investigates the impact of the tax reform 2000 by simulating the effect of a hypothetical repeal of this reform in 2005. The other two scenarios represent

revenue neutral flat tax policies, one with a low basic allowance and flat tax rate, and the other with higher values for these parameters, again for 2005. The ex-ante effects of the three reform policies are calculated by comparing the estimated transition rates in these scenarios to those estimated in a baseline scenario, which represents the current law of 2005. I also analyse the effects of the reforms on cumulative transition probabilities over longer time periods. For the simulations in this chapter, Germany's complex system of income taxes, social security contributions, and transfers is incorporated in the models explicitly by integrating the tax-transfer microsimulation model STSM (Steiner *et al.* 2005). This model is extended to include estimated private health and pension insurance contributions by the self-employed. The augmented tax-benefit model allows consistently calculating net incomes from estimated gross incomes in self-employment and dependent employment in the baseline and the three reform scenarios. The estimated structural coefficients of the transition models are shown to be robust to the different methods used for calculating net income in chapters 4 (estimated tax function) and 5 (tax-transfer microsimulation model). The simulation results indicate that a hypothetical repeal of the tax reform 2000 in 2005 would have increased the entry rate into self-employment from dependent employment by 2.2 % and decreased the exit rate by 6.8 % (relatively to the respective rates in the baseline scenario). In reverse this means that the tax reform 2000, which reduced the progressivity of the tax schedule, discouraged people from self-employment. In line with this result, the flat tax reform scenarios are found to deter people from entry into self-employment; the flatter the tax schedule, the stronger this effect (there are no significant effects of the flat tax policies on the exit rates). The effect of the higher income risk in self-employment in comparison to dependent employment, which is intensified by a flat tax, outweighs the effect of the higher increase in net returns. The estimated effects of the three tax reforms on the mid- and long-term cumulative transition probabilities are similar in relative terms to the estimated effects on the short-term transition rates. In summary, the ex-ante simulations show that in the three hypothetical tax reform scenarios considered here, the effect of the income tax as an insurance against income risk is decisive. In these scenarios, reducing the tax progressivity, and thus the risk-sharing by the government, discourages people from self-employment.

On the basis of these results, one can draw the policy conclusion that reforms aiming at flattening the general income tax schedule do not seem to be suitable instruments to promote entrepreneurship. Hence, in the discussion of flat tax policies and of changes to the

progressive income tax schedule in general, the impact on income risk should receive more attention. In this respect, flat tax reform proposals loose some of their alleged attractiveness, at least if the promotion of entrepreneurship is stated as a policy objective. The ex-post analysis of the income tax rate limitation for income from trade business suggests that tax reforms targeted specifically at the self-employed may be more effective instruments to stimulate entrepreneurship than general tax cuts. It is a political question, however, if such a deviation from the comprehensive income tax principle is desirable.

Chapter 2: Microsimulation Analysis of Local Business Taxation

2.1 Introduction

Local business taxation has been a constant source of discomfort and critique among policy makers, taxpayers and academics for a long time not only in Germany but apparently in many countries. Economists have pointed out that local business taxes are often rather a product of piecemeal legislation enacted over decades and do not follow clear guidelines of local taxation such as fiscal equivalence and the benefits principle (see e.g. Studenski, 1940, and Testa and Oakland, 1996, referring to the USA or Maiterth and Zwick, 2006, referring to Germany). In Germany, the local business tax is the main source of revenues for local governments and imposes a considerable burden on enterprises. As the tax largely depends on business profits, municipalities are faced with highly volatile tax revenues. Politicians, interest groups and economists have proposed various options for reform ranging from a pure profit tax to an origin-based value-added tax. The literature weighting the arguments is extensive.[1]

In spite of the dimension and importance of the debate, empirical information on the fiscal and distributional impact of different local business taxation systems based on micro data is scarce. Case studies and showcase calculations have dominated simulation studies of business taxation (e.g. Devereux *et al.* 2002; Spengel 2003). One reason is that detailed and representative individual firm and tax file data was hardly available, especially about small and medium sized enterprises (SME).[2] In Germany, fortunately the Research Data Centre of the statistical offices has made tax statistics increasingly accessible recently. Another reason

[1] Examples for the German discussion are Döring and Feld (2005), Petersen *et al.* (2005), Vesper (2004), Fuest and Huber (2003), Maiterth (2003), Junkernheinrich (2003), Zwick *et al.* (2003), Jarass and Obermaier (2003), Bach and Versper (2002), Scherf (2002), and Zimmermann (2002).

[2] Data on large corporations has been used for research more often as they are obliged to publish financial statements.

for the scarce empirical literature is that the behaviour of firms is hard to model as it has many dimensions – financing, investment, hiring, incorporation, entry and exit decisions all interact. This may explain why the field of microsimulation first covered the household sector, where the main economic decisions, labour force participation and work intensity, are more easily modelled, and is only slowly expanding into the business sector as researchers are gaining more experience with microsimulation and computational power is growing at the same time. Maiterth and Zwick (2006) used a microsimulation model to assess the first round effects of two reform options for the German local business tax on 253 example municipalities which were selected from the total of almost 14,000 municipalities in Germany. Zwick (2007) analysed a local surcharge on the personal and corporate income tax, using representative micro data for all municipalities.

For the empirical analysis in this chapter I use the newly developed microsimulation model BizTax. It is based on individual tax file data from the official local business and income tax statistics for 2001, which are updated to 2008. For the first time in Germany, the first round fiscal and distributional effects of different fundamental reform options for local business taxation can be quantified in detail on the basis of representative micro data.

In the section following this introduction, general models of local business taxation are identified based on theory and an international comparison. I describe the institutional background in Germany and define five fundamental tax reform options for the German local business tax. In section 2.3, I describe the data and the microsimulation model BizTax that is used to quantify the effects of these reform options. Section 2.4 presents the simulation results. The microsimulation model allows a precise analysis of the fiscal and distributional effects of the reform scenarios by industry, legal form, and by firm size in terms of profit and number of employees. Additionally the impact of the reforms on different regional categories can be analysed. For each of the various reform options, I investigate how its implementation would redistribute local business tax revenues between cores of agglomeration, surrounding areas and rural areas, between western and eastern Germany, and between municipalities with high, medium and low local tax revenues per capita. The last section provides a short summary and conclusion of this chapter.

2.2 Options for Local Business Taxation

2.2.1 Local Business Taxation in Public Finance Theory

The basic idea behind fiscal federalism theories is "fiscal equivalence" (Olson 1969; Bird 1999): If there are public services that benefit certain regions or groups, the pertinent beneficiaries shall decide on their quantity and quality but at the same time pay for them. This prompts citizens and firms to reveal their preferences and put some pressure on local governments for the efficient provision of public services. Where specific beneficiaries of public services can be identified, user charges are the preferred option. They are often ruled out for technical reasons or due to transaction costs, however. In these cases, taxation has to carry out the job.

In particular the German tradition in local public finance theory and practice highlights local firms and residents as the two main beneficiaries of local public services (Zimmermann 2002). Correspondingly, both groups shall contribute to the local budget via specific taxes in order to balance the different claims for public services. However, it is difficult to apportion the share between both groups properly since the main public services of the municipally benefit both groups, e.g. transportation infrastructure or secondary education. Thus, the idea of sharing the local tax burden between firms and residents can only serve as an institutional yardstick for political decision making.

The inclusion of immobile components into the local tax base ensures that the local beneficiaries bear the local tax burden. This speaks in favour of broad-based taxation at the local level. According to this principle, the tax base of a local business tax may include profits, interest expenses and other financing costs as well as the payroll. Taxing all income components leads to a tax on local net value added. Such a system exists in Italy (see section 2.2.2). The other alternative is a tax on business property, obviously measured by real estate, plant, or equipment that could easily be assigned to the local jurisdiction. All these broad-based taxation systems imply a shift of the tax burden to the taxed production factors, in particular to those which are less mobile.

The contrasting option for a local business tax is a pure tax on business *profit*s. A local business profit tax is levied in Luxembourg and Japan. This system meets the claims of the business community not to tax cost elements and to restrain from a higher tax burden on economic ability. It is argued that the taxation of cost components such as interest and wage

expenses can cause liquidity problems for companies during periods of low profits or losses and thus hamper the recovery of companies in trouble. Risky investments become less attractive as enterprises have to pay taxes even in case of failure. Another argument to tax local profits may derive from the theory of economic geography (e.g. Baldwin *et al.* 2003; Baldwin and Krugman 2002), which discusses the existence of location-specific rents. Such rents may, however, also appear as higher wages for managers and high-qualified specialists. Moreover, it is technically difficult to skim rents by taxes on extra profits or wages. In general, it is rather complicated to determine the local profit of a subsidiary or an establishment of a firm operating supraregionally or even internationally. In these cases the taxable income of the entire company or tax group is usually assessed at the national level and allocated to the sub-national jurisdictions by formula apportionment. As this formula uses payroll, sales, capital, or other business properties the apportionment transforms the local profit tax into a tax on these production factors (Gordon and Wilson 1986).

A further disadvantage of a local profit tax is the high volatility of revenues, which are strongly dependent on the business cycle. This is particularly problematic in the presence of regional structural change. In Germany, for example, tax revenues in a single municipality often depend on the economic performance of a small number of large enterprises and may be hit hard by the downturn of an industry dominating the regional economy. It may be argued that the government rather than the private sector should provide insurance against cyclical fluctuations in the tax base, but this task should be fulfilled at the state and federal levels rather than the local level. Borrowing limits are stricter for local authorities than at the state or federal level in Germany, which makes it difficult for them to borrow during recessions and smooth expenses over the business cycle.

2.2.2 International Comparison

In this section, the local business taxation systems in the main OECD countries are compared in order to identify the basic models which are actually implemented. All countries listed in Table 1 raise a land or property tax that is usually levied on the whole real estate value including residential buildings as well as plants and other commercial buildings. This corresponds to the principle of taxing immobile factors at the local level Moreover, it can be observed that in several countries local governments are endowed with some discretion to tax business properties as well as the resident population's income.

Table 1: Tax base and revenue of local business taxes[1] in selected OECD countries

Country	Tax Base							Revenue 2004[2] as percentage of		*For information:*	
	Business value added			Business capital		Local corporate income tax	Other production factors	GDP	Local tax revenue	Land / property tax	Local income tax
	Profit	Interest expenses	Wage expenses	Fixed assets	Equity / net capital						
Germany	✓	✓						1.3	50.0	✓	
France				✓				1.3	26.4	✓	✓
Belgium							✓			✓	✓
Netherlands										✓	
Austria			✓					0.8	20.7	✓	
Denmark										✓	✓
Finland										✓	✓
Sweden										✓	✓
Luxembourg	✓							1.7	91.3	✓	
United Kingdom										✓	
Ireland										✓	
Italy	✓	✓	✓					2.3	33.4	✓	
Spain							✓	0.2	1.6	✓	
Portugal						✓		0.2	12.4	✓	
Greece										✓	
Poland										✓	
Czech Republic										✓	
Slovak Republic										✓	
Hungary	✓	✓	✓					1.5	65.0	✓	
Norway										✓	
Switzerland					✓	✓	✓	0.5	10.9	✓	✓
Turkey										✓	
United States	✓	✓	✓	✓	✓	✓		0.0	1.0	✓	✓
Canada										✓	
Japan	✓					✓		0.0	21.5	✓	✓
Australia										✓	
New Zealand										✓	

1) Business taxes with considerable discretion over the tax revenue assigned to the local government, in particular the right to set the tax rates at least in certain limits.- 2) Excluding property tax revenue from plants and other business assets.
Sources: Mennel and Foerster (2006), OECD (2006), European Commission (2007), IBFD (2007).

Beyond the land tax, the international comparison displays a wide range of local or regional business taxation systems (Tables 1 and 2).[3] Nearly all conceivable combinations of the different production factors can be found as the tax base. From this variety of taxation systems some general models can be identified.

- A local *business profit tax* exists in Luxembourg and Japan.
- In some countries there are local *rates* to the national *corporation income tax*. Examples are Portugal, Switzerland, and the USA. These local rates are levied on the profit share apportioned to the local jurisdiction, usually allocated by a formula using payroll, sales, capital, or a weighted index of these factors. In the USA, the state and local franchise taxation systems often extend or replace the corporation income tax base by elements of capital or payroll.

[3] The revenue impact reported in Table 1, which was derived from the OECD revenue statistics (OECD 2006), only includes pure business taxes. It does not include revenues from land or property taxes falling on business properties as the statistics do not allow distinguishing between the shares of the business and the private spheres. Thus, the reported revenue shares underestimate the overall local tax burden on business properties. In many countries, local land or property taxes charge a much higher tax burden on real estate than in Germany. Particularly, in most states of the USA the local property taxes extend to a wider range of fixed assets, so the tax revenue is considerably higher than the reported one which arises from the local franchise taxes.

- Austria transformed its former *Gewerbesteuer* adopted from Germany to a local *payroll* tax during the 1990s. The payroll is taxed at 3 % without any discretion of the local government over the tax rate.
- Taxes on business *capital* are in place in France, in the Canadian provinces, and in the USA. The historical *taxe professionnelle* has survived to this day in France as a local business tax on fixed assets, measured by the rental value. The former payroll component of the tax was phased out until 2003. The Canadian provinces levy taxes on the equity capital of incorporated firms. In the USA, the state and local franchise taxation systems often include a capital component. Moreover, many local property tax systems in the USA do not only tax real estate including commercial buildings but also fixed assets such as machinery, motor vehicles, or other equipment.
- A tax on local *value added* exists in Italy and Hungary. Both countries use the subtraction method to define the value added, i.e. sales revenues minus operating expenses on the purchases of goods and services. In contrast to the national VAT that is applied in nearly all OECD countries as a tax on final consumption, this value-added tax is origin based and thus does not provide an input tax credit, and exports to outside the jurisdiction are not exempted. The tax base of the Italian IRAP goes beyond the mere cash flow base of the national VAT by providing depreciation allowances for investments in fixed assets and accounting for capital gains and losses on operational assets. Hungary applies a gross cash flow base: neither expenditures for investment goods nor depreciation allowances can be set off against the tax base.
- Finally, there are local business taxes that are levied on various *business properties*, e.g. floor space used, number of employees, electricity or energy consumption. Spain has such a taxation system, similar forms of local business taxation exist in the Swiss canton of Geneva, Belgium, and other countries. These taxes and charges usually do not raise considerable revenues, however.

Table 2: Local and regional business taxes[1)] in selected OECD countries

Country	Designation	Taxpayer	Tax Base	Tax Rate
Germany	Gewerbesteuer (local business tax)	Business enterprises, excluding farmers, professionals	Local operating profit plus half the interest expenses on long-term debt. Allowance of Euro 24,500 for non-incorporated firms	9% - 20%, average: 16.3% lower rates for small firms
France	Taxe professionnelle (local business tax)	Business enterprises and professionals, excluding farmers	Local fixed assests rental value, reduced by 16%	Limited to 3.5% of gross value added
Austria	Kommunalsteuer (municipality tax)	Entrepreneurs or other employers subject to VAT	Wage expenses, low threshold for small firms	3%
Luxembourg	Impôt commercial (local business tax)	Business enterprises, excluding farmers, professionals	Local operating profit. Allowance of Euro 40,000 for non-incorporated firms and Euro 17,500 for incorporated firms	6% - 9%
Italy	Imposta regionale sulle attività produttive - IRAP (regional business tax)	Entrepreneurs, non-profit organizations and public bodies	Local net value added from the provision of goods and services (substraction method), wage expenses for non-profit organizations	Standard rate 4.25%, region's discretion of +/- 1%-point
Portugal	Surcharge on corporate income tax (CIT)	Corporations subject to CIT	Local share of CIT liability	0% - 10%
Hungary	Helyi iparuzési adó (local business tax)	Entrepreneurs	Local gross value added (substraction method). Allowance of Euro 10,500 (optional)	0% - 2%
Switzerland				
Canton de Genève	Taxe professionnelle (local business tax)	Business enterprises and professionals, excluding farmers	Local business sales, rental value of fixed assets, number of employees	
All cantons	Cantonal corporate income tax (CIT), local surcharge	Corporations subject to national CIT	Cantonal/local share of CIT liability	Cantons: 2 % - 10% local: 2 % - 10%
	Vermögenssteuer (cantonal net worth tax, local surcharge)	Enterprises subject to cantonal PIT or CIT	Equity capital	0.05 % - 0.5%
Spain	Impuesto sobre actividades económicas (local business tax)	Business enterprises and professionals, excluding farmers	Industry sector and floor space used, number of employees, electricity consumption. Exemption up to a turnover of Euro 1,000,000	
United States	Various types:surcharge on national CIT and PIT, franchise (income) tax, property tax on business fixed assets	Enterprises subject to PIT or CIT	Local share of business income or CIT liability, partly wage expenses, fixed assets, or equity capital	usually 1% - 2% (local CIT surcharge)
Canada (provinces)	Capital tax	Incorporated enterprises	Equity capital	0.3% - 0.5%
Japan	Enterprise Tax	Business enterprises and professionals, excluding farmers	Local operating profit	3% - 12%

1) Business taxes with considerable discretion over the tax revenue assigned to the local government, in particular the right to set the tax rates at least in certain limits.
Sources: Mennel and Foerster (2006), OECD (2006), European Commission (2007), IBFD (2007).

2.2.3 Local business tax (*Gewerbesteuer*) in Germany

The German local business tax (*Gewerbesteuer*, sometimes also called "Trade Tax") has its origins in the 19th century "*taxe professionnelle*"-tradition and has been assigned to the local layer of German fiscal federalism since the 1930s. To this day, the local business tax is the main tax source of local governments in Germany (OECD 2006). Originally, it rested on the

pillars "profit before interests" (with adjustments), "capital" and "payroll". The idea was to tax a broader base of local value-added. However, over the last decades several reforms washed out the tax base increasingly. The optional payroll component was discarded in 1980, the addition of interest expenses on long-term debt to the taxable income was reduced by half in 1984, and the business capital tax was abolished in 1998. Since its early days, the tax has exempted liberal professions such as physicians, lawyers, architects, and journalists, as well as farmers.

Today, the main source of the local business tax base is the operating profit attributed to the local jurisdiction. Therefore, received dividends are not subject to the tax (if they stem from shareholdings of more than 10 %), and, correspondingly, losses from shareholdings are not allowed to be set off against taxable income. Moreover, the tax base is augmented by half of the interest expenses on long-term debt. Based on the resulting taxable income, the local business tax is determined in two steps. In the first step, the taxable income is multiplied by a basic federal tax rate (*Messzahl*) of 5% (in 2007) in order to obtain the uniform basic tax. Unincorporated firms, in particular SMEs, benefit from an allowance of €24,500 and reduced basic federal tax rates up to a taxable income of €72,500. The uniform basic tax is allocated to the local jurisdictions involved. In the second step, the local jurisdictions apply a multiplier (*Hebesatz*), which they are entitled to determine, to their allocated share of the uniform basic tax. These multipliers range from a minimum rate of 200 % to almost 500 % in high-performing agglomerations such as Munich, Hamburg, or Frankfurt. Taking into account that the local business tax liability reduces its own tax base as deductible expense, the effective local tax rates ranged from a minimum rate of 9 % to almost 20 % in 2007. The average rate was about 16 %. Sole proprietors and partners of non-incorporated firms can credit at least parts of the local business tax against their personal income tax liability in a lump sum (see section 2.2.4).

Thus, the local business tax imposes a rather high tax burden in particular on incorporated companies that do not benefit from the allowance, the reduced tax rates on low income and the income tax credit. Corporations account for almost 60 % of the tax revenue, which is highly concentrated on big and highly profitable enterprises. The local business tax rates considerably contribute to the high statutory tax rates on business profits in Germany, which are among the highest in Europe.

Consequently, the main intention of the federal government's recent business tax reform, which came into effect on January 1st, 2008, was to reduce the overall statutory tax rate on corporate profits to below 30 % and broaden the tax base. Besides the reduction of the corporation income tax from 25 % to 15 %, the reform also included some changes to the local business tax. The basic federal tax rate of the local business tax was lowered from 5 % to 3.5 % and the reduced basic tax rates for enterprises with low profits were abolished. At the same time, the deduction of the local business tax from its own tax base as well as from the corporate and personal income taxes was eliminated.[4] Moreover, the reform repealed the declining-balance method of depreciation and provided tighter regulations against tax planning schemes, e.g. a new earnings-stripping procedure against excessive external debt financing or impediments to the relocation of high profit functions to abroad.[5] The tax base of the local business tax was further affected by a modified addition of interest expenses: The addition of half the interest expenses on long-term debt was replaced by the addition of 25 % of all interest expenses including a lump sum interest portion of rents, leasing rates and royalties in as much as they exceed an allowance of €100,000. By lowering the tax rate and broadening the tax base, the reform aimed at improving the position of the German business location in international tax competition and reducing incentives for tax avoidance (Bach, Buslei, and Dwenger 2007). A fundamental reform of local business taxation and of local public finance institutions was not attempted and remains a key topic among many economists and policy makers.

2.2.4 Effective Local Business Tax Burden of Non-Incorporated Firms

The exemption of liberal professionals and farmers from the German Local Business Tax, which has survived since the 19th century, is contrary to the benefits-received principle, as liberal professionals typically use public services in the same way as other self-employed people especially in the service sector. Consequently, the reform options I consider in this analysis all include the integration of liberal professionals and farmers in the local business

[4] For sole proprietors and partners of non-incorporated firms this was compensated by a higher lump sum credit against the personal income tax (see section 2.2.4).

[5] Furthermore, received dividends of shareholdings of more than 10 % were not subject to the local business tax before the reform; this threshold was increased to 15 %. In the microsimulation model, this change is taken into account approximately by subtracting only 95 % of the corresponding reductions from the local business tax base. Individual information on the size of shareholdings was not available.

tax.[6] To calculate the effective tax burden this would impose on liberal professionals and farmers, one has to take into account the effect of the local business tax on the personal income tax. In the law of 2007, the local business tax liability was a deductible expense in Germany, which reduced the personal (or corporate) income tax. Additionally, sole proprietors and partners could credit 1.8 times the uniform basic tax against their personal income tax. For an entrepreneur subject to the top marginal tax rate for business income of 42 %, these rules effectively led to a complete relief from the local business tax if the multiplier set by the municipality was 340 % (Broer 2005).[7] If the multiplier was 450 %, for example, a marginal tax burden of 2.5% of profits remained.

The business tax reform 2008 abolishes the deductibility from the tax base and compensates this by a higher lump sum credit for unincorporated firms. Now 3.8 times the uniform basic tax can be credited against the income tax, which implies that the local business tax is completely compensated if the multiplier does not exceed 401 %. This can be deduced by solving

$$x\,t^i \times 1.055 = tax^{loc.bus.} + (x\,t^i - tax^{loc.bus.} / M \times 3.8)\,1.055$$

$$\Leftrightarrow M = 3.8 \times 1.055 = 400.9\%, \qquad (2.1)$$

where M is the multiplier set by the municipality, $tax^{loc.bus}$ is the local business tax, t^i is the average personal income tax rate, x is the taxable income, and the solidarity surcharge of 5.5% is taken into account. If the multiplier is 450 %, a marginal tax burden of 1.7% of profits remains. The weighted average multiplier in German municipalities was 390 % in 2005 (Federal Statistical Office 2006), in municipalities with more than 50,000 inhabitants the average was 430 % in 2006 (IFSt 2006). Using the microsimulation model BizTax (see section 2.3), I calculate that for about one quarter of the unincorporated firms liable to local business tax, the local business tax will not be completely compensated due to high municipal multipliers in 2008.

In summary, the effective tax burden imposed by the local business tax on sole proprietors and partners is relatively small, both before and after the business tax reform 2008. Thus, if liberal professionals and farmers were included in the local business tax, only those based in municipalities with high multipliers would face an increase in their effective

[6] It might also be considered to include non-profit organisations or even state and federal public bodies, which also benefit from local public services, in the tax base. This is the case in Italy, for instance.

[7] The solidarity surcharge of 5.5 % is taken into account. In the law of 2007, enterprises could even have a negative effective tax burden from the local business tax if the multiplier was below 340 %; this is ruled out after the business tax reform 2008.

marginal tax rates. Clearly, this is contingent on the lump sum deductibility from the personal income tax.

2.2.5 Reform options for Germany

The international comparison of local business taxation systems and the discussion of the theoretical foundations suggest the definition of five fundamental tax reform options for the German local business tax.

1. Integration of liberal professionals and farmers in the local business tax. They are also included in the following reform options 2-5.
2. Local business income tax: pure profit tax.[8] Like in the actual business tax reform 2008, but in contrast to the other scenarios considered here, this tax is not deductible from its own tax base, because it is not considered a cost component.
3. Local comprehensive business income tax (CBIT): tax on profits, all interest expenses, and interest portions of rents, leasing rates, and royalties.[9]
4. Local business value-added tax: additionally to the CBIT, the tax base includes the sum of wages and salaries.[10]
5. Local business property tax: The tax base comprises 10 % of the fixed assets of an enterprise, which can be interpreted as a hypothetical rate of return on real business capital.

The fiscal and distributional effects of each of these reform scenarios are simulated using the microsimulation model BizTax. The law of 2007 is the starting point for the definitions of the reform scenarios. Deviating from this, I assume that the reduced federal basic tax rates for enterprises with low profits are abolished, as in the actual business tax reform 2008. The allowance is left unchanged, except for the business value-added tax; here it is increased because of the substantially broader tax base. Specifically, it is set at a level that exempts the same share of firms with a positive tax base from the tax as if the actual law of 2007 was applied (almost a third). Finally, for each reform scenario I determine the federal basic tax rate which makes the reform neutral with respect to total local business tax revenue.

[8] This reform option could also be implemented as a surcharge on the corporate and personal income taxes, as advocated by the Federation of German Industries (BDI) and the German Chemical Industry Association (VCI) (2001).

[9] A similar reform (*Kommunalmodell*) was proposed by the German local authority central organisations (Bundesvereinigung der kommunalen Spitzenverbände 2003).

[10] Compare the discussion of an origin based value-added tax (*Wertschöpfungsteuer*) by Bach and Vesper (2002).

Additionally, I also simulate the effects of the actual German business tax reform 2008, but without the changes regarding the determination of profits due to a lack of data (see section 2.4).

2.3 Microsimulation Model for the Business Sector

Microsimulation models have developed to increasingly capable tools for the ex-ante analysis of fiscal and distributional effects of tax and social policy reforms. The prerequisite is a representative micro data basis of relevant agents such as individuals, households or firms. The models simulate the effect of a given policy reform for each individual agent and find the overall fiscal effect by aggregation, which can be split by group characteristics such as income classes or industries to analyze the distributional effects. While microsimulation models for household taxation are increasingly available, e.g. EUROMOD for several EU countries (Lietz and Mantovani 2007) or STSM for Germany (Steiner *et al.* 2005), empirically based microsimulation models for the business sector are still rare, partly due to limited data availability. Examples for research in this area are models developed for the UK and Italy in the context of the EU commission's DIECOFIS project (Parisi 2003).

This section introduces the newly developed microsimulation model BizTax for business taxation in Germany.[11] The model is based on individual firms' official local business tax files, which are provided by the statistical offices.[12] Thus, it represents the heterogeneity of enterprises in Germany with respect to key variables. I use the latest data wave available which consists of tax files for the year 2001.[13] This data base enables me to calculate each firm's local business tax liability. After having corrected a few cases with obviously erroneous data, the simulated tax liability for 2001 equalled the actual tax liability for that year given in the data in 99.978 % of the firms; the remaining firms were negligible in terms of their tax liability. After this initial data editing, a 10 % stratified random sample (247,314 observations) was drawn from the full set of local business tax files to make the computationally intensive simulation and further analysis manageable. As large enterprises have a potentially high impact on total local business tax revenues (with or without a reform),

[11] The development of the model is taking place in the context of a research project of DIW Berlin for the Federal Ministry of Finance. For a documentation of the microsimulation model BizTax and its data basis in full detail, see Bach, Buslei, Dwenger, and Fossen (2008).

[12] The data is available at the Research Data Centre of the statistical offices now, http://www.forschungsdatenzentrum.de.

[13] The next wave of official local business tax statistics will cover 2004.

a higher sampling probability was chosen for enterprises with either a higher local business tax base in 2001 or, more generally, with a higher value added from business. The largest enterprises were completely included in the sample.

The local business tax statistics provide all the variables needed to simulate each firm's local business tax liability for the governing law from 2001 to 2007.[14] The most important of these are the profit, the various additions and reductions, the legal form, and the local business tax multipliers effective for each enterprise. Additionally, the statistics include the wage expenses and the value of fixed assets, which are important to simulate the local business value-added tax and the local business property tax.[15] Information on the industry and region are also available, which I use for the tabulation of the results. The number of employees is estimated from the payroll using average wages by industry provided by the national accounts (Federal Statistical Office, 2001).

As mentioned in section 2.2.4, liberal professionals and farmers are exempted from the local business tax today and are therefore not included in the local business tax statistics. I use information about individuals with income from a liberal professional or farming activity based on a representative 10 % stratified random sample from the official personal income tax (PIT) files for 2001. The task was to generate datasets which represent the firms of these individuals in order to add them to the firm data base. If the liberal professional or farmer is operating alone, the profit of the firm equals his or her individual income from the mentioned activities which is given in the PIT files. These files also contain the information if a taxpayer is active in a business partnership, but not how many parties are involved. To generate a corresponding dataset representing a partnership in such a case, I assigned a number of parties to it randomly in a way that replicates the distribution of the number of parties in partnerships

[14] The deduction of the local business tax from its own tax base implies a complication: the local business tax is defined as a function of the tax base, but the local business tax is needed to determine the tax base in the first place. Especially in combination with the reduced tax rates for enterprises with low profits and the allocation of the uniform basic tax to local jurisdictions which impose different multipliers, a formula representation becomes unpractical (cf. König *et al.* 1992). In the microsimulation model the calculation of the local business tax is iterated till the solution found by nested intervals is more precise than one euro cent. The advantage of the iteration method is its flexibility, as the algorithm does not need to be changed for the simulation of tax reforms.

[15] A number of firms obviously did not fill in information on these two variables correctly, however. The tax authorities did not make inquiries in these cases, as these items were not needed for the tax assessment. Thus, implausible extreme values were replaced with imputed values following Zwick (2007). Furthermore, the local business tax statistics only include information about interest expenses for long term liabilities, but not about rents, leasing rates and short term interest expenses. Following Zwick *et al.* (2003), the aggregates of rents and leasing rates are assigned to the individual enterprises proportionally to their business property and payroll, and the short term interest expenses are assumed to amount to 77 % of the long term interest expenses. When the local business tax statistics for 2008 will be available, they will include individual information about these components of the financing costs, as the business tax reform 2008 includes them in the tax base (see section 2.2.3).

in Germany. The distribution was obtained from statistics about partnerships in Germany (Federal Statistical Office 2001). I adjusted the generated partnership's sampling weight according to the number of partners and its profit assuming that it was distributed uniformly over the partners within the partnership. Furthermore, the PIT files lack some information necessary to calculate the local business tax base, e.g. interest expenses. These variables were imputed from groups of comparable firms included in the local business tax statistics.[16] Finally I drew a 10 % stratified random sample again, analogously to the sample from the local business tax statistics, and added 124,166 observations representing the firms of the liberal professionals and farmers to the data base.

Using the combined data base, I want to simulate the effects of different tax reform options in the year 2008, the year the actual German business tax reform comes into effect. Thus, the cross sectional data for 2001 must be aged to reflect the situation of German enterprises in 2008. Changes in the German business sector's composition with respect to industries and legal forms are identified using the yearly value-added tax statistics. This allows adjusting the weights of the firms in the data base such that it represents the changed proportions in the population with respect to these characteristics. Furthermore, the relevant variables such as profits and interest expenses are aged to reflect the changes in the corresponding aggregates reported by the national accounts (Federal Statistical Office 2001-2007) and the corporate balance sheet statistics (Bundesbank 2004-2007). The German government's medium term projection (Federal Ministry of Economics and Technology 2007) is used for extrapolation after 2006.

Based on the edited and aged data, I use the microsimulation model to simulate the reform options discussed in section 2.2.5 for the year 2008, including the main components of the business tax reform 2008.[17] The law of 2007 (before the business tax reform 2008) is used as the reference scenario for the determination of the fiscal and distributional effects of the reform scenarios. This allows comparing the effects of the business tax reform 2008 with the other reform scenarios.

[16] As firms with cost structures comparable to liberal professionals, business, tax and engineering consultancies were drawn on, as far as they are included in the local business tax statistics, as well as insurance agents. For farmers the manufacturing sector was used.

[17] In case of consolidated companies, the local business tax statistics only report the tax base of the subsidiaries, but not its components (profits, long term interest expenses etc.). To translate the effects of a tax reform (and also of the extrapolation) to the subsidiaries, their tax base is adjusted proportionally to the change in the tax base of non-consolidated companies (separately for different industry groups).

The strengths of microsimulation models such as BizTax are the detailed implementation of the tax legislation and reform options, the representative incorporation of the real world's heterogeneity, and the ability to split the fiscal effects of tax reforms by detailed group characteristics. The model currently does not predict behavioural responses of companies which may be triggered by tax reforms, e.g. changes in financing and investment decisions, entries and exits of firms, and profit shifting of multinational corporations. The simulation results can thus be characterised as first round effects, i.e. before firms adjust their behaviour. As such behavioural responses normally take some time, this approach is especially suitable for short term analyses. Further, if one assumes specific behavioural responses, the model can be used to determine the fiscal effects.

2.4 Empirical Results

Table 3 shows the fiscal and distributional effects of the reform options for local business taxation which were discussed in section 2.2.5. The leftmost column displays the local business tax revenue in millions of euro if the law of 2007 is applied to the aged data for 2008. This is the reference scenario. The six columns to the right show the increase or decrease of the revenue (in %) relative to the reference scenario if the respective reform option were in effect in 2008.[18] The table splits the overall fiscal effect by categories of profit before tax, number of employees, industries and legal forms.

First of all it is interesting to look at the revenue distribution if the law of 2007 is applied. 73 % of the revenue comes from enterprises with profits above € 1 million, and still 58 % from those above € 5 million. Consistent with this, 58 % of the revenues stem from corporations. Partnerships account for a third of local business tax revenues, which reflects their high significance in Germany. Revenues from companies with losses are negligible in spite of the addition of half of the long-term interest expenses to the tax base. The revenue distribution gives support to the view of the German local business tax as a tax for corporations with high profits. If the company size is measured in terms of the number of

[18] In this chapter, I only consider the local business tax (*Gewerbesteuer*) and not its effects on the corporate income tax and the personal income tax (PIT) through its deductibility as a business expense and the lump sum credit against the PIT of sole proprietors and partners of non-incorporated firms. In general, a higher (lower) local business tax leads to lower (higher) revenues from these federal taxes. As a minor share of the PIT revenues is allocated to local jurisdictions, the local fiscal impact of reforms of the local business tax would partly be compensated. Financial equalisation schemes between the jurisdictions of the local, state and federal levels are not considered in this analysis either. They would lead to a further levelling of the distributional effects.

employees, however, revenues are distributed quite uniformly across the classes. This indicates that firms with a large number of employees do not necessarily report high profits.

Table 3: Revenue effects of reform scenarios of the local business tax in 2008 by profit before taxes, number of employees, industries, and legal forms

	Local Busin. Tax Revenues If Law of 2007 Is Applied	Actual Business Tax Reform 2008[1)]	Fundamental Reform Scenarios[2)]				
			Inclusion of Liberal Profession-als and Farmers	Local Business Income Tax	Compre-hensive Business Income Tax (CBIT)	Local Business Value-Added Tax	Local Business Property Tax
	Mill. €	Increase (+) / Decrease (-) of Local Business Tax Revenues in %					
Total	**38 579**	**- 9.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
By Profits Before Taxes in €							
Enterprises Reporting Losses, Total	84	+ 31.8	- 11.7	- 100.0	+2 324.4	+11 883.2	+22 290.7
Under - 1 000 000	36	+ 9.1	- 22.0	- 100.0	+3 181.8	+14 763.2	+31 552.8
- 1 000 000 - 0	48	+ 49.0	- 3.9	- 100.0	+1 673.1	+9 695.4	+15 254.6
Enterprises Reporting Profits, Total	38 496	- 9.3	+ 0.0	+ 0.2	- 5.0	- 25.8	- 48.4
0 - 25 000	227	- 21.6	- 19.1	- 38.1	+ 96.2	+ 562.8	+ 549.9
25 000 - 50 000	499	+ 68.8	+ 132.5	+ 117.4	+ 166.6	+ 277.3	+ 42.1
50 000 - 100 000	1 527	+ 32.4	+ 100.8	+ 97.5	+ 99.6	+ 20.7	- 38.4
100 000 - 250 000	3 083	- 4.0	+ 71.4	+ 70.6	+ 58.7	+ 54.8	+ 36.1
250 000 - 500 000	2 338	- 13.3	+ 45.1	+ 44.6	+ 31.7	- 12.0	- 24.2
500 000 - 1 000 000	2 343	- 15.0	+ 14.6	+ 13.8	+ 5.0	- 21.6	- 50.8
1 000 000 - 5 000 000	6 099	- 14.8	- 11.1	- 11.4	- 18.1	- 31.6	- 55.1
5 000 000 and more	22 381	- 12.0	- 22.6	- 21.2	- 27.2	- 53.1	- 69.3
By Number of Employees							
Under 10	6 543	+ 8.0	+ 73.0	+ 72.0	+ 70.7	- 10.0	+ 57.2
10 - 50	8 772	- 14.2	+ 1.2	+ 0.1	- 0.3	- 20.0	+ 0.8
50 - 250	8 173	- 15.8	- 17.4	- 17.9	- 21.6	- 34.5	- 28.3
250 - 500	2 723	- 13.4	- 23.2	- 22.7	- 24.9	- 31.4	- 18.3
500 - 2 000	5 358	- 11.9	- 23.1	- 21.8	- 24.5	- 30.2	- 0.3
2 000 and more	7 011	- 7.7	- 22.5	- 21.0	- 11.9	+ 109.9	- 14.0
By Industries							
Agriculture, Forestry, and Fishery	320	- 10.5	+ 155.2	+ 144.4	+ 223.8	+ 40.8	+ 247.1
Mining and Quarrying	258	- 13.4	- 19.7	- 19.7	- 25.4	- 26.3	- 52.0
Manuf. of Intermed. / Non-Durable Goods	6 616	- 11.8	- 21.5	- 21.0	- 24.5	- 29.1	- 54.3
Manuf. of Investment / Durable Goods	6 215	- 13.0	- 21.7	- 21.7	- 25.6	+ 4.1	- 43.9
Electricity, Gas and Water Supply	1 643	- 13.4	- 22.5	- 23.1	- 22.2	- 62.2	- 1.0
Construction	945	+ 3.4	- 4.4	- 6.0	- 1.8	+ 114.9	+ 50.6
Trade, Maintenance and Repair	7 271	- 9.1	- 16.0	- 16.6	- 20.3	- 22.6	- 58.7
Hotels and Restaurants	425	+ 12.9	+ 7.9	+ 3.9	+ 15.4	+ 163.6	+ 38.4
Transport, Storage and Communication	1 376	- 10.2	- 14.9	- 22.3	+ 7.2	+ 41.9	+ 122.4
Financial Intermediation	4 359	- 9.6	- 20.5	- 17.5	- 30.4	- 8.3	- 51.3
Real Estate and Renting	2 175	- 11.1	- 8.4	- 13.3	+ 29.6	- 37.6	+ 461.2
Business Service Activities	5 608	- 4.6	+ 24.2	+ 26.4	+ 28.8	+ 29.8	- 3.6
Public and Personal Service Activities	1 369	- 4.1	+ 277.3	+ 279.7	+ 243.1	+ 104.1	+ 2.5
By Legal Forms							
Sole Proprietorships	4 002	+ 18.7	+ 144.4	+ 144.0	+ 129.6	+ 27.3	- 23.2
Partnerships	12 858	- 11.8	- 5.5	- 5.9	- 6.6	- 15.8	+ 1.1
Corporations	21 719	- 12.9	- 23.3	- 23.1	- 20.0	+ 4.3	+ 3.6
Basic federal tax rate[3)]	5.00%[4)]	3.50%	3.63%	3.24%	2.95%	0.82%	5.68%[5)]

1) Excluding modified rules for the determination of taxable profits.- 2) The basic federal tax rates of the 5 reform scenarios are chosen such that the local business tax revenue is held constant in comparison to the law of 2007. There are no reduced basic federal tax rates for enterprises with low profits in these scenarios.- 3) Municipalities apply a multiplier, which is 390% on average, to their allocated share of the uniform basic tax.- 4) Reduced basic federal tax rates apply for non-incorporated enterprises with taxable income below € 72,500.- 5) Applied to 10 % of the value of business properties.
Source: Calculations based on the microsimulation model for business taxation BizTax.

For the actual business tax reform 2008 the simulation results indicate a decrease in local business tax revenue of 9.2% in comparison to the law in 2007. The modified rules for the determination of taxable profits are neglected, however, since reliable data, in particular concerning cost accounting, are not available. The Federal Ministry of Finance estimates that the business tax reform 2008 does not change the overall local business tax revenue if all measures are taken into account (German Bundestag 2007).[19] The distribution of the simulated revenue effects by profits before taxes shows that primarily highly profitable corporations benefit from the reduction of the basic federal tax rate from 5% to 3.5%. Companies with losses pay more local business taxes due to the changed rules for the inclusion of financing expenses. Significantly more revenue is levied on small firms with less than 10 employees or profits between the allowance of €24,500 and €72,500 because of the abolishment of the reduced basic tax rates for enterprises reporting profits in this range. The tightened profit determination rules may have a stronger impact on firms with high profits than on small firms and thus at least partly compensate these effects.[20]

The remaining five hypothetical reform scenarios adopt the abolishment of the reduced basic tax rates for small firms from the actual business tax reform 2008. The resulting flat basic federal tax rate is chosen such that the total local business tax revenue is held constant in comparison to the law of 2007. This makes the distributional effects of the fundamental reform options comparable. The basic federal tax rates for the different scenarios are shown at the bottom of the table.

In the first of these scenarios, liberal professionals and farmers are integrated into the local business tax. The simulation results show that this reform increases the revenue from enterprises with low and medium profits between the allowance of €24,500 and € 1 million. The percentage increase is highest for the profit category just above the allowance and below €50,000 (+133%) and decreases with higher profits. This reflects the profit distribution of liberal professionals. As in the actual business tax reform 2008, the abolishment of the reduced basic tax rates adds to the increased revenue collected from small firms. In contrast, large enterprises benefit from the reduced basic federal tax rate (3.629% instead of 5%) that offsets the broader tax base and makes the reform scenario revenue neutral. Municipalities

[19] Not considering the effects on the corporate and personal income tax and on fiscal equalisation.
[20] For a detailed analysis focussing specifically on the German business tax reform 2008, including the changes to the corporate tax, see Bach, Buslei, Dwenger, and Fossen (2007).

dominated by personal service industry or agriculture and forestry can expect higher local business tax revenues in this scenario.

The local business income tax shows similar effects because it likewise includes liberal professionals and farmers. As only operating profits are subject to taxes, no revenues are collected from companies with losses. The revenue neutral basic federal tax rate is 3.243 %. It is lower than in the scenario discussed before because the local business income tax is not deductible from the tax base.

The comprehensive business income tax (CBIT) includes all financing expenses in the tax base. Thus, in contrast to the local business income tax, revenue is levied on companies with losses or with profits below the allowance of €24,500 if their earnings before interests and taxes (EBIT) exceed the allowance. This leads to a sharp increase in revenue especially from companies with reported losses. The basic federal tax rate can be decreased to 2.949 % due to the broader tax base. Again, large and profitable corporations benefit from this tax rate reduction. Taxes levied on the financial intermediation industry decrease by 30 %.

The local business value-added tax additionally includes the sum of wages and salaries in the tax base. To compensate for the much broader tax base, the basic federal tax rate is decreased to only 0.825 % and the allowance is increased to €36,000 (see section 2.2.5). The inclusion of wages and salaries leads to an even stronger increase of revenue from enterprises making losses or profits below the allowance than the CBIT. The revenue from companies with more than 2000 employees more than doubles, while the revenue from companies with fewer employees decreases significantly. On the other hand, less tax is levied on companies with high profits. This shows that the business value-added tax is clearly dominated by the sum of wages and salaries in comparison to the other components of the tax base, i.e. profits and financing expenses. In contrast to the other scenarios, revenues collected from the construction industry and hotels and restaurants more than double, while revenues from electricity, gas and water supply decrease by 62 %.

Of all the reform scenarios considered here, the local business property tax is the one which most strongly increases revenues from companies reporting losses. Correspondingly, much less revenue is collected from firms with high profits. Local business tax revenues from companies with profits above € 500,000 drop by more than 50 %. The revenue neutral basic federal tax rate is 5.68 %, applied to 10 % of the value of business properties. In contrast to the other scenarios, local business taxes paid by the real estate and renting industry increase

by 461 %, and those paid by the transport, storage and communication industries more than double. Agriculture, forestry and fishery are also taxed most heavily in this scenario. On the other hand, revenues collected from the mining, manufacturing, trade and financial intermediation industries decrease by about half. Thus, a business property tax triggers the strongest redistribution across firm size, profitability, and industries among the reform scenarios analysed here.

Table 4 shows the distributional effects of the reform scenarios with respect to regional categories. In the upper part of the table, the effects are first split by western and eastern Germany and second by cores of agglomeration, surrounding and rural areas. The lower part displays the effects by regions with high, medium or low local tax revenues per capita.[21] The first column shows the distribution of local business tax revenues in millions of euro if the law of 2007 is applied. The second column gives the local business tax revenue per capita in the different regional categories. Local business tax per capita is only €254 in eastern Germany versus €523 in western Germany, which reflects that eastern Germany still lags behind in terms of productivity and profitability. As the next column shows, the actual business tax reform 2008 decreases local business tax revenues in eastern Germany by 0.5 percentage points more than in western Germany (again, not taking into account the tax base broadening measures of this reform). The other five hypothetical reform options, which are revenue neutral, all increase revenues in eastern Germany and decrease revenues in western Germany. This effect is strongest when the local business property tax is applied, which doubles local business taxes collected in eastern Germany and decrease those collected in western Germany by 12.1%.

Today, local business tax revenues are highly concentrated in cores of agglomeration in western Germany. In the reference scenario they account for 47 % of total local business tax revenues. The five hypothetical reform options reduce this concentration by decreasing revenues in cores of agglomeration in western Germany and increasing revenues in eastern Germany and in rural areas. All of these scenarios decrease revenues in municipalities with high local tax revenues per capita and increase revenues in municipalities with low or medium revenues per capita. Under the local CBIT, the local business value-added tax and the local

[21] The categories "core of agglomeration", "surrounding area" and "rural area" refer to definitions by the Federal Office for Building and Regional Planning (2007). These definitions are also the basis for the categorisation by local tax revenue per capita, which was set up by the German Institute of Urban Affairs (Reidenbach 2007). Local tax revenues per capita are classified as low if revenues per inhabitant were less than 80 % of the average in the same type of municipality in the period 2002 to 2005, and high if revenues per inhabitant exceeded 120 %.

business property tax, the revenue increase is relatively higher in the categories with low than in those with medium revenues. This confirms that the five hypothetical reform scenarios, and especially the latter three, distribute local tax revenues more equally across regions. The broader the tax base and the less it relies on profits, the stronger is the redistributive effect. Even the local business income tax redistributes revenues across regions due to the inclusion of liberal professionals and freelancers. The redistributive effect becomes stronger with the inclusion of interest expenses and the payroll in the tax base. The local business property tax has the strongest redistributive effect.

Table 4: Revenue effects of local business tax reform scenarios in 2008 by regional types

Regional Categories[1)]	Local Busin. Tax Revenues If Law of 2007 Is Applied	Local Business Tax per Capita[2)]	Actual Business Tax Reform 2008[3)]	Fundamental Reform Scenarios[4)]				
				Inclusion of Liberal Profession-als and Farmers	Local Business Income Tax	Compre-hensive Business Income Tax (CBIT)	Local Business Value-Added Tax	Local Business Property Tax
	Mill. €	€	Increase (+) / Decrease (-) of Local Business Tax Revenues in %					
Germay, Total	**38 579**	**468**	**- 9.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Western Germany[5)], Total	34 338	523	- 9.2	- 0.5	- 0.3	- 2.0	- 8.0	- 12.1
Cores of Agglomeration	18 130	769	- 8.3	- 3.6	- 1.7	- 5.1	- 12.4	- 18.9
Surrounding Areas	9 168	405	- 9.9	+ 3.7	+ 2.4	+ 1.8	- 14.3	- 9.1
Rural Areas	7 040	361	- 10.3	+ 1.7	- 0.2	+ 0.9	+ 11.6	+ 1.3
Eastern Germany[6)], Total	4 244	254	- 9.7	+ 4.4	+ 2.5	+ 16.4	+ 64.1	+ 98.2
Cores of Agglomeration	2 249	332	- 8.8	+ 5.0	+ 5.4	+ 12.3	+ 10.7	+ 91.7
Surrounding Areas	752	269	- 13.1	+ 0.8	- 3.5	+ 17.0	+ 63.2	+ 77.7
Rural Areas	1 242	173	- 9.4	+ 5.5	+ 1.0	+ 23.3	+ 161.4	+ 122.3
High Local Tax Rev. per Capita	19 363	913	- 10.0	- 7.2	- 6.3	- 9.2	- 19.7	- 22.6
Med. Local Tax Rev. per Capita	12 880	400	- 8.8	+ 7.3	+ 6.8	+ 6.4	+ 8.7	+ 1.6
Low Local Tax Rev. per Capita	6 338	218	- 7.7	+ 7.0	+ 5.4	+ 15.0	+ 42.0	+ 65.7

1) Local tax revenues per capita: low if revenues per inhabitant were less than 80% of the average in the same type of municipality in 2002 to 2005, high if revenues exceeded 120% (Reidenbach 2007).- 2) Inhabitants at the end of 2005.- 3) Excluding modified rules for the determination of taxable profits.- 4) The basic federal tax rates of the 5 fundamental reform scenarios are chosen such that the local business tax revenue is held constant in comparison to the law of 2007. There are no reduced basic federal tax rates for enterprises with low profits in these scenarios.- 5) Old federal states excluding West Berlin.- 6) New federal states including Berlin.
Source: Calculations based on the microsimulation model for business taxation BizTax.

The finding that the inclusion of liberal professionals in the local business tax has a redistributive effect could be explained by their relatively even distribution over municipalities. Physicians, for example, are not strongly concentrated in cores of agglomeration. Therefore they would contribute a relatively high share to revenues in surrounding and even rural areas if they became liable to local business tax.

2.5 Summary and Conclusion

The taxation of local business to generate revenues for local governments is common in OECD countries. Local authorities usually have some discretion over the tax rate. The international comparison reveals that the composition of the tax base varies widely. Local business tax systems range from a pure profit tax in Luxembourg and Japan to an origin-based value-added tax in Italy and Hungary, which includes interest expenses and the payroll in the tax base. France and some states in the USA tax fixed assets of companies at the local level. As general options for the design of local business taxation I identify a local business income tax, a local CBIT, a local business value-added tax, and a local business property tax.

Using the newly developed microsimulation model for the business sector BizTax, I simulate the first round distributional effects of these general reform scenarios if they were implemented in Germany in a revenue neutral way in 2008. Liberal professionals and farmers, who are exempted from the local business tax in Germany today, are integrated in these reform scenarios. Today's high concentration of local business tax revenues on corporations with high profits is found to decrease if the tax base is broadened by integrating more taxpayers and by including more elements of value added. The reform scenarios with a broader tax base also distribute the local business tax revenue per capita more equally across regional categories, especially by reducing today's high concentration of revenues on cores of agglomeration in western Germany. Revenues from local business taxation in rural areas and in eastern Germany increase.

The results also show that the reform scenarios including components other than profits in the tax base strongly increase the tax revenues collected from companies reporting losses or low profits. This does not necessarily imply that these scenarios impose a higher tax burden on sole proprietors or partners of small businesses, however, as they can credit the local business tax against their personal income tax in a lump sum (the credit is a multiple of the uniform basic tax). The business tax reform 2008 abolished the deductibility of the local business tax from the tax base and compensated this by a higher lump sum credit for unincorporated firms. This credit would clearly also apply to liberal professionals and farmers if they were integrated into the local business tax. Only those based in municipalities with high multipliers above 401 % would face a moderate increase in their effective marginal tax rates. This certainly increases the political feasibility of including these groups in the local

business tax, and of a tax base broadening reform in general, but the tax credit undermines the fiscal equivalence principle. Furthermore, it decreases the transparency of taxation and brings about bureaucracy, and if the personal income tax at the federal level is taken into account, the tax reform options are no longer revenue neutral. With or without the credit, a broadening of the tax base of the local business tax in the direction of an origin-based value-added tax or a business property tax with reduced tax rates would provide a more stable and reliable revenue source for local governments in Germany and distribute local tax revenues per capita more equally across regions.

As an inclusion of liberal professionals in the local business tax would increase the marginal tax rate on profit income for those situated in municipalities with high multipliers, a naturally arising question is if this would trigger behavioural responses. The local business tax reforms might provide incentives for potential liberal professionals to choose a salaried job instead of being self-employed. This leads to the main research question of this dissertation thesis, which the remaining chapters will deal with: What is the impact of changes in the income tax on entrepreneurial choice?

Chapter 3: Tax Reforms as Natural Experiments

3.1 Introduction

Do taxes play a role in the decision to be an entrepreneur? As summarised in the introduction to this dissertation thesis, economic theory does not unambiguously predict the effect of taxes on this choice. This calls for empirical evidence. The simplest setting to analyse the impact of taxes that comes to mind could be an exclusive tax advantage provided to the self-employed which is not available to the dependently employed, e.g. reduced tax rates for the self-employed. Intuitively one would expect that such a tax advantage would make self-employment relatively more attractive. A tax reform which increases the tax burden for the self-employed would be expected to have the opposite effect. This setting of a differential tax treatment is comparable to that analysed in chapter 2, for instance. If the local business tax were extended to the liberal professionals, their effective marginal tax rate on profit income would increase in municipalities with high local business tax multipliers. As the tax burden for the dependently employed would not change, liberal professionals at the margin might be induced to escape to a salaried job. Even in this comparatively intuitive case, however, theory does not clearly indicate the direction of the effect. Bruce (2002) illustrated that the effect of a differential tax treatment on the decision to be self-employed depends on individual preferences over returns and risk.

The empirical literature about the impact of taxation on entrepreneurship reflects the theoretical ambiguity. Most of the studies analysed general income taxes that apply both to the dependently employed and the self-employed. A number of studies found that higher tax rates lead to higher rates of entrepreneurial activity (e.g. Parker 1996; Schuetze 2000; and Cullen and Gordon 2002). Reasons may be the insurance effect of taxes or better avoidance and evasion opportunities available to the self-employed. Other recent studies called this

finding into question, reporting that progressive taxes as "success taxes" had a negative impact on entrepreneurship (Gentry and Hubbard 2000; Moore 2004). Parker (2003) found no significant influence at all. Georgellis and Wall (2002) reported a negative relationship at lower marginal tax rates and a positive relationship at higher marginal rates. Examining differential tax treatment of the self-employed, Bruce (2000) found that relatively higher expected *average* tax rates for the self-employed decrease, but relatively higher expected *marginal* tax rates increase the probability of entry into self-employment; Bruce (2002) added that higher relative taxes in self-employment may counter-intuitively decrease the probability of exit.

While prior studies were restricted by their use of time series data or single cross-sections, recent studies have emphasised the importance of using individual panel or repeated cross-sectional data to estimate the tax response (see Schuetze and Bruce (2004) for a survey). With this type of data, the effects of taxation have been analysed by exploiting tax reforms as natural experiments since Feldstein (1995). Gottfried and Schellhorn (2003) used the German income tax reform of 1990 as natural experiment to measure the tax rate elasticity of taxable income based on a taxpayer panel. The estimate they obtained was only slightly negative when they used the whole sample. For the subgroup of self-employed taxpayers, however, the estimated elasticity was significantly more negative, suggesting that entrepreneurs do respond to changes in tax rates.

In this chapter I analyse two tax legislation changes in Germany that exhibit specific features which make them especially suitable to be interpreted as natural experiments. These tax reforms were introduced as a tax relief for small and medium sized enterprises by limiting the top marginal tax rate for certain entrepreneurs, and thus represented a differential tax treatment in comparison to the dependently employed. Importantly, the law makes two distinctions that naturally define treatment and control groups for the interpretation of the reforms as experiments. First, only entrepreneurs with income above a certain threshold defined by the law benefited from the tax cut. Thus, individuals with income below the threshold serve as a control group. Second, the law did not apply to all self-employed individuals, but only to tradesmen (*Gewerbetreibende*) as opposed to liberal professionals (*Freiberufler*). As explained in chapter 2, the latter are self-employed persons with one of various professions that have traditionally been classified as liberal professions by the German income tax law, e.g. physicians, lawyers, architects, and journalists. This distinction

enables me to track the liberal professionals as additional control group. This allows applying a "difference-in-difference-in-difference" estimator (Gruber 1994) to isolate the effect of the reforms. This method controls for reform-independent trends in a more robust way than the conventional difference-in-difference technique. First the effects of the reforms on the probability of being self-employed are estimated. Additionally I estimate the impact of the reforms on the probability of entry into self-employment and exit from self-employment to gain some insight into changes in the flows.

The remainder of this chapter is organised as follows. Section 3.2 summarises the legislation changes that are relevant for this analysis. In section 3.3, I introduce the microcensus data, elaborate on the definition of the treatment and control groups and provide descriptive statistics. Section 3.4 describes the difference-in-difference-in-difference method within a regression framework. The empirical results are presented and discussed in section 3.5. In section 3.6, I re-estimate the effect of the two tax reforms on self-employment using a panel dataset. The intention is to investigate if controlling for the duration of the current employment state using hazard rate models changes the findings. These models take into account both right- and left-censored spells and unobserved heterogeneity. Section 3.7 concludes.

3.2 The Location Preservation Act and the Tax Relief Act

To understand the effect of income taxes on entrepreneurial choice, I analyse specific legislation changes in Germany in the 1990s that reduced the top marginal income tax rates exclusively for self-employed tradesmen. These tax reforms make it possible to study the impact of income taxes on entrepreneurial choice without distortions from a simultaneous change in the tax environment in the alternative sector, i.e. wage and salary employment. The legislation changes I exploit as natural experiments are known as tax rate limitation for income from trade (*Tarifbegrenzung für gewerbliche Einkünfte*), enacted in §32c of the income tax law. The context of these reforms was a reduction of the corporate income tax (CIT). The tax cuts were implemented with the intention to make Germany a more competitive business location in the globalised economy. However, a reduction of the CIT rate without complementary measures in the personal income tax (PIT) code would have favoured corporations, which are typically relatively large, over unincorporated companies,

e.g. sole proprietors and partnerships, which are typically small or medium sized. These businesses are not subject to the flat CIT in Germany; the sole proprietors or partners pay progressive PIT instead. Thus, the legislator decided to reduce the tax burden of unincorporated companies at the same time as lowering the CIT rate. Liberal professionals were not included to benefit from the tax cuts because they were already tax-advantaged being exempted from the local business tax (*Gewerbesteuer*, see chapter 2).

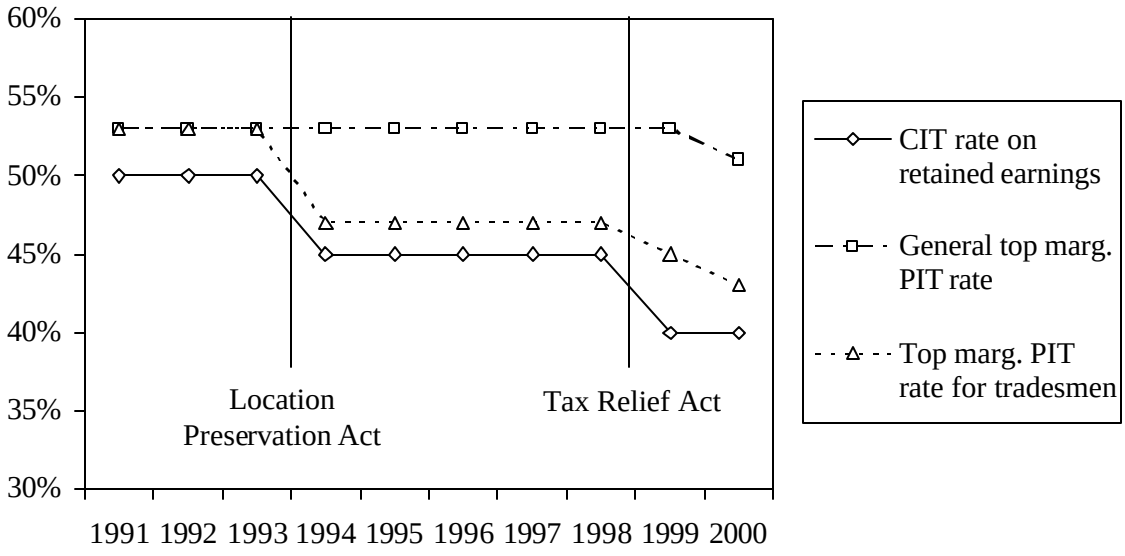
The first reform analysed is the Location Preservation Act (*Standortsicherungsgesetz*) of September 13th, 1993, which became effective on January 1st, 1994. It reduced the CIT rate for retained profits from 50 % to 45 %. By the same act, the general top marginal PIT rate of 53 % was reduced to 47 % for earnings from trade businesses above DM 100,278 (€51,271). According to the financial report of the Federal Ministry of Finance (1994), the limitation of the top PIT rate for tradesmen reduced tax revenues by € 716 million in the first year.

The second reform relevant in this analysis is the Tax Relief Act (*Steuerentlastungsgesetz 1999/2000/2002*) of March 24th, 1999, which was put into effect retroactively on January 1st, 1999. It further reduced the CIT rate for retained profits to 40 % and limited the top marginal PIT rate for earnings from trade business to 45 % (above DM 93,744 or €47,931) in 1999 and to 43 % (above DM 84,834 or €43,375) in 2000. The fiscal impact of the tax rate limitation for tradesmen at 45 % was a reduction in tax revenues of € 593 million in 1999, and the tax rate limitation at 43 % further lowered tax revenues by € 700 million in 2000, according to the financial report of the Federal Ministry of Finance (1999). The general top marginal tax rate for all personal income other than from trade businesses, e.g. wages and salaries, was still left unchanged at 53 % in 1999. The top marginal PIT rate was reduced to 51 % in 2000 and to 48.5 % in 2001: The latter reduction had been scheduled for 2002 by the Tax Relief Act but was pulled forward by the Tax Reduction Act in 2000.[22]

[22] The Tax Relief Act included some complementary measures with the intention to compensate parts of the fiscal impact. The most important changes were: Restrictions for high loss offsets between incomes from different sources; more restrictive rules for the assessment of certain provisions, especially in the insurance and nuclear energy industries; and restrictions for current-value depreciations. Furthermore, the so-called co-entrepreneurship decree was temporarily abolished, which facilitated tax-neutral transfers of individual assets between partners and their partnerships. These measures primarily affected large corporations or partnerships, and there are no obvious reasons why they should have affected high or low income tradesmen in a different way than high or low income liberal professionals.

Figure 1 visualises how the Location Preservation Act and the Tax Relief Act made the top marginal PIT rate for tradesmen depart from the general top marginal PIT rate to follow the reductions of the CIT rate on retained earnings.

Figure 1: Tax rate reductions for enterprises in Germany



Following these reforms, the Tax Reduction Act (*Steuersenkungsgesetz 2000*) of October 23rd, 2000 not only scheduled further general PIT rate reductions for 2003 (top marginal rate: 45 %) and 2005 (top rate: 42 %)[23], but also introduced a business tax reform at a larger scale, coming into effect on January 1st, 2001. Among other measures, the CIT rate for both retained and distributed profits was reduced to 25 %. For this analysis it is important to note that this reform replaced the limitation of the top PIT rate for tradesmen (§ 32c of ESt) with a different tax relief for the same group: tradesmen were granted a lump sum credit of the local business tax from their PIT liability (see chapter 2). Thus, this reform affected tradesmen in a different way than liberal professionals. It is furthermore likely to have affected people differently across income classes, as shown by Haan and Steiner (2005). To avoid a potential bias resulting from this reform, the data is limited to observations prior to the time the Tax Reduction Act 2000 could influence the actors.

[23] The latter reduction was passed as Supplementary Tax Reduction Act about two months later.

3.3 Data

3.3.1 Sample Design

This analysis is based on the microcensus (*Mikrozensus*) which is provided by the Federal Statistical Office. It is an official representative yearly household survey, similar to the Current Population Survey in the USA and the Labour Force Survey in the UK. The microcensus consists of a 1 % sample of all households in Germany, i.e. about 370,000 households per year, 70 % of which (selected at random) are available to researchers outside the Federal Statistical Office. The large sample size is important for this analysis since only about 1% of the population belongs to the group of self-employed tradesmen with income above the relevant threshold. As the microcensus is an official census, most questions are subject to compulsory response. This ensures a low rate of item non-response and that entrepreneurs, including those with high income, are adequately represented. [24]

I restrict the sample to individuals between 18 and 65 years of age and excludes farmers, people in education, vocational training, or military service, and civil servants. The excluded individuals presumably have a limited occupational choice set, or at least they have different determinants of occupational choice that could distort the analysis. I also exclude family members helping in a family business because they are not entrepreneurs in the sense that they run their own business.

The analysis of self-employment rates is based on pooled cross sections of the microcensus from 1991 to 2001. I do not consider years before 1991 as this was the first year covering the five new federal states of eastern Germany. Furthermore, income information is given in categories, and 1991 is the first wave providing more detailed categories for high incomes. The reference week of the question for an individual's employment status is always the last week in April. As mentioned in section 3.2, I decide not to include observations potentially influenced by the Tax Reduction Act 2000, which was passed in October 2000 and came into effect in January 2001. Taking into account that adjusting expectations and eventually changing occupation as a reaction to a reform would take some time, the employment state in April 2001 is probably not influenced much by the reform. Thus, I

[24] More information about the microcensus can be found at http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Content/Statistics/Mikrozensus/Aktuell.psml.

exclude the years 2002 and later. Since the microcensus was not carried out in 1992 and 1994, I cannot include these years in the analysis.

The first reform I analyse, the Location Preservation Act, was passed in September 1993 and came into effect on January 1st, 1994. Deliberation in parliament started on January 4th, 1993, when the first draft was issued. It is unlikely that agents adjusted their behaviour early during the ongoing debate because the outcome of the political process was uncertain.[25] Thus, the employment state in April 1994 is probably not influenced by the reform, again considering the time lag before a reaction can be observed.[26] In contrast, the employment status in April 1995 is potentially influenced by the reform. Thus, all observations from 1995 onward are marked by a "post 1994 reform" dummy. The second reform, the Tax Relief Act, was passed in March 1999 and went into effect in two steps, on January 1st, 1999 (retroactively) and January 1st, 2000. Parliamentary deliberation started with the first draft law on November 9th, 1998. The employment status in April 1999 is unlikely to have been influenced by the reform which was passed only a month before. Thus, a "post 1999 reform" dummy is assigned to all observations in 2000 and 2001. For the joint estimation of the effects of the two reforms, I convert the "post 1994 reform" to a "post-1994, pre-1999 reform" dummy variable that is zero for all observations from 2000 onward to avoid an overlap of the two reform dummy variables.

An increasing (decreasing) self-employment rate can be caused by a higher (lower) entry rate, or a lower (higher) exit rate, or a combination of both. It is also possible that a higher (lower) entry rate is offset by a higher (lower) exit rate, and that the self-employment rate remains constant as a consequence. Additionally to analysing the probability of being self-employed, I thus also study the probability of entry into self-employment and exit from self-employment to gain insights into possible changes in the flows. As the microcensus provides independent cross sections, each person is observed in a single year *t* only. To identify transitions between employment states, I rely on a retrospective question on a respondent's employment state in the year prior to the interview. It was only posed in a 45 % sub-sample of the microcensus (selected at random), and only from 1996 onwards. The analysis of transitions can thus only be based on this sub-sample from 1996 to 2001, and I can therefore only analyse the second reform of 1999.

[25] On June 22nd, the Bundesrat (Federal Council) denied its approval of the law. Consequently, the Mediation Committee between the Bundesrat and the Bundestag (parliament) was invoked, and the law was changed considerably during this process.

[26] The year 1994 is not included in this analysis anyway as the microcensus was not carried out in that year.

In principle, the set of transitions between self-employment and dependent employment includes those who decide to incorporate. An unincorporated firm is run by a self-employed sole proprietor or by various self-employed partners, whereas in an incorporated firm, which is a legal entity, the managers are employees.[27] It is not clear, though, if all respondents make the distinction correctly when answering the survey question; many formerly self-employed will probably still report themselves as self-employed after incorporating. Thus, the effect of the tax reforms on self-employment may be underestimated.

3.3.2 Definition of the Treatment and Control Groups

The two tax reforms provide two dimensions along which the treatment and control groups can be distinguished. First, the legislation changes were only applicable to tradesmen as opposed to liberal professionals. Second, only individuals with gross income from self-employment above a certain threshold were affected by the reforms. Table 5 sketches the definition of the treatment and control groups.

Table 5: Treatment and control groups

	Potential Gross Self-Empl. Income Below Threshold	Potential Gross Self-Empl. Income Above Threshold
Potential Tradesmen (*Gewerbetreibende*)	*control group*	*treatment group*
Pot. Liberal Professes-sionals (*Freiberufler*)	*control group*	*control group*

The distinction between tradesmen and liberal professionals in the German tax law has its origins in the 19th century. It was sometimes justified by the opinion that tradesmen used capital more intensively in production than liberal professionals.[28] Bach, Broer, and Fossen (2008) illustrate empirically that production structures differ little between tradesmen and liberal professionals nowadays.[29] The self-employed can be identified as tradesmen or liberal professionals by the profession they report, since the liberal professions are defined by an official catalogue in the German income tax law. In some special cases this catalogue is

[27] The difference is not only a formal one. It determines the level of personal risk, which is a prominent characteristic of an entrepreneur. Furthermore, from a public viewpoint, the distinction is important as it determines taxes, social security obligations and benefit entitlements.

[28] The Federal Constitutional Court (1977) cast serious doubt on this argument. In 2003, the German federal government also stated that there was no reason to distinguish between tradesmen and liberal professionals, but its initiative to eliminate this distinction in the tax law failed to pass parliament (German Bundestag 2003).

[29] Dentists and medical specialists (liberal professionals) typically work with higher capital intensity than software firms (tradesmen), for example. Law firms (liberal professionals) often have more employees than crafts businesses (tradesmen).

rendered more precise by court ruling. Table A 1 lists the professions classified as liberal. Additionally, I assign a label "potential tradesman" or "potential liberal professional" to persons who are currently dependently employed or not working. This is necessary to determine who would benefit from the tax rate reduction if he or she decided to become self-employed. Again, the reported professions determine the classification. Someone is labelled as a "potential liberal professional" if the person reports a profession that would be a liberal profession if he or she were self-employed, no matter if the person is actually self-employed or not.[30]

Individuals who are unemployed and those not participating in the labour force usually do not report a profession. Hence, the data do not provide obvious criteria to determine if someone is likely to become either a tradesman or a liberal professional. The person is somewhat arbitrarily labelled as "potential tradesman". However, as it is unlikely that the income of formerly unemployed or not working individuals will be above the relevant threshold in the first year of starting up their own business, they are part of the control group irrespective of their classification as tradesmen or liberal professionals.

Apart from distinguishing between tradesmen and liberal professionals, the second dimension for separating out the treatment group requires determining if an individual's gross income from self-employment is or would be above the threshold defined by the income tax law. As the threshold first set in 1994 was reduced in 1999 and 2000, I create two dummy variables: one indicating if an individual's income would be above the threshold prevailing in 1994, and another one indicating if it would be above the 2000 threshold. Since the two steps of the second reform were part of the same act, the temporary 1999 threshold is not treated separately.

[30] For example, a physician can be employed in a hospital, unemployed/not working, or self-employed. In the latter case he or she would be a liberal professional in the sense of the law. Thus, all physicians are interpreted as "potential liberal professionals".

Income from self-employment of the self-employed is observed directly.[31] For the dependently employed, unemployed and not working individuals, I estimate the counterfactual income they would earn if they decided to be self-employed. Mincer type regressions of income from self-employment are estimated separately for each year. As explanatory variables I include an individual's age and its square, the number of children, and dummy variables indicating the type of secondary schooling, professional qualification, gender, marital status, residence in eastern or western Germany, the city size, and a set of industry dummies.[32] The estimated earnings equations are used to predict potential income from self-employment for those who are not self-employed.[33] In the model of the probability of being self-employed, I use predicted income from self-employment for the self-employed, too, in order to treat all observations in the same way.

The microcensus only provides net income, and only as a categorical variable with 18-24 classes. Thus, I approximate a self-employed person's net income by the midpoint of his/her net income class and use it as the dependent variable in the regression of self-employment earnings described above. Then, I employ a simple function to compute an approximate gross income from the predicted net income, using average income tax rates by income deciles in Germany as calculated by Bach, Corneo, and Steiner (2005).[34]

A choice has to be made whether to use real or nominal incomes. As the income threshold defined by the tax law refers to nominal income, at first sight it seems reasonable to use nominal incomes in order to decide who is really affected by the law. If I used nominal incomes, however, people would creep up from the low income group to the high income group with time just due to inflation. Haan and Steiner (2005) showed that this bracket

[31] The data do not allow separating out additional wage and salary or capital income of the self-employed. In principle, this would be necessary because the tax rate limitation only applied to income from trade business. Using the German Socio Economic Panel (SOEP), a representative household panel survey for Germany provided by the German Institute for Economic Research (DIW Berlin), I find that additional wage income of the self-employed was on average only 4.6 % of the income from self-employment in the period 1991-2001. Capital income was on average 17.3% of self-employment income for tradesmen and 20.6 % for liberal professionals. My inability to subtract capital income from the income of the self-employed may lead to an overestimation of income from self-employment in the income predictions and thus to groups of potential high-income tradesmen and liberal professionals which are somewhat too large. As the effect is similar for the treatment and control groups, I do not expect this to cause a major distortion in the analysis. To be sure, in the empirical analysis a sensitivity check regarding a possible misclassification of income groups is performed (section 3.5.2).

[32] The industry dummies are normalised in such a way that the base category represents the average industry effect. This allows accounting for industry effects in the estimation of earnings equations also for currently non-employed people, for whom no industry affiliation is observed, by assigning them the average effect across all industries.

[33] The regression and prediction results are available from the author upon request.

[34] This simple tax function cannot account for joint taxation of married couples. I tested the robustness of the results with respect to this limitation (see section 3.5.2).

creeping effect is quite substantial in the German tax system. For the application of this chapter's estimation method, comparability of the treatment and comparison groups before and after the reforms is crucial. This requires a definition that is consistent and stable over time. For this analysis, it is relevant to distinguish between individuals who expect to find themselves in the high income or the low income group if self-employed. Thus, I decided to deflate all incomes (and also the thresholds defined by the law) using the Consumer Price Index.

Table A 2 in the Appendix presents descriptive statistics for the self-employed in Germany, separated by tradesmen with income above and below the income threshold relevant for the 1999 reform, and liberal professionals. The weighted mean of the self-employment rate in the sample is 6.1 %. The mean characteristics reveal important differences between the various groups of self-employed people: 53.2% of the liberal professionals have a university degree, but only 11.8 % of the tradesmen above the income threshold and even only 7.2% of those below the threshold; the reason is that most liberal professions are academic professions, whereas a large share of the tradesmen are craftsmen, shopkeepers etc. Descriptive statistics displaying differences in individual characteristics between self-employed, dependently employed and unemployed/inactive individuals are summarised in Table A 3.

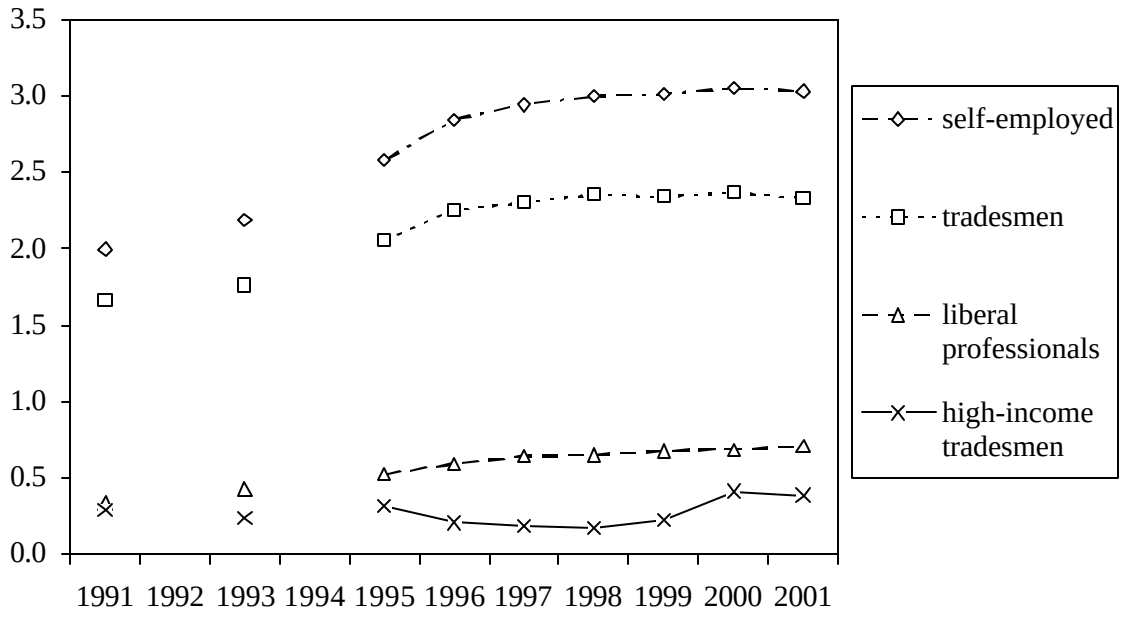
As described above, all individuals who would be tradesmen with an expected income above the threshold if they decided to be self-employed belong to the treatment group of the reforms. Table A 4 compares characteristics of this group to those of potential tradesmen with lower income and potential liberal professionals. The actual self-employment rate is highest among potential liberal professionals (20.8 %) and lowest among potential tradesmen with low income (4.7 %). The latter is by far the largest group in the sample (89.1%). Only 2.8 % of the potential tradesmen in the high income group are women. One reason for this low share is that a large share of women in Germany work part-time, which results in relatively low estimates of income for women.

3.3.3 Trends in Self-Employment

Between 1991 and 2001, the period relevant for this analysis, self-employment grew significantly in Germany (see Figure 2). This growth pattern can be observed both for tradesmen and liberal professionals. The solid line shows the time trend of the tradesmen with income above the threshold of the reform in 1999, i.e. of the group who benefited from both

tax cuts. This trend line exhibits peaks both in 1995 and in 2000, the years after the two reforms came into effect. While the trend falls again in 1996, it remains on a higher level after the second reform. The trends of the tradesmen, the liberal professionals and the self-employed as a whole do not have peaks in the years following the reforms. The first reform falls into a steady growth period, while the trends are almost constant during the introduction of the second reform. The fact that only the group that benefited from the reforms peaks in the years following the reforms, especially after the second one, may indicate that the reforms had a positive impact on the self-employment rate in the treatment group.

Figure 2: Time trends of self-employment in Germany (in millions)



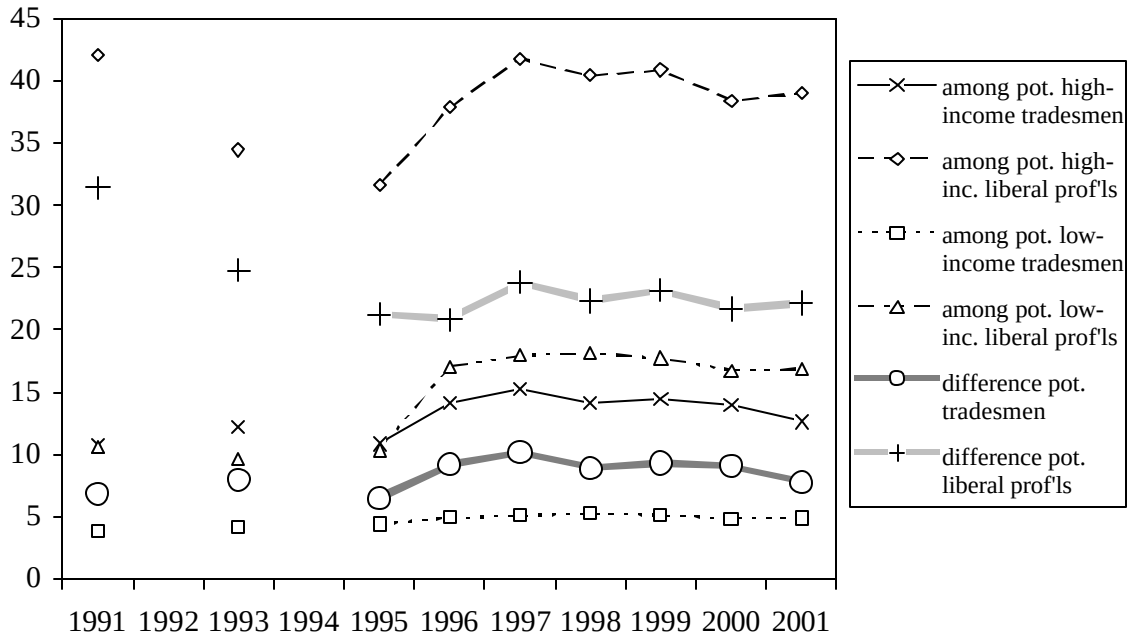
Source: Own calculations based on the scientific use file of the German microcensus.

Figure 3 depicts the time trends of the self-employment rates in the treatment group and the control groups. Both for potential tradesmen and liberal professionals, the figure also gives the time trends of the differences in the self-employment rates between those with a potential self-employment income above and below the threshold. The differences in the self-employment rates between potential high and low income people are roughly parallel for tradesmen and liberal professionals.[35] In 1996, the difference increases for tradesmen, but

[35] Between 1991 and 1993, the difference falls for liberal professionals, but increases for tradesmen. This difference in these trends disappears after controlling for observable characteristics, as the placebo test before the reform of 1994 shows (section 3.5.2). This test reveals that the triple difference between the two years 1991 and 1993 is not significant.

decreases for liberal professionals. This could be a slightly retarded consequence of the first reform in 1994, if it increased the relative probability of being self-employed for the treatment group (high-income tradesmen). In 2000, the difference between high and low income liberal professionals decreases, while the difference between the tradesmen remains almost constant. This may give some support for the hypothesis that the reform in 1999 increased the probability of self-employment for the treatment group relative to the other groups. In the next section I set out the empirical methodology to identify the effects of the tax reforms on self-employment rates.

Figure 3: Self-employment rates in Germany (in %)



Source: Own calculations based on the scientific use file of the German microcensus.

3.4 Empirical Methodology

The basic idea of this chapter's estimation strategy is to view the two legislation reforms described in section 3.2 as "natural experiments" which exogenously provide a comparison group like the control group in a randomised laboratory setting. If such a comparison group can be identified, one can compare the difference in average behaviour of the eligible group before and after the reform with the difference in behaviour of the comparison group. This "difference in difference" represents the average treatment effect on the treated (ATT), i.e. the

average effect of the reform on those affected by the reform (see, for example, Blundell and Costa Dias, 2002).

The two tax reforms analysed in this study affected tradesmen with incomes above a certain threshold defined by the tax law and provided naturally identified comparison groups, namely liberal professionals and individuals with incomes below the threshold (see section 3.3.2). Applying the "difference-in-difference" (DD) approach to identify the ATT for potential high-income tradesmen means to compare the difference in average self-employment rates (or, alternatively, transition rates into and out of self-employment) of potential high-income tradesmen before and after each reform with the respective outcome variable of the comparison groups before and after the reform. As the tax reforms studied provide two independent dimensions for distinguishing the treatment group from the control groups, i.e. the separations by profession and by income, I can go beyond the simple DD approach and apply a "difference-in-difference-in-difference" (DDD) estimator (Gruber 1994).

The DDD approach allows identifying the ATT under weaker assumptions than required under the DD approach. In particular, the DDD estimator only requires that the difference between the time trends of the self-employment rates of potential high and low income tradesmen would have been the same as the difference between those of potential high and low income liberal professionals in the absence of the reforms. That means, if a contemporaneous shock affected all tradesmen, *or* if it affected all individuals with high income equally, the assumption would *not* be violated, because the DDD method controls for such shocks.

The identifying assumption includes the requirement that there be no systematic composition changes within the treatment and comparison groups that cannot be controlled for. In this setting, people can switch groups if their gross income moves across the threshold, and in principle also if they change between liberal and trade professions. However, people cannot choose to switch between tradesman and liberal professional status due to tax incentives, for example, because the criteria are fixed and profession-related. Most professions require specific education and work experience; this is especially true for liberal professions which are usually specialised academic professions.

To control for compositional changes between treatment and control groups and to improve on the efficiency of estimated effects, I implement the DDD method in a regression

framework and include a set of observable time-varying covariates and other characteristics. Various determinants of self-employment have been identified in previous empirical studies (e.g. Evans and Leighton, 1989, and Taylor, 1996). I include age and its square, and dummy variables indicating gender, type of secondary schooling and professional qualification, German nationality, residence in eastern Germany, the size of the respondent's residence city, and a constant. Furthermore, Brown *et al.* (2006), Parker (2005), and Bruce (1999) all find evidence that an individual's household context has an influence on the decision to be self-employed. This is accounted for by controlling for the marital status, the number of children, the employment status of the respondent's spouse and the spouse's income (if the respondent is married), and other household income. Descriptive statistics of all the variables included in the regression models for the various samples used in the estimation are provided in Table A 2 to Table A 4 in the Appendix.

The effects of both reforms are estimated jointly using a single regression. The following equation for the linear probability model illustrates the DDD estimator:

$$\begin{aligned}\text{Prob}\left(y_i = 1 \middle| a_i, b_i, c_i, d_i, e_i, x_i^c\right) = \; & \alpha \\ & + \delta_1 a_i + \delta_2 b_i + \delta_3 c_i \\ & + \delta_4 (a_i \times b_t) + \delta_5 (b_i \times c_i) + \delta_6 (a_i \times c_i) \\ & + \delta_7 (a_i \times b_i \times c_i) \\ & + \delta_8 d_i + \delta_9 e_i \\ & + \delta_{10} (a_i \times d_i) + \delta_{11} (d_i \times e_i) + \delta_{12} (a_i \times e_i) \\ & + \delta_{13} (a_i \times d_i \times e_i) \\ & + x_i^c \beta^c + \varepsilon_i\end{aligned} \tag{3.1}$$

where i indexes observations. The outcome variable y_i is a dummy indicating self-employment or transition into or out of self-employment, depending on the model, and Prob(·) is the response probability. α is the intercept, x_i^c is the row vector of control variables, β^c is the corresponding column vector of coefficients, and ε_i is the error term. a to e denominate dummy variables (= 0 in the base case), with:

a_i = 1 if i is classified as a potential tradesman.
b_i = 1 if i is observed after the 1994 reform and before the 1999 reform.
c_i = 1 if i's self-employment income is above the threshold defined in 1994.
d_i = 1 if i is observed after the 1999 reform.
e_i = 1 if i's self-employment income is above the threshold defined in 1999.

The second-level interactions control for differences in the behaviour of the treatment and control groups that are independent of the tax reforms studied. The coefficients of the double

interactions with *b* and *d* capture reform-independent differential time trends that affect all tradesmen or all high-income individuals, and the other double interactions control for time-invariant differences between potential high-income tradesmen and other people. The coefficient of the third-level interaction d_7, is the DDD estimate of the impact of the 1994 reform. It captures the effect of the 1994 reform on the response probability of the treated, i.e. potential tradesmen with income above the 1994 threshold. To measure the impact of the 1999 reform as well, I include *d* and *e* and their interactions. d_{13} is the DDD estimate of the *cumulative* effect of the 1994 and the 1999 reforms, because *b* is defined as 1 in the period after the 1994 and before the 1999 reform only (see section 3.3.1). d_{13} represents the change in the response probability of potential tradesmen with income above the (lower) 1999 threshold after both reforms.

Two examples shall illustrate how the DDD method controls for contemporaneous shocks. First, one might assume that the risk-taking behaviour between liberal professionals and tradesmen may differ, and that this may have triggered a different reaction of potential liberal professionals to the reform. This would be captured by the coefficient of the interaction of *a (potential tradesman)* and the post-reform dummy, and thus not bias the DDD estimator. Second, one might suspect that the more restrictive rules for the determination of taxable profits introduced together with the second reform (see section 3.2) primarily affected enterprises with higher profits. As all potential self-employed persons with high income would be affected, the effect would be picked up by the coefficient of the interaction of the dummy variables *e (income above threshold 1999)* and *d (after 1999 reform)*.[36] Again, the DDD estimator would not be biased.

The full effect of the reforms on the probability of being self-employed can only be measured if the self-employment rate reaches its new equilibrium level sufficiently fast. Even though the observation period covers 11 years, and the period after the first reform still covers 7 years, it is possible that the self-employment rate adjusts too slowly to capture the full static effect of the reforms, especially considering that only 2 years are observed after the second reform. In contrast the flows into and out of self-employment can be expected to adjust rather quickly. This should show up in the estimates of the impact of the reforms on the probability of entry and exit. In the exit model, the population comprises the stock of self-employed

[36] If not only high but also low income self-employed were affected, the effect would be captured by the coefficient of the *d (after 1999 reform)* dummy variable alone.

people in a given year, which allows using actual income to determine if an individual's self-employment income is above the income threshold. In the entry model, the population comprises the stock of dependently employed people, the unemployed and those not participating in the labour market. Apart from that, the econometric framework of the transition models is the same as that of the static model; only the outcome variable is replaced by a respective transition indicator. Using the microcensus, I can only analyse the effect of the second reform on exits and entries, because information about the employment status in the year before the interview was not provided before 1996 (see section 3.3.1).

Instead of the linear probability model given above for illustration, a binary logit model is a more suitable specification for a model of the probability of being self-employed (and of the transitions). In the following, I therefore estimate models of the following form:

$$\text{Prob}\left(y_i = 1 \middle| x_i\right) = \frac{\exp(x_i b)}{1+\exp(x_i b)}. \tag{3.2}$$

The row vector x_i is comprised of the DDD dummy variables a_i-e_i and their interactions as described in the previous section and the control variables x_i^c.

As the logit model is nonlinear, the coefficients do not represent the marginal effects of the variables. Thus, in contrast to the linear probability model, the coefficient of the DDD triple interaction cannot be interpreted as the treatment effect on the treated. Instead, the effects of the double and triple interactions between the dummy variables have to be calculated as double or triple differences of predicted probabilities, see Ai and Norton (2003). The corresponding standard errors are found by applying the Delta method.

3.5 Results

3.5.1 Estimated Effects of the Tax Reforms

Table 6 reports the estimation results of the logit models describing the probability of being self-employed and the probabilities of entry into and exit out of self-employment. The variables of primary interest are the triple interaction dummy variables which correspond to the DDD estimates of the tax reform effects. For the 1994 tax reform, the relevant interaction variable is *a ´ b ´ c (DDD 1994)*, and for the 1999 reform, it is the variable *a ´ d ´ e (DDD 1999)*. In the probability model of being self-employed, the *a ´ d ´ e (DDD 1999)* variable corresponds to the cumulative effect of both reforms in 1994 and 1999, because the

dummies for the periods after the 1994 and the 1999 reforms are defined consecutively and do not overlap.

The logit coefficient of the *a ´ d ´ e (DDD 1999)* triple interaction and the corresponding triple difference (see below) are positive and highly significant in the model of the probability of being self-employed. This indicates that the two tax rate reductions in 1994 and 1999 together significantly increased the self-employment probability of the treated.[37] Neither the coefficient of the *a ´ b ´ c (DDD 1994)* interaction nor the corresponding triple difference is significant at the 10% level, which indicates that the first reform alone did not have a significant effect.

To find the quantitative effect of the two reforms taken together, I predict probabilities using the estimated model of the probability of being self-employed, and calculate the triple difference corresponding to the *a ´ d ´ e (DDD 1999)* triple interaction (Table 7). The probabilities are predicted at the mean values of the control variables in the sample.[38] The dummy variable *b*, which indicates the period from 1995 to 1999, and its interactions are set equal to zero in all these predictions.

The number at the bottom right of the table is the triple difference, which represents the treatment effect of the two reforms on the treated. For the treatment group, the probability of being self-employed rose by 0.79 percentage points due to the reforms. This estimated effect is statistically significant, with a standard error of 0.34 (*p*-value 0.019). To calculate the effect of the second reform alone, formally one would have to subtract the effect of the first reform from this triple difference corresponding to the *a ´ d ´ e (DDD 1999)* triple interaction. As the triple difference corresponding to the *a ´ b ´ c (DDD 1994)* interaction is insignificant, we may attribute the estimated increase in the self-employment probability to the second reform alone.

[37] The two DDD coefficients for the two reforms are jointly significant (*p*-value 0.0005).
[38] I repeated the calculation taking the average of the predicted probabilities for each individual, which yielded similar results.

Table 6: Logit estimation results of self-employment state and transition probabilities

Model	Prob. of Being Self-Employed	Probability of Entry	Probability of Exit
Cross-sections	**1991-2001**	**1996-2001**	**1996-2001**
a: potential tradesman	-0.9730***	-1.0640***	1.0277***
	(0.0203)	(0.0437)	(0.0803)
1st reform dummies and interactions			
b: after 1994 and before 1999 reform	0.0910***		
	(0.0231)		
c: expected income above threshold 1994	0.3673***		
	(0.0313)		
a × b	-0.1109***		
	(0.0218)		
b × c	0.0472		
	(0.0415)		
a × c	-0.5344***		
	(0.0429)		
a ´ b ´ c (DDD 1994)	-0.0397		
	(0.0625)		
2nd reform dummies and interactions			
d: after 1999 reform	0.2178***	0.0097	0.0179
	(0.0279)	(0.0774)	(0.1316)
e: expected income above threshold 1999	-0.0271	-0.0587	-0.6508***
	(0.0199)	(0.0795)	(0.1752)
a × d	-0.1820***	-0.0060	0.1732
	(0.0279)	(0.0764)	(0.1280)
d × e	-0.0416	0.1793	-0.1746
	(0.0345)	(0.1169)	(0.3080)
a × e	-0.0826***	0.0311	-0.5005**
	(0.0223)	(0.0960)	(0.2004)
a ´ d ´ e (DDD 1999)	0.1408***	-0.1934	-0.0473
	(0.0409)	(0.1483)	(0.3481)
Control variables			
Female	-1.0690***	-0.8304***	0.4675***
	(0.0071)	(0.0278)	(0.0355)
Eastern Germany	-0.3647***	-0.3448***	-0.1509***
	(0.0077)	(0.0320)	(0.0427)
Age	0.2566***	0.1614***	-0.2248***
	(0.0021)	(0.0090)	(0.0120)
Age squared	-0.0027***	-0.0019***	0.0023***
	(0.0000)	(0.0001)	(0.0001)
Secondary schooling (low/no degree)			
missing	0.2555***	0.3978***	-0.6026***
	(0.0190)	(0.0790)	(0.1408)
university entrance qualification	0.5965***	0.6463***	-0.3508***
	(0.0112)	(0.0465)	(0.0611)
medium qualification	0.3614***	0.3632***	-0.2960***
	(0.0079)	(0.0330)	(0.0404)
Professional qual.(apprenticeship or less)			
missing	0.3510***	0.4848***	-0.1285
	(0.0168)	(0.0670)	(0.1067)
master craftsman	1.1783***	0.7842***	-0.8125***
	(0.0084)	(0.0383)	(0.0530)
advanced technical college	0.3116***	0.2240***	0.1536**
	(0.0135)	(0.0542)	(0.0710)
university	0.6296***	0.4564***	-0.0498
	(0.0133)	(0.0540)	(0.0748)
German	0.0800***	-0.0778	-0.1106*
	(0.0124)	(0.0479)	(0.0642)
			continued ./.

Table 6 continued

Model	Prob. of Being Self-Employed	Probability of Entry	Probability of Exit
Cross-sections	**1991-2001**	**1996-2001**	**1996-2001**
Children under 18 in household	0.0363***	0.0129	0.0142
	(0.0035)	(0.0145)	(0.0194)
Married	-0.3072***	-0.5914	0.4452
	(0.1002)	(0.4510)	(0.4545)
Spouse's income in €1000/month	0.0645***	0.0721***	-0.0167
	(0.0031)	(0.0121)	(0.0198)
Spouse's working status (no working)			
unmarried, missing	0.2932***	-0.0899	-0.1561
	(0.1003)	(0.4521)	(0.4545)
working	0.5904***	0.4293***	-0.8706***
	(0.0091)	(0.0381)	(0.0444)
Other household income in €1000/month	0.0268***	0.0114	0.0141
	(0.0025)	(0.0121)	(0.0138)
City size (population ≤ 20,000)			
20,000-500,000	-0.1871***	-0.0052	0.1089***
	(0.0062)	(0.0260)	(0.0359)
> 500,000	0.0336***	0.1522***	0.2300***
	(0.0081)	(0.0341)	(0.0473)
Year dummies	YES	YES	YES
Constant	-7.8859***	-6.4311***	2.6725***
	(0.1122)	(0.4880)	(0.5287)
Wald χ^2	142978.32	6766.83	2543.70
Log likelihood	-494004.23	-38645.68	-13209.98
Number of observations	2475034	662617	40289

Base categories for dummy variables are given in parentheses. Heteroscedasticity robust standard errors in parenthesis below the logit coefficients. Stars (* / ** / ***) indicate significance of the logit coefficients at the 10% / 5% / 1% level. Source: Own calculations based on the scientific use file of the German microcensus.

Table 7: Probabilities of being self-employed (in %) – triple difference calculation

Before the Reforms

Potential...	High-Income		Low-Income		Difference	
Tradesmen	3.40	(0.05)	3.77	(0.04)	-0.38	(0.05)
Freelancers	9.18	(0.21)	9.40	(0.18)	-0.23	(0.17)
Difference	-5.78	(0.20)	-5.63	(0.17)	-0.15	(0.17)

After the Reforms

Potential...	High-Income		Low-Income		Difference	
Tradesmen	3.87	(0.07)	3.91	(0.04)	-0.04	(0.07)
Freelancers	10.75	(0.26)	11.43	(0.20)	-0.68	(0.31)
Difference	-6.89	(0.26)	-7.52	(0.19)	0.64	(0.32)

Difference Between After and Before the Reforms

Potential...	High-Income		Low-Income		Diff.-in-Diff.	
Tradesmen	0.47	(0.08)	0.13	(0.05)	0.34	(0.08)
Freelancers	1.58	(0.29)	2.03	(0.26)	-0.45	(0.33)
Diff.-in-Diff.	-1.11	(0.29)	-1.89	(0.25)	**0.79**	(0.34)

Standard errors calculated by the Delta method are in parenthesis. The bold number is the diff.-in-diff.-in-diff.. Source: Own calcul. based on the German microcensus (1991-2001).

The magnitude of the effect is not only statistically, but also economically significant. In the absence of the reforms, the probability of being self-employed for potential high-income tradesmen in the period after the reforms would have been 3.87 % - 0.79 % = 3.08 %. Thus, in relative terms the estimated causal effect of the reforms is a 25.6 % higher self-employment probability for the treatment group. As the marginal tax rate for the treatment group was reduced from 53 % to 43 % in the observation period, which is a relative reduction of 18.9 %, the estimated elasticity of the self-employment probability with respect to the marginal tax rate is -1.36. Given an estimated standard error of 0.72, it is significant at the 10 % level (*p*-value 0.061).

This result is in line with the conceptually similar study of Moore (2004), who exploits tax reforms of 1986 and 1993 in the USA as natural experiments using repeated cross-section data. Although not consistently significant with respect to alternative specifications, the results of Moore (2004) imply an even larger negative elasticity. Compared to other studies, the elasticity found in this chapter appears rather large, especially taking into account that the recent literature sometimes reports insignificant effects (see Schuetze and Bruce 2004; Parker 2003), and older literature often even implies positive elasticities (e.g. Long 1982a and 1982b; Schuetze 2000). The different findings can be explained by the fact that most of these studies analyse tax rate changes that apply both to self-employed and dependently employed people, while the tax cuts analysed here exclusively benefit the self-employed. Studies finding positive effects of tax rates on self-employment suggest general tax rate increases may make self-employment more attractive relative to wage work due to better avoidance and evasion opportunities. However, this argument does not apply for a differential tax treatment of the self-employed as analysed here.

In the models of entry into and exit out of self-employment, the coefficients of the *a ´ d ´ e (DDD 1999)* triple interaction are not significant (Table 6). As mentioned before, the information contained in the cross-sections before 1996 does not allow analysing transitions, so I can only estimate the effect of the second reform alone. The estimated causal effect of the second reform on the probability of exit in the treatment group, which is calculated as a triple difference again (Table A 6 in the Appendix), is -1.89 percentage points. The negative sign of the triple difference in the analysis of exits is consistent with the result from the self-employment probability model: The increase of the self-employment probability for the treatment group may be explained by a lower exit probability. The effect is

economically significant, although it just fails statistical significance at the 10 % level, given an estimated standard error of 1.18 (p-value = 0.108).

The triple difference in the entry model is -0.41 percentage points (see Table A 5 in the Appendix), with a standard error of 0.27. It is not significant at the 10 %-level (p-value 0.128). Even though the hypothesis that the second reform had no impact on the probability of entry into self-employment cannot be rejected, the negative point estimate challenges the finding that the tax cuts increased the probability of self-employment. This may still hold true if the higher self-employment probability is driven by a lower exit rate. As the triple difference in the exit model is only somewhat more significant than the triple difference in the entry model, the results from the transition models must certainly be interpreted with caution.

3.5.2 Specification and Sensitivity Tests

In this section, I test the robustness of the results, starting with the validity of the assumptions underlying the DDD identification approach (see section 3.4). While these cannot be tested directly, I can check if influences were present immediately prior to the reforms which exclusively affected the treatment group. If so, it seems likely that this influence was also present during and after the reforms, which would make it impossible to separate out the effects of the reforms. To check this, placebo tests are employed. The idea of placebo tests is to define the DDD dummy variables as if the reform had taken place in a year prior to the true reform already. The years after the respective reform are excluded to avoid measuring the effect of the true reform. For the first placebo tests, I use two years before the reform 1994 (as the microcensus does not provide a cross-section for 1994), and for the second test, I use the year prior to the reform in 1999 (excluding the years before the 1994 reform from the sample to avoid measuring its effect). Table A 7 in the Appendix shows that the DDD coefficients are insignificant in both placebo tests. The corresponding triple differences are also insignificant. If confounding factors on the treatment group other than the true reforms were present, the coefficient of the DDD interaction variables would pick up that effect in these placebo tests. Hence, the results of the tests support the validity of the identifying assumption of the DDD analysis.

It is still possible that a differential time trend between the self-employment rates in the treatment and control groups exists in other years which I have not included in the placebo tests. This is tested by including a time trend in the self-employment probability model and interacting it with the dummy variables which indicate potential tradesmen and people with

expected income above the threshold. Again, the coefficient of the triple interaction would pick up a differential time trend.[39] I only use the years between the first and the second reform; otherwise the triple interaction with the time trend would measure the effects of the reforms.[40] Table A 8 shows that the coefficient of the time trend's triple interaction is insignificant; the corresponding triple difference is also insignificant. This is further support for the absence of reform-independent differential time trends between the treatment and the control groups and thus for the identifying assumption.

Another specification check concerns the definition of treatment and control groups. As described in section 3.3.2, the tax reforms only applied to tradesmen with income above certain thresholds defined by the tax law. In the primary analysis, I used individually estimated expected income from self-employment to determine if somebody is affected by the reform. Future entrepreneurial income is uncertain, however, and individuals may hope that there is a certain probability of achieving an income above the threshold even if the point estimate of their expected income lies below. To account for this possibility, I check if the results of this analysis change if I assume that people with expected lower income also conclude that the tax reforms are relevant to them. The robustness test consists in defining lower income thresholds to distinguish between treatment and control groups and re-estimating the probability model of being self-employed. The thresholds are reduced by 15 % (model A) and, alternatively, by 30 % (model B) of the standard deviation of real gross income per year in the sample, which is €14,063. In model A (model B), the share of people with expected self-employment income above the threshold assigned to the 1994 reform increases from 1.27 % to 1.72 % (2.31 %), and of those above the 1999 threshold from 6.21 % to 8.35 % (11.02 %).

Table A 9 provides the results of these tests. They show that the significance of the triple interactions is sensitive to the threshold, but only if the threshold is decreased substantially. In model A, the logit coefficient of the triple interaction *a ´ b ´ c (DDD 1994)* is negative and

[39] The identifying assumption states that, in the absence of the reforms, the difference between the time trends in the self-employment rates of the potential high-income and low-income tradesmen would be the same as the difference between the time trends of the potential high-income and low-income liberal professionals. If this assumption holds, the coefficient of the triple interaction term is zero, because a difference in the time trends between the high-income and low-income self-employed would already be captured by the coefficient of the double interaction between the *time trend* and *c (expected income above threshold)*; the additional information that someone is a potential tradesman would not be informative with respect to the self-employment rate.

[40] A time trend tests before the first reform is equivalent to the first pre-reform test, and a time trend test after the second reform would also only cover two cross-sections and would be likely to pick up a delayed effect of the second reform.

insignificant, and the coefficient of *a ´ d ´ e (DDD 1999)* is positive and significant, as in the main estimation. The estimated triple difference corresponding to *a ´ d ´ e (DDD 1999)*, which represents the effect of the two tax reforms together, is 0.38 percentage points. This is smaller than the result from the main estimation (0.79 percentage points). The result is consistent with a weaker response, or no response at all, of individuals with expected income up to 15 % below the threshold set in the tax law, in comparison to those with expected income above it. In model B the coefficients of both triple interactions are insignificant. As in this model additional people with expected income even further below the threshold are assigned to the treatment group, the insignificant average effect on this group gives some support to the original assumption that those sufficiently below the threshold did not respond to the reforms.

Finally, the sensitivity of the results to the modelling of income taxation was checked. The function used to calculate gross income from estimated net income does not account for joint taxation of married couples (see section 3.3.2). For the main beneficiaries of German income splitting, i.e. married bread-winners whose spouse earns substantially less or nothing, gross income will thus be overestimated. Thus, both for tradesmen and liberal professionals, too many people tend to be assigned to the high-income group. To test the robustness of the results, I repeat the estimation of the probability of being self-employed using the sub-sample of the unmarried only, without the variables indicating the spouse's employment status and income. In this estimation, the logit coefficients of the triple interactions were positive and significant for both reforms. The triple differences, which were also significant, were 3.43 for the first and 1.34 percentage points for the second reform. This confirms the general result that the tax cuts increased the probability of self-employment. It also indicates that the response of unmarried people in the treatment group to the reforms was substantially stronger than that of the whole population, perhaps because of their younger average age and greater flexibility.

3.6 Hazards of Entry and Exit

3.6.1 Technical Limitations with Cross-Sectional Data

So far, I have estimated the probability of being self-employed and the probabilities of entry into and exit out of self-employment based on the microcensus. Due to the limitations of

cross-sectional data, the empirical models require several rather strong assumptions. The probability of being self-employed in *t* is assumed to be independent of the initial condition, i.e. the employment state in *t*-1 (dependent employment, self-employment or unemployment/ inactivity). Furthermore, it is likely that the probability of being self-employed not only depends on the employment state in *t*-1, but also on further lags of the dependent variable. Likewise, the probability of entry into self-employment probably depends on the spell duration in dependent employment or unemployment/inactivity, and the probability of exit depends on the duration of the self-employment spell. As the microcensus does not provide information about the duration of the current spell, one is forced to ignore this state dependence, which may lead to omitted variables bias.

A consistent way to control for the effect of the spell duration is the application of hazard rate models. Survival analysis has been applied to study entrepreneurial choice (Evans and Leighton 1989; Taylor 1999), but these studies did not consider the impact of taxes. Schuetze and Bruce (2004) pointed out that ignoring the survival of self-employed ventures has been a significant shortcoming of the existing tax related literature. Thus, in this section I re-estimate the effect of the two tax reforms on self-employment using hazard rate models. Econometrically, I account both for right- and left-censored spells and control for unobserved heterogeneity.

3.6.2 Application of Panel Data

As the microcensus does not include information about the duration in the current spell, a different dataset has to be employed for the estimation of hazard rate models. Thus, this analysis is based on the German Socio-economic Panel (SOEP) provided by the German Institute for Economic Research (DIW Berlin). It is a representative yearly panel survey containing detailed information about the socio-economic situation of about 5 to 12 thousand households in Germany and the individuals living in these households.[41] In comparison to the microcensus, the disadvantage of the SOEP is the considerably smaller number of observations, which may lead to rather imprecise estimation results. To include as many observations as possible, I draw on 18 waves from 1984 (the first wave available) to 2001. From 1984 to 1991 only observations in western Germany are included (which I control for by a dummy variable).

[41] For a description of the SOEP see Wagner *et al.* (2007).

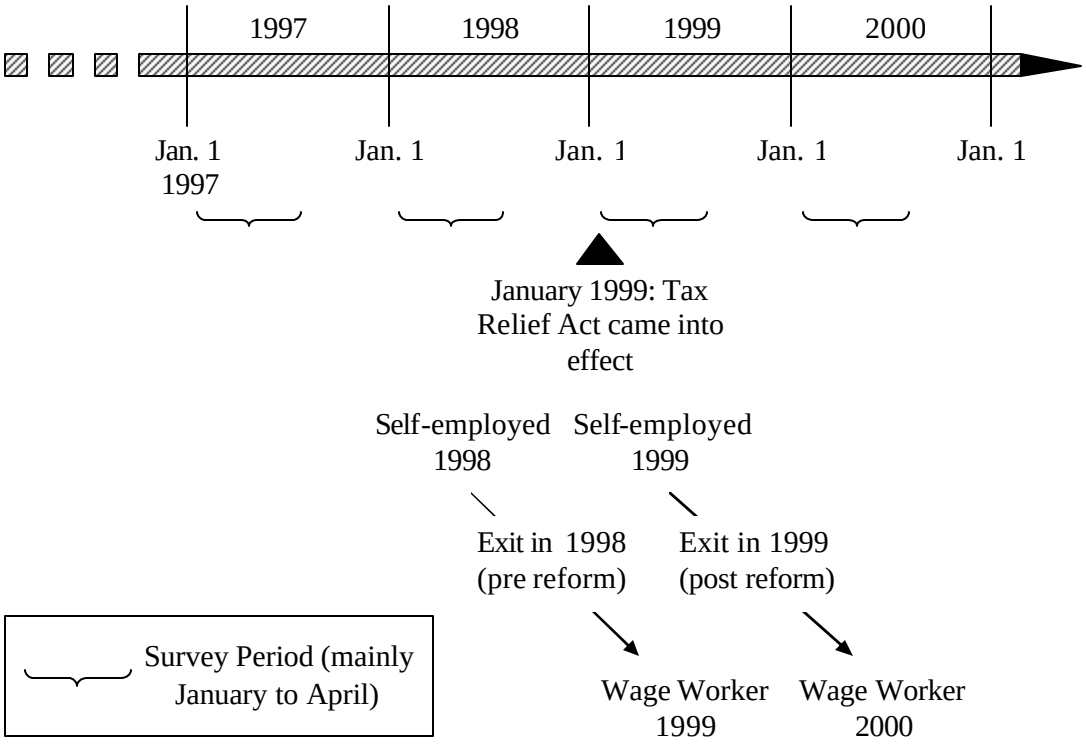
The panel structure of the SOEP allows tracking individuals over time and observing their spells in a certain employment status. This makes it possible to model the hazard of changing the employment state (e.g. leaving self-employment) controlling for duration dependence. The SOEP also includes retrospective questions about a respondent's age at his or her most recent occupational change and the age at the first job. This allows recovering the duration of employment spells that had begun before the respondent first entered the panel, and thus accounting for left-censoring. Moreover, the SOEP provides a rich variety of control variables. In particular, retrospective questions about the individual employment history enable me to calculate a respondents' lifetime work and unemployment experience. Information on the average monthly gross income from self-employment and from dependent employment in year t is obtained from retrospective questions in the consequent wave $t+1$.

The sample is defined in the same way as described in section 3.3.1 with regard to age and occupations. In the SOEP, a transition between employment states can be identified when the same individual is observed over two consecutive years t and $t+1$, and in $t+1$, the individual has a different employment status than in t. 97 % of the interviews for the SOEP are carried out from January to July, with 80 % being conducted during the first quarter of the year. Thus, it is more likely that the transition actually occurred in t, and I set a transition dummy equal to one in year t (see Figure 4). With the same considerations as in section 3.3.1, all observations from 1994 to 1998 are marked with a "post-1994, pre-1999 reform" dummy, and all observations from 1999 onward are marked with a "post 1999 reform" dummy. The last year I include is 2000 to rule out a distortion of the estimation results by the Tax Reduction Act 2000.

The distinction between tradesmen and liberal professionals is simple in the analysis of self-employment spells using the SOEP data, because self-employed individuals are classified as liberal professionals or "other self-employed" individuals here. As farmers were excluded, I can classify "other self-employed" as tradesmen. [42] For the estimation of the entry model, I classify dependently employed and not working individuals into "potential tradesmen" or "potential liberal professionals" based on the professions reported, as described in section 3.3.2 (see Table A 1).

[42] To be precise, in the German tax legislation it is also possible to be self-employed without being tradesman, liberal professional, or farmer, e.g. private asset managers and executors of a will. These infrequent professions are not coded in the SOEP, however, and because of their small number, they are negligible in this analysis.

Figure 4: SOEP sample construction (examples)



With regard to income information, the SOEP does not have the limitations of the microcensus, where only net income is available, undifferentiated by sources, and only as a categorical variable. The SOEP provides gross income from self-employment in the year prior to the interview as a continuous variable. Using this information, I estimate Mincer-type earnings equations for *t*-1 analogously to what is described in section 3.3.2. As explanatory variables, I include education dummies, age and its square, dummies indicating marital status, number of children, lifetime experience in full-time and part-time employment and unemployment, the duration of the self-employment spell and its square, and regional, firm size and industry dummies. The estimated earnings equations allow predicting gross income from self-employment for those who are not self-employed and determining if incomes are above or below the income thresholds. Incomes and thresholds are deflated using the Consumer Price Index.

Table A 10 in the Appendix presents descriptive statistics for the treatment group "tradesmen with income above the 1999 threshold" and the control groups "tradesmen with lower income" and "liberal professionals". To get a picture of the characteristics of the actually self-employed tradesmen and liberal professionals, I base this analysis on the sub-

sample of the self-employed. In contrast to the microcensus, the SOEP explicitly distinguishes between self-employed tradesmen and liberal professionals, so it is not necessary to derive the group assignment from the profession reported. The table confirms the pattern found earlier. Women are rare in the group of tradesmen with an income above the threshold, and liberal professionals are more academic then tradesmen. The mean self-employment rate in the sample is 6.16 %, the mean annual rate of entry is 1.31 % of the employed or not working population, and the mean annual exit rate is 12.47 % of the self-employed (all means reported are weighted).

3.6.3 Hazard Rate Models

Completely analogously to the analysis with the microcensus, the effects of the two tax reforms in 1994 and 1999 are identified using the difference-in-difference-in-difference method (see section 3.4). The difference here is that I employ this technique within hazard rate models to explain the transitions into and out of self-employment. This allows estimating the probability of a transition conditional on the duration of the current spell in self-employment, employment or unemployment/inactivity.

Conceptually, the duration of these spells can be any integer number of days. I use yearly data, because interviews are conducted once a year and the covariates are not available on higher frequency. As the hazard rate is still small even in intervals of a year (see section 3.6.2), a discrete time logistic hazard model based on years can be interpreted as an approximation for an underlying continuous time model in which the within-year durations follow a log-logistic distribution (Sueyoshi 1995).

Exit from self-employment and entry into self-employment are modelled analogously; in the following, a spell refers to a self-employment spell in the exit model and to an employment or unemployment/inactive spell in the entry model. Individuals can experience multiple spells in the observation period. The discrete non-negative random variable T_{ik} describes the duration of the k-th spell of individual i. When a spell terminates in year t (measured from the beginning of the spell), T_{ik} takes on the value $T_{ik} = t$. The hazard rate $l_{ik}(t)$ is defined as the probability that spell k of person i ends in period t, i.e. a transition occurs[43], conditional on survival until the beginning of t:

[43] In the entry model, a transition from employment to unemployment/inactivity or vice versa is treated as censored, because only transitions to self-employment are of interest here.

$$l_{ik}\left(t\middle|X_i(t),e\right)=P\left(T_{ik}=t\middle|T_{ik}\geq t,\ X_i(t),e\right). \tag{3.3}$$

where $X_i(t)$ is a vector of characteristics of individual i in interval t, including the DDD dummy variables *a-e* and their interactions as described in section 3.4, and ε is a time-invariant individual effect, the specification of which is described below.

The probability of remaining in the current spell ("survival") in period t, conditional on having survived until the beginning of t, is the complementary probability

$$P\left(T_{ik}>t\middle|T_{ik}\geq t,\ X_i(t),e\right)=1-l_{ik}\left(t\middle|X_i(t),e\right). \tag{3.4}$$

The survivor function, which gives the *unconditional* probability of remaining in the current spell until the end of period t, can be written as the product of the survival probabilities in all periods before and in t:

$$S\left(t\middle|X_i,e\right)=P\left(T_{ik}>t\middle|X_i,e\right)=\prod_{t=1}^{t}\left(1-l_{ik}\left(t\middle|X_i(t),e\right)\right). \tag{3.5}$$

Consequently, the unconditional probability of a transition in period t is the probability of survival until the beginning of period t multiplied by the hazard rate in period t:

$$P\left(T_{ik}=t\middle|X_i,e\right)=l_{ik}\left(t\middle|X_i(t),e\right)\prod_{t=1}^{t-1}\left(1-l_{ik}\left(t\middle|X_i(t),e\right)\right). \tag{3.6}$$

I employ the maximum likelihood method to estimate the model, which allows consistently taking into account completed spells as well as both left-censored and right-censored spells in the estimation. For a fully observed spell completed with a transition into or out of self-employment (in the entry or exit model, respectively), the contribution to the likelihood function is given by equation (3.6). For a right-censored spell the likelihood contribution is given by the survivor function (3.5), because it is only known that a person "survived" till the end of the observation period, but not when the spell will end. Combining these two cases, the likelihood contribution of a spell k of an individual i can be written as

$$L_{ik}^{\,notleft-censored}\left(\,param.\middle|c_i,X_i,e\right)=\left[\frac{l_{ik}\left(t_{ik}\middle|X_i(t_{ik}),e\right)}{1-l_{ik}\left(t_{ik}\middle|X_i(t_{ik}),e\right)}\right]^{c_{ik}}\prod_{t=1}^{t_{ik}}\left(1-l_{ik}\left(t\middle|X_i(t),e\right)\right) \tag{3.7}$$

where c_{ik} is a censoring indicator defined such that c_{ik} = 1 if a spell is completed and c_{ik} = 0 if a spell is right-censored.

If a spell is left-censored in the SOEP, i.e person i enters the panel after spell k has already lasted u_{ik} years, I have to condition on survival up to the end of period u_{ik}, which means dividing expression (3.7) by $S(u_{ik})$. Then the likelihood contribution of the spell is

$$L_{ik}\left(parameters\middle|c_i, X_i, e\right) = \left[\frac{l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}{1-l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}\right]^{c_{ik}} \frac{\prod_{t=1}^{t_{ik}}\left(1-l_{ik}\left(t\middle|X_i(t), e\right)\right)}{\prod_{t=1}^{u_{ik}}\left(1-l_{ik}\left(t\middle|X_i(t), e\right)\right)} \tag{3.8}$$

$$= \left[\frac{l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}{1-l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}\right]^{c_{ik}} \prod_{t=u_{ik}+1}^{t_{ik}}\left(1-l_{ik}\left(t\middle|X_i(t), e\right)\right)$$

Note that this more general notation includes equation (3.7) for spells that are not left-censored (u_{ik}=0). In the SOEP, the retrospective employment history questions enable me to recover u_{ik} for self-employment and employment spells, so left-censoring can be dealt with.[44]

The overall likelihood contribution of an individual i is the product of the likelihood contributions of the K_i spells the person experienced in the observation period, and the sample likelihood function is given by the product of the individual likelihood contributions:

$$L\left(parameters\middle|c, X, e\right) = \prod_{i=1}^{N}\prod_{k=1}^{K_i} L_{ik} \tag{3.9}$$

The log-likelihood function is

$$\begin{aligned}\log L\left(parameters\middle|c, X, e\right) &= \sum_{i=1}^{N}\sum_{k=1}^{K_i}\log L_{ik} \\ &= \sum_{i=1}^{N}\sum_{k=1}^{K_i} c_{ik}\log\left[\frac{l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}{1-l_{ik}\left(t_{ik}\middle|X_i(t_{ik}), e\right)}\right] + \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{t=u_{ik}+1}^{t_{ik}}\log\left[1-l_{ik}\left(t\middle|X_i(t), e\right)\right]\end{aligned} \tag{3.10}$$

I define a new binary indicator variable y_{ikt} = 1 if person i completes spell k in period t, and y_{ikt} = 0 otherwise. The y_{ikt} correspond to the transition dummy variables introduced in section 3.6.2. Effectively adding some zeros to the sum, it can be written

$$\begin{aligned}&\log L\left(parameters\middle|y, X, e\right) \\ &= \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{t=u_{ik}+1}^{t_{ik}} y_{ikt}\log\left[\frac{l_{ik}\left(t\middle|X_i(t), e\right)}{1-l_{ik}\left(t\middle|X_i(t), e\right)}\right] + \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{t=u_{ik}+1}^{t_{ik}}\log\left[1-l_{ik}\left(t\middle|X_i(t), e\right)\right] \\ &= \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{t=u_{ik}+1}^{t_{ik}}\left(y_{ikt}\log\left[l_{ik}\left(t\middle|X_i(t), e\right)\right] + (1-y_{ikt})\log\left[1-l_{ik}\left(t\middle|X_i(t), e\right)\right]\right)\end{aligned} \tag{3.11}$$

[44] For unemployment spells, however, I do not observe how much time the unemployment period has lasted if a person is already unemployed when first entering the panel, so here a potential left-censoring problem remains. The unemployment spell is assumed to start with entry into the panel in these cases. Moreover, if a person switched jobs within dependent employment or self-employment before entering the panel, the only information available is the time passed since the job change, but not the duration of the overall spell in dependent employment or self-employment, respectively. It must be assumed such job changes without changing the employment state did not occur in the partially observed spells before entering the panel.

The last expression has exactly the same form as the standard likelihood function for a binary regression model in which y_{ikt} is the dependent variable and in which the data is organised in person-period format. This derivation represents a generalisation of the "easy estimation method" available for discrete time hazard models (see Jenkins 1995) with respect to multiple spell data.

Even conditional on the explanatory variables, all observations for a given individual, both within and between spells, can be expected to be correlated due to the individual effect e, which represents the unobserved heterogeneity in the population that is not controlled for by the included control variables. This unobserved heterogeneity could, for example, relate to the ability to be an entrepreneur, attitude towards risk and the motivation to be independent. I specify the individual effect e in a nonparametric way and assume an arbitrary discrete probability distribution with a small number M of mass points e_m with the probabilities $P(e_m)$ (cf. Heckman and Singer, 1984, and Steiner, 2001). Here, $M = 2$ mass points are assumed for each model.[45] The following conditions have to be satisfied:

$$\begin{aligned} &E(e) = \sum_{m=1}^{M} P(e_m) e_m = 0 \quad \text{(zero expected value assumption);} \\ &\sum_{m=1}^{M} P(e_m) = 1 \qquad \text{(probabilities sum up to unity);} \\ &E(eX) = 0 \qquad \text{(indiv. effect is uncorrelated with explanatory variables).} \end{aligned} \tag{3.12}$$

The mass points e_m and their probabilities $P(e_m)$ are estimated jointly with the parameters of the model by adjusting the likelihood function:

$$\begin{aligned} &L\left(parameters \middle| y, X\right) = \\ &\prod_{i=1}^{N} \sum_{m=1}^{M} P(e_m) \prod_{k=1}^{K_i} \prod_{t=u_{ik}+1}^{t_{ik}} \left(\left[l_{ik}\left(t \middle| X_i(t), e_m\right) \right]^{y_{ikt}} \left[1 - l_{ik}\left(t \middle| X_i(t), e_m\right) \right]^{(1-y_{ikt})} \right) \end{aligned} \tag{3.13}$$

The maximum likelihood function is valid under the assumption that all observations are independent conditional on the explanatory variables and the individual effect.

The functional form of the hazard rate is specified as a logistic hazard model. As mentioned before, this model is consistent with an underlying continuous time model in which the within-interval durations follow a log-logistic distribution. The hazard rate is specified as

[45] The models did not converge with $M = 3$ mass points, which indicates that the data does not identify more than 2 mass points.

$$l_{ik}\left(t \middle| X_i(t), e\right) = \frac{\exp\left(f(t) + X_i(t)b + e\right)}{1 + \exp\left(f(t) + X_i(t)b + e\right)}, \tag{3.14}$$

where the function $f(t)$ represents the dependence of the hazard rate on the spell duration (baseline hazard) and is specified as a polynomial function of the third degree. Given the logit specification of the hazard rate, the likelihood function (3.14) can be maximised with respect to the coefficients of the baseline hazard and of the explanatory variables, and to the mass points and their respective probabilities, subject to the constraints on the individual effects, by standard numerical optimisation procedures.[46]

In the model of entry into self-employment, the current spell of an individual at risk may be dependent employment or unemployment/inactivity. Thus, in the entry model, a dummy variable *empl* is included in *X*. A value of one indicates that the individual is currently dependently employed; "unemployment/inactivity" is the base category. The *empl* dummy is interacted with the spell duration (and its square and cube) to allow for different baseline hazards of entry into self-employment for the two different spell types.

Due to different sample designs in the SOEP and the microcensus, some of the control variables included in *X* are defined differently in the two datasets, and some variables are only included in one of the datasets; see Table A 11 in the Appendix for a list of the chosen explanatory variables from the SOEP and their exact definitions. In the SOEP, I include additional variables representing full time and part time work experience and unemployment experience in years and their square terms. By including this information, I account for the view that one accumulates human capital through work experience, while unemployment experience might devaluate it. These effects might have a different impact on self-employment than on dependent employment.

3.6.4 Results

Table 8 reports the estimation results of the two transition models based on the SOEP – the probability model of entry into self-employment and that of exit from self-employment. The table shows the logit coefficients and the marginal effects, estimated at the sample means, with their robust standard errors. The marginal effects indicate the change in the estimated probabilities in percentage points ("0.01" in the table means "1 %"), given an increase of the corresponding explanatory variable by one unit if the variable is measured on a metric scale;

[46] I use the Stata programme gllamm version 2.3.10. for the estimations. A description of gllamm is provided by Rabe-Hesketh and Skrondal (2004).

for dummy variables, the "marginal" effects measure the probability change corresponding to a discrete switch of the variable from zero to one.[47]

The variables of primary interest are the interaction dummy variables which correspond to the DDD estimates of the tax reform effects. For the 1994 tax reform, the relevant interaction variable is *a x b x c (DDD 94)*, and for the 1999 reform, it is the variable *a x d x e (DDD 99)*. The coefficient of the *a x d x e (DDD 99)* variable represents the cumulative effect of both the 1994 and the 1999 reforms, because the dummy variables for the periods after the 1994 and the 1999 reforms are defined consecutively and do not overlap (cf. section 3.5.1).

Neither in the entry nor in the exit model are any of the coefficients of the DDD variables significant at the 10 % level. The two DDD coefficients corresponding to the reforms in 1994 and 1999 are not jointly significant either (*p*-value 46 %). Based on the analysis using the SOEP, the null hypothesis, which states that the two tax reforms had no effect on the entry rate or the exit rate of those affected by the reforms, cannot be rejected. The standard errors are large, so it is well possible that the significance tests fail not because the true effects are zero, but due to the relatively small sample size; especially the number of transitions per year in the treatment group is small. This interpretation is supported by the estimation results of the probability model of being self-employed using the much larger microcensus, which yielded significant results (see section 3.5).

Other variables are found to be significant determinants of entrepreneurial choice. Key variables in the hazard rate models are those related to the duration of the spell in the current employment state. In the model of exit from self-employment, the coefficient of the *duration* variable is negative and significant and that of its square term *dur_sq* is positive and significant, indicating that the hazard of exit first decreases with the duration of the self-employment spell and later increases. In the model of entry into self-employment, the coefficient of the *duration* variable is negative and significant again. The dummy indicating that the individual at risk is dependently employed (*empl*) and its interaction with *duration*, *dur_e*, are insignificant. Thus, irrespective of whether a spell is an employment or an unemployment/inactivity spell, the more years a person has stayed in a certain state, the less likely he or she is to enter self-employment.

[47] The interaction effects are calculated as double or triple differences, as pointed out in section 3.5.1. The corresponding standard errors are found by applying the Delta method.

Table 8: Self-employment transition probabilities: Logit estimation results and marginal effects (SOEP 1985-2001)

	Probability of Entry		Probability of Exit	
	Logit Coefficient	**Marginal Effect**	**Logit Coefficient**	**Marginal Effect**
a: tradesman[1]	0.222	0.002	-0.261	-0.026
	(0.293)	(0.002)	(0.243)	(0.025)
b: after 94 reform [1]	0.373	0.004	0.437	0.044
	(0.394)	(0.004)	(0.448)	(0.046)
c: threshold 94[1]	-0.005	-0.000	-0.044	-0.004
	(0.419)	(0.004)	(0.961)	(0.092)
a x b[2]	-0.178	-0.002	-0.144	-0.020
	(0.362)	(0.004)	(0.348)	(0.038)
b x c[2]	-0.934	-0.009	-0.329	-0.034
	(0.893)	(0.007)	(1.279)	(0.120)
a x c[2]	0.320	0.004	0.235	0.023
	(0.460)	(0.004)	(1.093)	(0.113)
a x b x c (DDD 94)[2]	0.791	0.006	0.320	0.039
	(0.939)	(0.007)	(1.436)	(0.149)
d: after 99 reform [1]	0.280	0.003	0.594	0.062
	(0.493)	(0.005)	(0.452)	(0.050)
e: threshold 99[1]	0.673	0.008	-2.483	-0.172
	(0.380)	(0.006)	(0.795)**	(0.038)***
a x d[2]	-0.375	-0.004	-0.241	-0.033
	(0.471)	(0.005)	(0.385)	(0.044)
d x e[2]	-0.643	-0.008	-0.155	-0.064
	(0.700)	(0.009)	(1.020)	(0.063)
a x e[2]	-0.692	-0.008	0.826	0.051
	(0.407)	(0.006)	(0.888)	(0.038)
a x d x e (DDD 99)[2]	0.796	0.009	-0.314	0.019
	(0.745)	(0.009)	(1.205)	(0.066)
female[1]	-0.425	-0.004	0.453	0.046
	(0.086)***	(0.001)***	(0.194)*	(0.020)*
east[1]	-0.361	-0.003	-0.533	-0.048
	(0.102)***	(0.001)***	(0.213)*	(0.018)**
highschool[1]	0.252	0.003	-0.324	-0.031
	(0.112)*	(0.001)*	(0.227)	(0.021)
apprenticeship[1]	0.106	0.001	0.102	0.010
	(0.091)	(0.001)	(0.212)	(0.021)
highertechncol[1]	0.424	0.005	-0.337	-0.032
	(0.108)***	(0.001)***	(0.236)	(0.021)
university[1]	0.460	0.005	0.207	0.021
	(0.126)***	(0.002)**	(0.247)	(0.025)
age	0.214	0.002	-0.181	-0.018
	(0.033)***	(0.000)***	(0.073)*	(0.007)*
agesq	-0.003	-0.000	0.002	0.000
	(0.000)***	(0.000)***	(0.001)*	(0.000)*
ftexp10	-0.011	-0.000	-0.508	-0.049
	(0.152)	(0.001)	(0.334)	(0.032)
ftexpsq100	-0.012	-0.000	0.037	0.004
	(0.040)	(0.000)	(0.075)	(0.007)
ptexp10	1.427	0.013	-0.258	-0.025
	(0.278)***	(0.003)***	(0.631)	(0.061)
ptexpsq100	-0.718	-0.007	-0.127	-0.012
	(0.168)***	(0.002)***	(0.316)	(0.031)
unemexp10	0.608	0.006	2.986	0.290
	(0.634)	(0.006)	(1.422)*	(0.139)*
unemexpsq100	-1.450	-0.014	-1.712	-0.166
	(1.008)	(0.009)	(2.075)	(0.202)
disabled [1]	-0.323	-0.003	0.035	0.003
	(0.172)	(0.001)*	(0.465)	(0.046)
				continued ./.

Table 8 continued

	Probability of Entry		Probability of Exit	
	Logit Coefficient	**Marginal Effect**	**Logit Coefficient**	**Marginal Effect**
german[1]	0.039	0.000	-0.105	-0.010
	(0.139)	(0.001)	(0.321)	(0.033)
nchild	0.089	0.001	-0.010	-0.001
	(0.038)*	(0.000)*	(0.090)	(0.009)
married[1]	0.096	0.001	0.227	0.022
	(0.104)	(0.001)	(0.222)	(0.021)
separated[1]	0.566	0.007	0.150	0.015
	(0.217)**	(0.003)*	(0.461)	(0.048)
divorced[1]	-0.055	-0.001	0.466	0.049
	(0.168)	(0.001)	(0.306)	(0.035)
fatherse[1]	0.637	0.008	-0.592	-0.053
	(0.108)***	(0.002)***	(0.206)**	(0.017)**
empl[1]	-0.130	-0.001		
	(0.173)	(0.002)		
duration	-0.411	-0.004	-0.127	-0.012
	(0.126)**	(0.001)***	(0.055)*	(0.005)*
dur_sq	0.038	0.000	0.008	0.001
	(0.021)	(0.000)	(0.004)*	(0.000)*
dur_p3	-0.001	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)
dur_e	0.088	0.001		
	(0.131)	(0.001)		
dur_sq_e	-0.021	-0.000		
	(0.021)	(0.000)		
dur_p3_e	0.001	0.000		
	(0.001)	(0.000)		
_cons	-8.783		2.928	
	(0.671)***		(1.371)*	
ε_1	-0.326	0.004	-0.882	0.054
	(0.077)***	(0.001)***	(0.159)***	(0.009)***
π_1[3]	1.954		0.670	
	(0.263)***		(0.268)*	
ll	-5962.26	-5915.88	-1403.94	-1403.94
N	95970[5]	95970[5]	4103[4]	4103[4]

Heteroscedasticity robust standard errors in parenthesis below the logit coefficients. Year dummies also included, but not shown for brevity. Stars (* / ** / ***) indicate significance of the logit coefficients at the 5% / 1% / 0.1% level.

[1] marginals for discrete change of dummy variable from 0 to 1

[2] marginals are double differences (triple differences, respectively)

[3] log-odd of probability $P(\varepsilon_1)$

[4] currently self-employed individuals

[5] individuals who are not currently self-employed

Source: Own calculations based on the SOEP (1984-2001).

Further important determinants of entrepreneurial choice include age, gender, and education. Everything else equal, higher *age* increases the probability of entry into self-employment (with decreasing marginal rates). The hazard of exit from self-employment is found to decrease with age (again with decreasing absolute margins). Gender effects are also evident and uniform across all models. Everything else equal, women have a lower probability of entry into self-employment and a higher probability of exit. The marginal effects (evaluated at sample means) indicate that the probability of entry is 0.4 percentage points lower for women.

Compared to the average probability of entering self-employment in a given year of 1.31 %, this is a relatively large economic effect. Similarly, holding a *university* degree significantly increases the probability of entry by 0.5 percentage points.

3.7 Summary and Conclusion

In this chapter the impact of taxation on entrepreneurship was analysed by exploiting two German tax reforms in 1994 and 1999/2000 as natural experiments in order to identify their effects on the probability of being self-employed. These legislative changes were implemented to promote small and medium sized enterprises. They reduced the top marginal income tax rates exclusively for self-employed tradesmen, but not for the alternative sector, i.e. wage and salary employment, introducing a differential tax treatment. The tax reforms provided two naturally defined comparison groups which were not affected by the reforms, the so-called liberal professionals and tradesmen with income below a certain threshold defined by the tax law. This enables me to apply a "difference-in-difference-in-difference" estimator to isolate the effect of the reforms, which is more robust than the conventional difference-in-difference technique. As the primary data basis I use repeated cross-sections of the microcensus, the official continuous household survey in Germany. In an extended robustness check, I re-estimate the effects of the reform using the German Socio-Economic Panel, which allows controlling for the duration of the current employment state using hazard rate models.

The results of the primary analysis indicate that the two tax rate reductions in Germany together significantly increased the probability of being self-employment. The estimated causal effect of the two reforms is an increase in the self-employment rate in the treatment group by 0.79 percentage points. In relative terms the estimated treatment effect on the treated is an increase in the self-employment probability by 25.6%. This implies an elasticity of -1.36 with respect to the marginal tax rate. The elasticity is large in comparison with results from the existing literature. This may be explained by the fact that the reforms analysed here did not constitute general tax cuts, but applied specifically to a sub-group of the self-employed.

The supplementary analyses of the probabilities of entries into and exits out of self-employment using the microcensus did not yield significant results, but tentatively suggest

that the increase in the self-employment rate due to the reforms may be triggered by a decrease in the exit rate out of self-employment. Using the SOEP, the estimated effects of the two reforms on the hazards of entry and exit are insignificant due to large standard errors. The number of observations in the panel dataset seems to be too small for a precise estimation of the reforms' effects.

For policy makers who wish to promote entrepreneurship, the results from the primary static estimation may suggest that reduced tax rates for the self-employed may be considered as a suitable policy instrument to meet the intended objective. As the results are still tentative and could not be confirmed by the analysis of transitions at an acceptable significance level, more research is needed to provide clear evidence-based policy advice with regard to taxes and entrepreneurship. A better understanding of the roles played by the expected return and the risk associated with entrepreneurial activity may help clarify how taxation influences entrepreneurship.

3.8 Appendix

Table A 1: Professions classified as liberal professions

Microcensus		SOEP	
Value Number	Profession(s)	ISCO-88 Code	Profession(s)
600	Engineers without further specification	2113	Chemists
603	Civil engineers	2121	Mathematicians and related professionals
604	Cartographers and surveyors	2141	Architects, town and traffic planners
608	Other engineers	2142	Civil engineers
609	Architects	2148	Cartographers and surveyors
611	Chemists and method engineers	2149	Architects, engineers and related professionals not elsewhere classified
753	Accountants and related professionals	2211	Biologists, botanists, zoologists and related professionals
757	Business consultants and related professionals	2221	Medical doctors
813	Legal representatives and advisors	2222	Dentists
821	Publicists	2223	Veterinarians
822	Translators and interpreters	2230	Nursing and midwifery professionals
831	Musicians	2411	Accountants
832	Visual artists and singers	2419	Business professionals not elsewhere classified
833	Artists (fine art)	2421	Lawyers
834	Artists (applied art)	2441	Economists
835	Professions related to stage, image and sound	2444	Philologists, translators and interpreters
837	Photographers and cinematographers	2445	Psychologists
841	Medical doctors	2451	Authors, journalists and other writers
842	Dentists	2452	Sculptors, painters and related artists
843	Veterinarians	2453	Composers, musicians and singers
851	Alternative practitioners	2454	Choreographers and dancers
852	Masseurs, balneotherapists and physiotherapists	2455	Film, stage and related actors and directors
853	Nursing and midwifery professionals	3131	Photographers and image and sound recording equipment operators
863	Educators	3144	Air traffic controllers
875	Teacher of arts	3226	Physiotherapists and related associate professionals
880	Scientists	3232	Midwifery associate professionals
886	Psychologists	3241	Traditional medicine practitioners

Table A 2: Weighted mean characteristics of the self-employed by treatment status

Variable	Unit	Tradesmen With Income Above 1999 Threshold	Tradesmen With Lower Income	Liberal Professionals
Female	%	15.8	31.5	33.1
Eastern Germany	%	10.6	22.9	19.0
Age	years	45.2	43.3	43.9
Secondary school				
university entrance qualification	%	22.3	16.5	68.4
medium qualification	%	36.1	37.0	21.7
lower or no qualification	%	34.3	39.9	4.7
no answer	%	6.8	5.8	5.0
Professional qualification				
apprenticeship or lower	%	42.5	50.2	15.8
master craftsman	%	22.6	20.9	6.8
advanced technical college	%	8.1	4.4	13.5
university	%	11.8	7.2	53.2
no answer	%	8.7	7.5	6.6
German	%	94.0	91.7	94.6
Children under 18	number	0.66	0.63	0.68
Married	%	70.9	68.3	63.7
Spouse's income per month	€1,000	0.944	0.782	1.075
Spouse's working status				
working	%	53.0	53.6	51.7
not working	%	17.8	14.6	12.0
unmarried or n/a	%	29.2	31.8	36.4
Other household income per month	€1,000	0.992	1.195	1.419
City size				
≤ 20,000	%	43.8	45.8	33.4
20,000-500,000	%	40.9	38.0	39.8
> 500,000 inhabitants	%	15.3	16.2	26.8
Group's share of the self-employed	%	16.9	61.9	21.2
Observations	number	25707	93745	32375

Source: Own calculations based on the scientific use file of the German microcensus (1991-2001).

Table A 3 : We ighted mean characteristics of working age persons by employment status

Variable	Unit	Self-Employed Persons	Employees	Unemployed/ Inactive Persons
Female	%	29.2	46.4	64.2
Eastern Germany	%	20.0	23.0	23.2
Age	years	43.8	39.2	46.4
Secondary school				
university entrance qualification	%	28.5	14.4	12.1
medium qualification	%	33.6	37.9	22.0
lower or no qualification	%	31.5	41.3	52.4
no answer	%	5.8	4.7	9.4
Professional qualification				
apprenticeship or lower	%	41.6	63.3	48.6
master craftsman	%	18.2	6.8	3.5
advanced technical college	%	7.0	4.3	1.9
university	%	17.8	6.6	3.2
no answer	%	7.5	6.1	10.0
German	%	92.7	91.7	88.9
Children under 18	number	0.65	0.62	0.51
Married	%	67.7	61.5	65.2
Spouse's income per month	€1,000	0.872	0.665	0.877
Spouse's working status				
working	%	53.1	45.7	33.4
not working	%	14.6	15.7	31.7
unmarried or n/a	%	32.3	38.6	34.9
Other household income per month	€1,000	1.208	1.128	1.136
City size				
≤ 20,000	%	42.8	42.5	39.6
20,000-500,000	%	38.9	42.2	44.4
> 500,000 inhabitants	%	18.3	15.3	16.0
Potential tradesmen	%	78.8	92.1	98.9
Potentially high self-employment income	%	20.3	8.6	2.3
Potential high-income tradesmen	%	10.9	7.0	2.2
Group's share in working age individuals	%	6.1	58.1	35.8
Observations	number	151827	1442004	881203

Source: Own calculations based on the scientific use file of the German microcensus (1991-2001).

Table A 4: Weighted mean characteristics of working age persons by treatment status

Variable	Unit	Potential Tradesmen With Income Above 1999 Threshold	Potential Tradesmen With Lower Income	Potential Liberal Professionals
Female	%	2.8	54.0	55.1
Eastern Germany	%	5.2	23.6	25.5
Age	years	48.2	41.9	39.9
Secondary school				
university entrance qualification	%	47.3	10.7	44.1
medium qualification	%	38.1	31.1	40.3
lower or no qualification	%	6.8	49.0	11.1
no answer	%	7.3	6.5	4.4
Professional qualification				
apprenticeship or lower	%	23.3	59.8	38.5
master craftsman	%	9.6	5.9	9.6
advanced technical college	%	19.7	2.1	12.8
university	%	35.1	2.9	29.8
no answer	%	8.9	7.6	5.9
German	%	90.2	90.5	95.0
Children under 18	number	0.79	0.56	0.66
Married	%	85.6	62.3	59.8
Spouse's income per month	€1,000	0.679	0.751	0.847
Spouse's working status				
working	%	52.0	40.9	46.6
not working	%	33.4	21.3	13.1
unmarried or n/a	%	14.6	37.9	40.4
Other household income per month	€1,000	0.952	1.140	1.208
City size				
≤ 20,000	%	33.5	42.3	35.1
20,000-500,000	%	45.3	42.6	43.1
> 500,000 inhabitants	%	21.2	15.0	21.8
Self-employed	%	12.8	4.7	20.8
Employed	%	74.2	56.2	73.1
Unemployed / inactive	%	13.1	39.1	6.1
Group's share in working age individuals	%	4.7	89.1	6.2
Observations	number	115538	2203102	156394

Source: Own calculations based on the scientific use file of the German microcensus (1991-2001).

Table A 5: Probabilities of entry into self-employment (in %) – triple difference calculation

Before Reform 1999						
Potential...	High-Income		Low-Income		Difference	
Tradesmen	0.75	(0.05)	0.77	(0.02)	-0.02	(0.05)
Freelancers	2.08	(0.15)	2.21	(0.09)	-0.12	(0.16)
Difference	-1.33	(0.14)	-1.43	(0.09)	0.10	(0.16)
After Reform 1999						
Potential...	High-Income		Low-Income		Difference	
Tradesmen	0.74	(0.05)	0.78	(0.03)	-0.03	(0.05)
Freelancers	2.51	(0.20)	2.23	(0.14)	0.28	(0.23)
Difference	-1.76	(0.19)	-1.45	(0.14)	-0.31	(0.23)
Difference Between After and Before Reform 1999						
Potential...	High-Income		Low-Income		Diff.-in-Diff.	
Tradesmen	-0.01	(0.07)	0.00	(0.03)	-0.01	(0.07)
Freelancers	0.42	(0.23)	0.02	(0.17)	0.40	(0.26)
Diff.-in-Diff.	-0.43	(0.23)	-0.02	(0.16)	**-0.41**	(0.27)

Standard errors calculated by the Delta method are in parenthesis. The bold number is the difference-in-difference-in-difference.
Source: Own calculations based on the German microcensus (1991-2001).

Table A 6: Probabilities of exit from self-employment (in %) – triple difference calculation

Before Reform 1999						
Potential...	High-Income		Low-Income		Difference	
Tradesmen	4.24	(0.40)	12.27	(0.31)	-8.04	(0.48)
Freelancers	2.54	(0.41)	4.77	(0.35)	-2.22	(0.51)
Difference	1.69	(0.56)	7.50	(0.45)	-5.81	(0.69)
After Reform 1999						
Potential...	High-Income		Low-Income		Difference	
Tradesmen	4.11	(0.51)	14.48	(0.53)	-10.37	(0.68)
Freelancers	2.18	(0.51)	4.85	(0.50)	-2.67	(0.69)
Difference	1.93	(0.71)	9.63	(0.66)	-7.70	(0.94)
Difference Between After and Before Reform 1999						
Potential...	High-Income		Low-Income		Diff.-in-Diff.	
Tradesmen	-0.12	(0.65)	2.21	(0.69)	-2.33	(0.85)
Freelancers	-0.36	(0.65)	0.08	(0.60)	-0.44	(0.86)
Diff.-in-Diff.	0.24	(0.90)	2.13	(0.78)	**-1.89**	(1.18)

Standard errors calculated by the Delta method are in parenthesis. The bold number is the difference-in-difference-in-difference.
Source: Own calculations based on the German microcensus (1991-2001).

Table A 7: Logit estimation results of self-employment probabilities with placebo tests in the years prior to the true reforms

Model	Placebo Test in 1992	Placebo Test in 1998
Cross-sections	1991, 1993	1995-1999
a: potential tradesman	-1.150	-1.101
	(0.031)***	(0.014)***
b: after year of placebo test	-0.283	0.107
	(0.039)***	(0.028)***
c: exp. inc. above threshold 94 / 99, rsp.	0.463	0.020
	(0.070)***	(0.023)
a x b	0.297	-0.037
	(0.042)***	(0.029)
b x c	0.120	0.011
	(0.089)	(0.045)
a x c	-0.707	-0.124
	(0.089)***	(0.025)***
a x b x c (placebo diff.-in-diff.-in-diff.)	-0.048	-0.013
	(0.124)	(0.055)
Control variables, constant	YES	YES
Wald χ^2	26212.22	83134.60
Log likelihood	-90061.43	-285724.71
Number of observations	517059	1403427

Heteroscedasticity robust standard errors in parenthesis. Stars (* / ** / ***) indicate significance of the logit coefficients at the 10% / 5% / 1% level.
Source: Own calculations based on the scientific use file of the German microcensus.

Table A 8: Logit estimation results of self-empl. probabilities with interacted time trend

Model	Time Trend Test
Cross-sections	1995-1999
a: potential tradesman	-1.021
	(0.022)***
time trend	0.146
	(0.014)***
c: expected income above threshold 1999	0.091
	(0.033)***
a x b	-0.057
	(0.008)***
time trend x c	-0.009
	(0.013)
a x c	-0.190
	(0.038)***
time trend x b x c (placebo diff.-in-diff.-in-diff.)	0.011
	(0.016)
Control variables, constant	YES
Wald χ^2	79423.96
Log likelihood	-289157.83
Number of observations	1403427

Heteroscedasticity robust standard errors in parenthesis. Stars (* / ** / ***) indicate significance of the logit coefficients at the 10% / 5% / 1% level.
Source: Own calculations based on the scientific use file of the German microcensus.

Table A 9: Logit estimation results of self-empl. probabil. with reduced income thresholds

	Model A: Thresholds reduced by 15 % of the standard deviation of income	Model B: Threshold reduced by 30 % of the standard deviation of income
Cross-sections	1991-2001	1991-2001
a: potential tradesman	-0.9763***	-0.9831***
	(0.0205)	(0.0209)
b: after 1994 and before 1999 reform	0.0832***	0.0805***
	(0.0233)	(0.0235)
c: expected income above threshold 1994	0.2690***	0.2106***
	(0.0295)	(0.0283)
a x b	-0.1010***	-0.0932***
	(0.0220)	(0.0222)
b x c	0.0350	0.0044
	(0.0380)	(0.0354)
a x c	-0.4564***	-0.3716***
	(0.0391)	(0.0360)
a x b x c (diff.-in-diff.-in-diff. 1994)	-0.0062	0.0212
	(0.0543)	(0.0482)
d: after 1999 reform	0.1966***	0.1990***
	(0.0287)	(0.0296)
e: expected income above threshold 1999	0.0029	0.0696***
	(0.0197)	(0.0198)
a x d	-0.1682***	-0.1518***
	(0.0288)	(0.0297)
d x e	0.0053	0.0008
	(0.0342)	(0.0343)
a x e	-0.0693***	-0.0386*
	(0.0213)	(0.0208)
a x d x e (diff.-in-diff.-in-diff. 1999)	0.1134***	0.0383
	(0.0394)	(0.0386)
Control variables, constant	YES	YES
Wald χ^2	143426.78	144380.76
Log likelihood	-494055.80	-494115.58
Number of observations	2475034	2475034
Joint signific. of DDD coeff. (*p*-values)	0.008	0.607

Heteroscedasticity robust standard errors in parenthesis. Stars (* / ** / ***) indicate significance of the logit coefficients at the 10% / 5% / 1% level.

Source: Own calculations based on the scientific use file of the German microcensus.

Table A 10: Weighted mean characteristics by treatment and control groups (self-employed persons in the SOEP 1984-2000)

Variable	Unit	Tradesmen with Income Above 1999 Threshold	Tradesmen with Lower Income	Liberal Professionals
Female	%	9.07	38.88	35.13
East Germany	%	6.30	14.78	11.88
High school	%	28.09	21.56	65.31
Apprenticeship	%	47.42	47.12	22.60
Higher technical college	%	32.75	29.77	18.86
University	%	24.07	13.23	62.63
Age	years	43.89	43.43	42.19
Full time work experience	years	20.22	17.26	12.22
Part time work experience	years	0.23	1.73	1.95
Unemployment experience	years	0.32	0.45	0.36
Disabled	%	4.59	2.86	1.45
German	%	96.34	96.40	95.45
Children under 17 in household	number	0.67	0.65	0.73
Married	%	67.04	67.39	61.05
Separated	%	2.56	2.11	3.93
Divorced	%	11.62	8.86	13.20
Self-employed father	%	26.03	18.99	19.44
Home ownership	%	61.82	54.56	47.62
Employment status spell duration	years	8.04	6.59	5.88
Actual weekly work hours	hours	54.90	47.78	39.63
Person-year observations	number	782	3252	1288

Source: Own calculations based on the SOEP 1984-2000.

Table A 11: Definition of variables (SOEP)

Variable	Definition
DDD variables:	
a	Dummy for individuals classified as a potential tradesman in t
b	Dummy for years after the 1994 reform and before the 1999 reform
c	Dummy for individuals whose income in *t* is above the threshold defined in 1994
d	Dummy for years after the 1999 reform
e	Dummy for individuals whose income in *t* is above the threshold defined in 1999
Other covariates:	
female	Dummy for females
east	Dummy for individuals who live in one of the 5 new eastern federal states or East Berlin
highschool	Dummy for individuals who have a high school degree ("Fachhochschulreife" or "Abitur")
apprenticeship	Dummy for individuals who finished an apprenticeship ("Lehre")
highertechncol	Dummy for individuals who finished a higher technical college or similar ("Berufsschule", "Schule Gesundheitswesen", "Fachschule", "Meister", "Beamtenausbildung", or "Sonstige Ausbildung")
university	Dummy for individuals who have a university degree
age	Age of individual
agesqr	Age squared
ftexp10	Years of full time work experience. Uses information from the lifetime empoyment history in the SOEP (see text for details). Divided by 10.
ftexpsq100	Fill time work experience squared and divided by 100
ptexp10	Years of part time work experience. Uses information from the lifetime empoyment history in the SOEP (see text for details). Divided by 10.
ptexpsq100	Part time work experience squared and divided by 100
unemexp10	Years of unemployement experience. Uses information from the lifetime empoyment history in the SOEP (see text for details). Divided by 10.
unemexpsq100	Unemployment experience squared and divided by 100
disabled	Dummy for handicapped / physically challenged individuals
german	Dummy for German nationality
nchild	Number of children under 17 in the household
married	Dummy for married and not separated individuals. Omitted category for marital status is "single"/"widowed".
separated	Dummy for married, but separated individuals
divorced	Dummy for divorced individuals
fatherse	Dummy for individuals whose father is/was self-employed
empl	Entry model: Dummy for individuals who are employed in *t* Self-employment state model: Dummy for individuals who were employed in *t*-1
selfemplpy	Dummy for individuals who were self-employed in *t*-1
duration	Duration of current spell (self-employment or employment). Uses information from lifetime job biography in the SOEP (see text for details).
dur_sq	Square of duration variable
dur_p3	Duration variable to the power of 3
dur_e	Interaction variable of duration and empl
dur_sq_e	Interaction variable of dur_sq and empl
dur_p3_e	Interaction variable of dur_p3 and empl

Dummy variables are equal to one if condition holds and zero otherwise.

Chapter 4: Structural Microeconometric Model of Entrepreneurial Choice

4.1 Introduction

The previous chapter delivered evidence that income taxes have an effect on the self-employment rate. The ways and mechanisms through which income taxes affect entrepreneurial choice remain to be investigated. What are the roles of expected returns and risk? The purpose of this chapter is to improve the understanding of the effects of income taxes by developing and estimating structural models of entry into and exit out of self-employment.

The dominating empirical research approach to analyse the impact of income taxation on entrepreneurial choice has been the ex-post analysis of certain tax reforms. This is the avenue I followed in chapter 3. Recent studies in this branch of research in other countries (including Moore 2004; Parker 2003; Bruce 2002; Cullen and Gordon 2002; Georgellis and Wall 2002; Bruce 2000; and Schuetze 2000) found mixed results about the responsiveness of entrepreneurial choice to taxation (see Schuetze and Bruce 2004 for a survey). For the ex-ante evaluation of future tax reform options, which is required for policy advice, these ex-post studies are only of limited applicability. This is an additional motivation for developing structural models.

Income taxation may influence entrepreneurial choice, which is understood here as the decision between dependent employment and self-employment, through its impact on net (after-tax) earnings in both alternatives. Thus, to understand the effect of income taxation, it is necessary to analyse the influence of net earnings on this decision. In models of entrepreneurship as an occupational choice, the probability of choosing self-employment can be represented as a function of the differential in expected earnings from self-employment and wage employment. Empirical studies analysing this earnings differential include Fraser and

Greene (2006) and Taylor (1996), who confirmed that higher expected earnings in self-employment relative to paid employment significantly increase the probability of becoming self-employed, Dolton and Makepeace (1990) and Rees and Shah (1986), who also found a positive, but insignificant effect, and Hamilton (2000), who in contrast concluded that factors other than earnings induce people to become self-employed. All these studies only looked at gross earnings, however, so they did not consider the impact of taxes.

Not only preferences of individuals over net returns, but also over risk may play a role in entrepreneurial choice, as higher risk associated with income from self-employment may deter risk-averse individuals from choosing this option. This idea is related to Kanbur (1982) and Kihlstrom and Laffont (1979) who modelled entrepreneurial choice as trading off risk and monetary returns. They suggested that the less risk-averse become entrepreneurs and may receive a risk premium as compensation of the greater variance of their earnings. The historical roots of these models are in the work of Knight (1921), according to whom the central role of the entrepreneur is to bear risks. Recent empirical works found evidence that risk attitudes play a significant role in the decision to become self-employed (Cramer *et al.* 2002; Caliendo, Fossen and Kritikos 2006).

Taxation alters both the expected value and the variance of net earnings. Taxes reduce the expected net returns of a risky project such as starting up a business (Gentry and Hubbard 2000), but also flatten the stream of net returns over years, which reduces the risk associated with self-employment (cf. Domar and Musgrave 1944). The first effect may discourage, but the second may encourage an entrepreneurial venture. The overall effect of taxation on entrepreneurial choice remains unclear as long as it is not understood to what extent both the expected value of net income and the risk associated with it influence this choice.

A structural model is needed to approach this problem. Attempts to estimate a structural model of entrepreneurial choice incorporating earnings and risk have been very rare. Rees and Shah (1986) formulated a model of the probability of being self-employed assuming a utility function with constant relative risk aversion, but used a simplified model without an explicit risk parameter in their empirical estimation. Pfeiffer and Pohlmeier (1992) specified a similar model and actually estimated its parameters using the first waves of the German Socio-Economic Panel (SOEP waves 1984-1989, limited to West Germany). They only considered gross incomes, however, and left out the role of taxation, which is the main motivation for the research conducted here. Moreover, mean income and variance curves will be estimated

individually in this chapter, and duration dependence will be controlled for in the transition models (see section 4.3). Rosen and Willen (2002) used the Panel Study of Income Dynamics and found that in comparison to wage employment, self-employment both comes with an increase in mean yearly consumption and an increased variance of returns, which is consistent with a risk premium for the self-employed. They used the measured level and variance of income in the two occupational modes to asses a theoretical model of self-employment choice, but came to the conclusion that the risk premium was too large to be rationalised by conventional measures of risk aversion. A possible explanation may be that the authors used yearly income and did not take into account that the self-employed work more weekly hours on average than wage employees. They also only looked at gross incomes and neglected the impact of taxes.

In this chapter I develop a structural model of transition probabilities between dependent employment and self-employment, which takes into account both expected net earnings and net earnings variance in the two alternative employment states. These first and second moments of random earnings are estimated empirically for both income from self-employment and dependent employment, controlling for non-random selection into these states. Not only one period's income, but lifetime income matters for the significant decision to enter or exit self-employment. This is taken into account by predicting the curves of future expected earnings and earnings variance over each individual's lifetime conditional on the choice to be an entrepreneur or a wage worker. Summary statistics of these predicted curves enter the structural transition models, which enables me to estimate the model parameters empirically. These parameters include the standard Arrow-Pratt measure of relative risk aversion, which can be related to results in the existing literature. The estimated model allows calculating elasticities of the transition probabilities with respect to the expected value and the variance of net income.

The structural transition model is developed in section 4.2 of this chapter, and translated into empirical discrete time hazard rate models in section 4.3.1. Section 4.3.2 briefly introduces the data. The methodology for the estimation of gross earnings and their variance, controlling for selection, is described in sections 4.3.3 to 4.3.5. Sections 4.3.6 and 4.3.7 deal with the tax rate function and the calculation of annuities. The empirical results are presented in section 4.4, along with a sensitivity analysis of the estimated structural parameters of the

model, and section 4.5 concludes. In chapter 5 of this dissertation thesis, the estimated structural model will be applied to perform ex-ante evaluations of specific tax reforms.

4.2 The Structural Model

The model presented here is based on a binary representation of the decision to be self-employed or dependently employed. In a given period, an individual i makes a rational choice to be an entrepreneur instead of working in a wage job in the next period if his/her expected utility in self-employment (se) is higher than in dependent employment (e):

$$E(U_{se}(y_{i,se})) > E(U_e(y_{i,e})), \tag{4.1}$$

where $y_{i,se}$ is agent i's net return from self-employment and $y_{i,e}$ is his/her net return from wage work. Both $y_{i,se}$ and $y_{i,e}$ are random variables because future income is risky. Empirically earnings of entrepreneurs are significantly more volatile than those of employees with comparable characteristics (Heaton and Lucas 2000; Borjas and Bronars 1989). In this model, it is assumed that people know the probability distribution of their future income in both occupational states. Thus, there is no complete uncertainty, but people do not know the realisation of their income in future periods. The expected utility with respect to y is approximated by a second order Taylor series expansion around μ_y:

$$\begin{aligned} E(U(y)) &\approx U(\mu_y) + U'(\mu_y)E(y-\mu_y) + \frac{1}{2}U''(\mu_y)E((y-\mu_y)^2) \\ &= U(\mu_y) + \frac{1}{2}U''(\mu_y)\sigma_y^2 \end{aligned} \tag{4.2}$$

where $\mu_y = E(y)$ and $\sigma_y^2 = Var(y)$ and the subscripts of y are suppressed for simplicity. The equation demonstrates that $E(U(y)) < U(E(y))$ if agents are risk-averse ($U''(y)<0$).[48]

In the following, I assume constant relative risk aversion (CRRA), as *inter alia* in Kanbur (1982), Rees and Shah (1986), and Pfeiffer and Pohlmeier (1992). This implies that the utility function must satisfy

$$-\frac{yU''(y)}{U'(y)} = r \tag{4.3}$$

where the constant r is the coefficient of CRRA (Pratt 1964). The following random utility function satisfies the CRRA condition, yields increasing utility for money $y>0$, and allows

[48] This general result follows directly from Jensen's inequality.

utility to vary across individuals depending on observable characteristics x_i and an error term e_{ij}:

$$U_j(y_{ij}, x_i, e_{ij}) = \begin{cases} a\,\dfrac{y_{ij}^{1-r}}{1-r} + b'_j x_i + e_{ij}; & r \neq 1. \\ a \ln y_{ij} + b'_j x_i + e_{ij}; & r = 1. \end{cases} \tag{4.4}$$

The parameter $a > 0$ reflects the weight of risk adjusted income in the utility function. This specification implies risk preference for $r < 0$, risk neutrality for $r = 0$ and risk aversion for $r > 0$. The error term e_{ij} captures unobservable tastes influencing utility that might be different across observations and in the two alternative employment states $j \in \{se; e\}$ (self-employment and dependent employment). These tastes are unobservable for the researcher and thus treated as a random variable, but they are known to the individuals in the sample, in contrast to the error in future earnings y. The first and second order partial derivations of U with respect to y (suppressing subscripts j and i) are

$$\begin{aligned} U'(y,x,e) &= \begin{cases} a\,y^{-r}; & r \neq 1. \\ a\,y^{-1}; & r = 1. \end{cases} \\ U''(y,x,e) &= \begin{cases} -a\,r\,y^{-r-1}; & r \neq 1. \\ -a\,y^{-2}; & r = 1. \end{cases} \end{aligned} \tag{4.5}$$

Plugging U'' into equation (4.2) yields expected utility with respect to y:

$$E(U(y,x,e)) \approx \begin{cases} a\left(\dfrac{m_y^{1-r}}{1-r} - \dfrac{1}{2} r m_y^{-r-1} s_y^2\right) + b'x + e; & r \neq 1. \\ a\left(\ln m_y - \dfrac{1}{2m_y^2} s_y^2\right) + b'x + e; & r = 1. \end{cases} \tag{4.6}$$

For $a > 0$, the equation implies that given expected earnings, for risk-averse agents expected utility decreases with greater variance of earnings. For risk-neutral agents the variance does not matter, and for risk-loving individuals, greater variance actually increases expected utility. Taking the expectation with respect to the random earnings variable y did not remove the utility error term e.

As the agent chooses the employment state which gives him/her the highest utility, the probability that agent i decides to be an entrepreneur in the next period is

$$\begin{aligned}\text{Prob}(se|\, y_{i,se}, y_{i,e}, x_i) &= \text{Prob}(E(U_{se}(y_{i,se}, x_i, e_{i,se})) > E(U_e(y_{i,e}, x_i, e_{i,e}))) \\ &= \text{Prob}(e_{i,e} - e_{i,se} < \alpha(V(y_{i,se}) - V(y_{i,e})) + (b_{se} - b_e)' x_i) \\ &= F(\alpha(V(y_{i,se}) - V(y_{i,e})) + b' x_i)\end{aligned} \tag{4.7}$$

where $b = b_{se} - b_e$, F is the cumulative density function of the error terms $e_i = e_{i,e} - e_{i,se}$, which are assumed to be independently and identically distributed, and

$$V(y_{ij}) = \begin{cases} \dfrac{m_y^{1-r}}{1-r} - \dfrac{1}{2} r m_y^{-r-1} s_y^2; & r \neq 1. \\ \ln m_y - \dfrac{1}{2m_y^2} s_y^2; & r = 1. \end{cases} \tag{4.8}$$

can be interpreted as expected risk adjusted income. This random utility model is the basis for the empirical transition models that will be outlaid next.

4.3 Empirical Methodology

4.3.1 Transition Models

Equation (4.7) represents a structural model of binary choice between self-employment and dependent employment that gives the probability of being self-employed in the next period $t+1$. To avoid the strong assumption that the self-employment probability in period $t+1$ is the same for somebody who is dependently employed in period t and for somebody who is already self-employed in t, I condition the self-employment decision on the current employment state. Thus, I focus on transitions and estimate separate models for the probability of entering self-employment conditional on being dependently employed and the probability of switching to dependent employment conditional on being self-employed. Moreover, the probability of being self-employed in the next period not only depends on the current employment state, but also on its duration. Section 3.6 of this dissertation thesis has also shown that the duration of an individual's spell in dependent employment significantly influences the probability of entering self-employment. Equally, the spell duration in self-employment influences the probability of exit (see also Evans and Leighton, 1989, and Taylor, 1999). Thus, I additionally condition equation (4.7) on the duration of the current spell in self-employment or dependent employment by including a flexible function of the respective spell duration t in the x vector. This function, the baseline hazard, is specified as a cubic polynomial (higher order polynomials were not significant, see also section 4.4.3):

$$\beta' x_i = \beta^{1\prime} x^1_i + \delta_1 t_i + \delta_2 t_i^2 + \delta_3 t_i^3, \quad (4.9)$$

where x^1_i denominates the vector of the other explanatory variables (they will be discussed below). The models are estimated using the maximum likelihood method. In the following, the model of transition from dependent employment to self-employment (entry model) is taken as an example.[49] The likelihood contribution of an observation i is given by equation (4.7) if a transition occurs between t and t+1, which is now written as

$$\text{Prob}(trans_i = 1 \mid y_{i,se}, y_{i,e}, x_i) = F(\alpha(V(y_{i,se}) - V(y_{i,e})) + \beta^{1\prime} x^1_i + \delta t_i + \delta t_i^2 + \delta t_i^3), \quad (4.10)$$

where $trans_i$ is a binary indicator variable that equals 1 if a transition is observed, and 0 otherwise. If no transition occurs, the likelihood contribution is the complementary probability

$$\text{Prob}(trans_i = 0 \mid y_{i,se}, y_{i,e}, x_i) = 1 - \text{Prob}(trans_i = 1 \mid y_{i,se}, y_{i,e}, x_i) = 1 - F(\cdot), \quad (4.11)$$

The log likelihood function for the sample is thus given by

$$\ln L = \sum_{i=1}^{N} \left(trans_i \ln F(\cdot) + (1 - trans_i) \ln \left(1 - F(\cdot)\right)\right). \quad (4.12)$$

The data used in this analysis covers multiple periods (see section 4.3.2), so the index i refers to person-period observations in this context. Each person-period observation i contributes to the likelihood function (4.12). Individuals can experience multiple spells in self-employment or dependent employment in the observation period.

If the person-period observations i are instead indexed by person, spell number and spell duration, the model can be written as a discrete time hazard rate model where the hazard rate

$$\begin{aligned} \lambda_{pk}(t) &= \text{Prob}(T_{pk} = t \mid T_{pk} \geq t, y_{pk,se}(t), y_{pk,e}(t), x_{pk}(t)) \\ &= \text{Prob}(trans_{pk}(t) \mid y_{pk,se}(t), y_{pk,e}(t), x_{pk}(t)) \end{aligned} \quad (4.13)$$

is the probability that spell k of person p ends in period t, i.e. a transition occurs, conditional on survival until the beginning of t. The discrete non-negative random variable T_{ik} describes the duration of the k-th spell of person p; when a spell terminates in period t (measured from the beginning of the spell), T_{pk} takes on the value $T_{pk} = t$. The maximum likelihood method allows to consistently take into account not only completed spells, but also both right-censored and left-censored spells in the estimation. Right-censored spells (where the end of a spell is not observed) contribute to the likelihood function through equation (4.11). For left-

[49] The model of transition from self-employment to dependent employment (exit model) is specified analogously. The only difference is that the coefficient α of the risk-adjusted income differential (defined as the difference between self-employment and dependent employment in all models) is expected to be negative in the exit model. In the likelihood maximisation, α is left unconstrained, so a check if α has the expected sign in all models serves as a test for the models' consistency.

censored spells (spells that had started before the person entered the panel) retrospective employment history information in the data make it possible to recover the spell duration t correctly and to include these spells consistently in the likelihood function, too (see section 3.6.3 for the derivation of the likelihood contribution of left-censored spells). The survivor function, which describes the probability of remaining in the current spell (*unconditional* on survival until the beginning of t), is given by

$$S(t) = \prod_{t=1}^{t} \left(1 - l_{pk}(t)\right) \tag{4.14}$$

(cf. equation 3.5 in section 3.6.3). The cumulative transition probability, or failure function, is the complementary probability

$$Fail(t) = 1 - S(t) = 1 - \prod_{t=1}^{t} \left(1 - l_{pk}(t)\right) \tag{4.15}$$

This function is of special interest in this context as it describes the probability of switching from self-employment to dependent employment (or vice versa) during the first t years of a spell. In the following, for brevity I will remain with the indexation of equations by person-period observations i rather than the indexation by person, spell number and spell duration.

To complete the specification of the likelihood function, it remains to specify the cumulative density function F of the error terms $e_i = e_{i,e} - e_{i,se}$ in equation (4.7). Following McFadden's (1974) random utility model, I assume the error terms $e_{i,e}$ and $e_{i,se}$ are independently and identically distributed, with the type I extreme value distribution. As McFadden showed, it follows that F is the cumulative logistic probability distribution. The implications of alternatively assuming that F is the cumulative normal distribution are tested in section 4.4.3.

The vector x^1_i controls for observable individual characteristics and covariates that may shift taste with respect to self-employment. It includes variables that emerged as important determinants of self-employment in prior studies: age, education, work experience, unemployment experience, number of children, region, and a constant (for example, see Taylor, 1996; Evans and Leighton, 1989; for German data see Georgellis and Wall, 2004; Holtz-Eakin and Rosen, 2005). Furthermore, Brown *et al.* (2006), Parker (2005) and Bruce (1999) all find evidence that an individual's household context influences the decision to be self-employed. I account for this by controlling for the marital status, the spouse's

employment type, if applicable, and the income of other household members in x_i. A sensitivity analysis with regard to the chosen control variables is conducted in section 4.4.3.

Before the transition models can be estimated by maximising the likelihood function with respect to its parameters (the coefficient of the risk adjusted income differential a, the coefficient of relative risk aversion r, the parameters of the baseline hazard d_1, d_2 and d_3 describing the duration dependence, and the parameter vector of the characteristics influencing taste, b^1), the expected value of income m_y and its variance s_y^2 in the two alternative employment states are required for each individual in each period, as these statistics enter the likelihood function through V. The strategy for estimating m_y and s_y^2 is described in sections 4.3.3 to 4.3.5, after the data basis for this analysis is shortly described in the next section.

4.3.2 Data

This analysis is based on the German Socio-Economic Panel (SOEP) which was introduced in section 3.6.2 already. I use 22 waves from the first wave available in 1984 to 2005. Like in chapter 3, the sample is restricted to individuals between 18 and 64 years of age and excludes farmers, civil servants, and those currently in education, vocational training, or military service (see section 3.3.1). Family members helping in a family business are also excluded After removing observations with missing values for any of the relevant variables, 117,321 person-year observations are left for the analysis. Table A 12 in the Appendix shows how these observations are distributed over the possible employment states dependent employment, self-employment, and unemployment or non-participation, further split by full-time and part-time work (full-time is defined as a minimum of 35 hours per week) and gender. Working individuals are classified as self-employed or dependently employed based on whether they report self-employment or dependent employment as their primary activity. A transition can be identified in the data when a person is observed in different employment states in two consecutive years t and t+1.

This chapter focuses on the choice between full-time dependent employment and full-time self-employment, because the attention is on the comparison of earnings in the two alternative employment states, not on the decision to work full-time or part-time or the decision to work or not to work. Thus, as in Taylor (1996) and Rees and Shah (1986), the transition models are based on full-time working individuals. I control for possible selectivity

effects arising from selection into the full-time working categories by a two-step procedure (see section 4.3.4). As a robustness check, the analysis is repeated taking into account transitions into part-time dependent employment or self-employment as well (see section 4.4.3).

All estimations (except for the tax rate regression) are conducted separately for men and for women because of the well documented differences in male and female wage equations, and because results from a separate analysis might help explain why the share of the self-employed is much lower among women than among men, at least in Germany. Table A 14 in the Appendix shows descriptive statistics for full-time self-employed and dependently employed men and women in the sample. For a description of the variables used in this analysis, see Table A 13. All monetary variables, and therefore all monetary results reported in this chapter, are deflated by the Consumer Price Index (2001 = 100).

4.3.3 Estimation of Expected Hourly Income

A key variable in the models of transition between dependent employment and self-employment developed above is an individual's expected net income m_y. It is understood here as expected *hourly* net income in order to focus attention on the differential in monetary compensation for work and not on differences in hours worked (as, for instance, in Hamilton, 2000, and Taylor, 1996). For each individual m_y must be estimated for the two alternatives self-employment and wage employment. Therefore, I first estimate separate Mincer-type regressions of hourly gross income from dependent employment (using the full-time dependently employed) and from self-employment (using the full-time self-employed) on a vector of demographic and human capital and work related variables z_i^{earn}:

$$y_{ij}^{g} = \theta_j' z_i^{earn} + \sigma_j \lambda_{ij} + u_{ij}, \qquad (4.16)$$

where y_{ij}^{g} are hourly gross earnings[50] of person-year observation i in employment state $j \in \{se; e\}$, θ_j is the coefficient vector, $\sigma_j \lambda_{ij}$ controls for selection (see section 4.3.4), and u_{ij} is the error term. Conceptually, human capital variables clearly determine gross incomes, not net incomes, as the latter depend on the tax legislation. Thus, gross incomes are estimated here,

[50] Income information for year t is obtained from retrospective questions in wave $t+1$ about a respondent's average monthly gross income in t, differentiated by income from dependent employment and self-employment. Income from self-employment (employment) is only averaged over months in which the respondent was actually self-employed (employed), so the information remains accurate if the respondent switched between employment states. Earnings levels rather than log(earnings) are used in the regression to avoid excluding people who report zero earnings, which is sometimes observed for the self-employed during temporary periods (cf. Hamilton 2000).

and estimations of net incomes are derived later (see section 4.3.6). The variables vector z_i^{earn} includes age, education, the duration of the spell in the current employment state, lifetime work and unemployment experience, region, and a constant. Moreover, as predictions of income enter the structural transition models, for identification some variables should be included in the earnings, but not in the transition equations. I follow Fraser and Greene (2006), Taylor (1996) and Rees and Shah (1986) by including industry dummies, which are well proven determinants of earnings, in z_i^{earn} only.[51]

The estimated income models are then used to obtain individual predictions for gross earnings in the two alternative states self-employment and dependent employment, one of which is counter-factual, for every individual and period in the sample of the full-time working population. If there are unobservable factors that both influence selection into full-time self-employment or full-time dependent employment and income, it is necessary to control for selection.

4.3.4 Selection

A two-step procedure is applied to control for selection effects in the earnings regressions (4.16) (and also in the estimation of earnings variance (4.21) as will be described in the next section). The earnings regressions are the 2nd step after the estimation of a 1st step equation of selection into the 5 possible employment states shown in Table A 12: full-time and part-time self-employment, full-time and part-time dependent employment and unemployment/inactivity. The probability of being observed in each of these 5 employment states j is estimated by a reduced form multinomial logit:

$$\text{Prob}(J_i = j | z_i) = F\left(g_j' z_i\right) = \frac{\exp(g_j' z_i)}{\sum_{k=1}^{5} \exp(g_k' z_i)}, \tag{4.17}$$

where g_j are the coefficient vectors[52] and z_i is the vector of regressors. This vector consist of the variables z_i^{earn} used in the earnings regression (4.16) (excluding spell duration), and for

[51] Additionally dummy variables for German nationality and physical handicap are added to the earnings equations, as these variables turn out to be important for the prediction of earnings. Year dummies are also included to account for the business cycle.

[52] g_j is normalised to 0 for the base category j="unemployment/inactivity".

identification, it additionally includes variables indicating a self-employed father[53], the number of children, and the marital status.[54]

Modelling the decision between the 5 employment states as a multinomial logit implies the assumption of independence from irrelevant alternatives (IIA). Hausman and McFadden (1984) suggested that under the IIA, the parameter estimates should not change systematically if one of the outcome categories is omitted from the model. The results from the corresponding Hausman specification tests are shown in Table 9. In none of the tests can the null hypothesis be rejected, which states that the difference in the coefficients in the models with and without the respective alternative is not systematic. Thus, there is no evidence for a violation of the IIA, and I proceed with the multinomial logit model.

Table 9: Hausman tests of independence from irrelevant alternatives

Omission of Alternative:	χ^2	*p*-value
Unemployed/inactivity[1)]	1.01	0.9999
Full-time employment[2)]	162.55	0.2462
Part-time employment	88.15	0.9999
Full-time self-employment[3)]	-19.15	1.0000
Part-time self-employment	9.13	0.9999

[1] Full-time employment is used as the base category for this test.
[2] In this test, the χ^2-value seems to be large, but it is still insignificant. This is explained by the high number of degrees of freedom as a result of the high number of variables in the model, which includes year and federal state dummies.
[3] The negative value obtained for χ^2 here indicates that in this case the asymptotic assumptions of the Hausman test are not met. Again, the null hypothesis cannot be rejected.

After estimation of (4.17), an individual sample selection term l_{ij} (similar to the "inverse Mill's ratio") is calculated for the two states of interest $j \in \{se; e\}$ (full-time self-employment and dependent employment):

$$l_{ij} = f\left(\frac{\Phi^{-1}\left(F\left(g_j' z_i\right)\right)}{F\left(g_j' z_i\right)}\right), \tag{4.18}$$

[53] Having a self-employed father is used as an exclusion restriction as this characteristic is likely to have an impact on the probability of being self-employed (e.g. Dunn and Holtz-Eakin 2000), e.g. through an inherited business, but is not expected to have an influence on earnings after controlling for other relevant factors (cf. Taylor 1996). In Germany, self-employed mothers were rare in the generation of most respondents' parents, so only self-employed fathers are used.
[54] The number of children and marital status are well known to influence the decision to participate in the labour market and the choice between part-time and full-time work, especially for women (e.g. Mroz 1987), but are not expected to influence gross earnings (cf. Rees and Shah, 1986).

where f and Φ^{-1} are the standard normal density function and the inverse of the cumulative standard normal density function. Then the term l_{ij} enters the earnings equation (4.16) for earnings in employment state $j \in \{se;e\}$, which allows to estimate its coefficients σ_j. For the subsequent prediction of an individual's earnings in each of the two employment states, $\sigma_j l_{ij}$ enters the prediction equation if individual i is actually observed in that state, and in the counter-factual case, $\sigma_j l_{ij,cf}$ enters the equation with

$$l_{ij,cf} = -f\left(\frac{\Phi^{-1}\left(F\left(g_j' z_i\right)\right)}{1-F\left(g_j' z_i\right)}\right). \tag{4.19}$$

For a detailed description of the two-step procedure for polychotomous-choice models and selectivity bias see Maddala (1983, pp. 275-278).

4.3.5 Estimation of Earnings Variance

Along with an individual's expected income m_y, the first moment of random earnings, the individual variance of earnings s_y^2, i.e. the second moment, is also required to estimate the transition models between dependent employment and self-employment. The literature on the earnings differential has mostly analysed the first moment only, and if the second moment is taken into account, as in Pfeiffer and Pohlmeier (1992) and in Rosen and Willen (2002), the variance is usually modelled as a population parameter and not estimated on an individual basis, which implies the assumption that income is homoscedastic. This assumption is relaxed here, allowing the variance of earnings to differ not only between self-employment and dependent employment, but also to depend on individual characteristics and covariates.[55] The point made in this chapter is that individuals do not only worry about the first, but also the second moment of their *individual* probability distribution of income in the two alternative employment states when they consider a transition.

As the error term in the earnings equation (4.16) u_{ij} has an expected value of 0, the variance of gross random earnings conditional on the explanatory variables is

$$s_{gy}^2 = Var(y_{ij}^g) = E(u_{ij}^2). \tag{4.20}$$

Thus, the squared residuals from the earnings regression can be used to specify a flexible heteroscedasticity function and estimate s_{gy}^2. The natural logarithm of the squared residuals

[55] Therefore, heteroscedasticity robust (White) standard errors are reported in the earnings regression (4.16).

are regressed on the explanatory variables of the earnings model z_i^{earn} and the selection term l_{ij} from (4.18) to control for selection, separately for the two employment states $j \in \{se;e\}$:

$$\ln(\hat{u}_{ij}^{\,2}) = p_j' z_i^{earn} + s_j^{var} l_{ij} + e_{ij}, \tag{4.21}$$

where e_{ij} is the error term. Taking the logarithm of the squared residuals is the common approach to ensure that predicted values for the variance are strictly positive.[56] For the prediction of the variance in the counter-factual employment state, l_{ij} is replaced by $l_{ij,cf}$ from (4.19) as in the earnings regression. This procedure yields individual predictions of the variance of gross earnings, which is the basis for the calculation of the variance of net earnings, as will be described in the next section.

4.3.6 Estimation of the Tax Function

As individual utility depends on net (after-tax) income, the relevant variables in the structural transition models are the expected value and the variance of net income. To derive net income from gross income, the German progressive income tax schedule must be approximated. As the SOEP provides information about both a respondent's gross and net income, individual and year specific average tax rates t_i, can be calculated:

$$t_i = \frac{grossinc_i - netinc_i}{grossinc_i}, \tag{4.22}$$

where $grossinc_i$ and $netinc_i$ are gross and net income.[57] These tax rates t_i, are regressed on a vector z_i^{tax} of variables relevant for the tax code:

$$t_i = k' z_i^{tax} + v_i, \tag{4.23}$$

where k is the coefficient vector and v_i is the error term capturing specifics of the tax legislation which cannot be taken into account in this approximation.[58] The vector z_i^{tax} includes polynomials of the first, second and third degree of gross yearly income to model the non-linear nature of the tax function, a "married" dummy, additionally interacted with a

[56] To obtain consistent predictions for the squared residuals, the predicted values from the log model must be exponentiated and multiplied with the expected value of $\exp(e_{ij})$. A consistent estimator for the expected value of $\exp(e_{ij})$ is obtained from a regression of the squared residuals on the exponentiated predicted values from the log model through the origin. This procedure does not require normality of e_{ij} (see Wooldridge 2003).

[57] Respondents are asked to state their gross and net income in the month before the interview. It is assumed that this reflects average monthly income. Taxes are levied on yearly income, of course, but a multiplication of gross and net incomes by 12 (or some other factor) is irrelevant as it would cancel out in the tax rate formula (4.22).

[58] All working respondents, no matter if full-time or part-time, provide information that is used to estimate this tax function.

"female" dummy (to account for the effect of income splitting), the number of children, a "disabled" dummy, and a "self-employed" dummy (to allow for differential tax treatment). After this tax function is estimated, it can be used to predict average tax rates conditional on the predicted gross incomes in both the true and the counter-factual employment state and on individual characteristics.[59] This allows deriving the expected value and variance of net incomes in both alternatives.

4.3.7 Calculation of Annuities

In the model developed above, agents considering a transition between the two employment states dependent employment and self-employment compare the expected value m_y and the variance s_y^2 of net income in the two alternatives. Rational agents will not only take into account next year's returns when they consider a decision as important as starting or giving up a self-employed venture, they will rather take into account future expected income and income variance over the remaining years of their economic activity; the horizon is assumed to be reached at 65 years (the retirement age in Germany). Thus, equations (4.16), (4.21) and (4.23) are used to predict the expected net income and net income variance for each individual in each of the two alternative employment states for all years until the individual reaches the age of 65 by adjusting the duration in the respective employment state within the explanatory variables. Then the capital value method is applied to calculate an annuity of expected income:

$$m_y = \frac{q^{n_i}(q-1)}{\left(q^{n_i}-1\right)} \sum_{k=1}^{n_i} \frac{y_{ijk}^{net}}{q^k}, \tag{4.24}$$

where q is the real interest rate plus one, and n_i is the number of remaining years of economic activity for individual i. In the main specification, q is assumed to be 5%; the sensitivity of the results with respect to q is tested in section 4.4.3. The difference between net income derived from actual gross income and net income derived from predicted gross income in an individual's actual employment state j_i in the year of observation is added to $y_{ij,k}^{net}$ if $j=j_i$, as this difference contains additional information about an individual's productivity in state j_i. An annuity of income variance is calculated analogously. These annuities finally enter the utility function and thus the structural transition model (4.10).

[59] Predicted y_{ij}^g are hourly incomes, whereas the tax function requires yearly income. For the conversion, the average number of hours worked in the sample of full-time working people is used.

4.4 Empirical Results

4.4.1 Expected Value and Variance of Earnings

The reduced form multinomial logit equation of selection into the different employment states (4.17) is estimated first. Table 10 reports the estimated marginal effects of the variables on the probabilities of the outcomes "full-time self-employment" and "full-time dependent employment" for men and women.[60] The significant marginal effects of *fatherse* indicate that the probability of being full-time self-employed is 7.2 percentage points higher for men with a self-employed father and 0.8%-points for women. The higher probability confirms results found in the literature (e.g. Dunn and Holtz-Eakin 2000; Taylor 1996). A child significantly reduces the probability of being full-time dependently employed (21.9%-points for women, but only 1.8%-points for men); the probability of being full-time self-employed is not affected as much, it decreases for women whereas for men it even increases. Married men and women have a lower probability of being full-time self-employed, whereas the effect for dependent employment differs strongly by gender: The probability of working full-time in dependent-employment is 18.8%-points lower for married women, whereas it is 13.8%-points higher for married men.

[60] The multinomial logit coefficients for all categories and the marginal effects for the outcome categories "part-time self-employment" and "part-time dependent employment" are available upon request. Even though the primary purpose of this multinomial logit estimation is the prediction of the selectivity terms l_{ij}, the marginal effects are reported here as they reveal interesting partial correlations of variables with the different employment states. In contrast, the multinomial logit coefficients are difficult to interpret, as even the sign of a coefficient may be different from the sign of the corresponding marginal effect.

Table 10: Multinomial logit estimation of employment state probabilities

Variable	Marginal Effect on Outcome Probability (Robust Standard Error)			
	Men		Women	
	Full-Time Self-Employed	Full-Time Dep. Employed	Full-Time Self-Employed	Full-Time Dep. Employed
highschool	0.0057	-0.0303	0.0069	0.0258
	(0.0026)*	(0.0057)***	(0.0014)***	(0.0072)***
apprenticeship	-0.0037	0.0864	-0.0027	0.0956
	(0.0022)	(0.0042)***	(0.0010)**	(0.0056)***
highertechncol	0.0147	0.0546	0.0044	0.0927
	(0.0028)***	(0.0040)***	(0.0013)***	(0.0072)***
university	0.0005	0.0761	0.0115	0.2503
	(0.0027)	(0.0043)***	(0.0019)***	(0.0094)***
age_bgn	0.0120	-0.0002	0.0014	-0.0062
	(0.0010)***	(0.0016)	(0.0004)***	(0.0022)**
age_bgn_sq	-0.0001	-0.0002	-0.0000	-0.0003
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
workexp_bgn	-0.0001	0.0082	0.0017	0.0261
	(0.0005)	(0.0009)***	(0.0002)***	(0.0011)***
workexp_bgn_sq	-0.0000	-0.0001	-0.0000	-0.0002
	(0.0000)*	(0.0000)***	(0.0000)***	(0.0000)***
unemexp	-0.0140	-0.0576	-0.0054	-0.1013
	(0.0013)***	(0.0025)***	(0.0009)***	(0.0035)***
unemexp_sq	0.0005	0.0034	0.0001	0.0058
	(0.0001)***	(0.0003)***	(0.0002)	(0.0004)***
german	-0.0005	0.0551	0.0017	-0.0121
	(0.0037)	(0.0070)***	(0.0020)	(0.0096)
disabled	-0.0208	-0.0655	-0.0098	0.0057
	(0.0025)***	(0.0076)***	(0.0011)***	(0.0102)
nchild	0.0046	-0.0175	-0.0034	-0.2187
	(0.0008)***	(0.0017)***	(0.0006)***	(0.0031)***
married	-0.0117	0.1383	-0.0055	-0.1883
	(0.0022)***	(0.0047)***	(0.0012)***	(0.0057)***
fatherse	0.0721	-0.0960	0.0083	0.0270
	(0.0048)***	(0.0071)***	(0.0019)***	(0.0081)***
Fed. state dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
constant	YES	YES	YES	YES
LR χ^2	21190.336		33341.201	
Pseudo R^2	0.252		0.224	
N	54157		63164	

The table shows the marginal effects on the probabilities of the outcome categories "full-time self-employment" and "full-time dependent employment". For dummy variables, the change in the probability caused by a discrete change from 0 to 1 are reported. The categories "part-time self-employment" and "part-time dependent employment" are not shown for brevity. The base category is "unemployment / inactivity". Stars (* / ** / ***) indicate significance at the 5% / 1% / 0.1% level.
Source: Own calculations based on the SOEP 1984-2004.

Now the selectivity terms l_{ij} can be calculated using (4.18), and the 2nd step earnings equation (4.16) can be estimated. The results from the earnings regressions are shown in Table 11. Unemployment experience has a significant negative effect on earnings in dependent employment and even more so in self-employment for both men and women. Men with a university degree enjoy much higher earnings than those without, especially in self-employment. For women, the positive effect is smaller in both employment states, and it is

insignificant in self-employment. The duration of the spell in the current employment state has a positive and significant influence on earnings for self-employed and dependently employed men and for dependently employed women (the development of income in time will be discussed in detail below). The coefficient of the selectivity term l is negative in all models, which indicates that the error terms in the selection equation (4.17) and the earnings equation (4.16) are negatively correlated. It is significant in the models of dependent employment only. Insignificant and sometimes negative selection terms in regressions of earnings from self-employment are often reported in the literature (Brock and Evans 1986; Rees and Shah 1986; Evans and Leighton 1989; Dolton and Makepeace 1990; and Borjas and Bronars 1989), suggesting that there is no significant selection on unobservables; Taylor (1996), in contrast, reports positive and significant selection effects.

Table 12 shows the estimation results of the earnings variance equation (4.21). For both employment states and genders, the explanatory variables are jointly significant at conventional significance levels, which confirms the hypothesis that earnings are heteroscedastic (Breusch-Pagan test). This result shows that the variance of earnings not only differs between dependent employment and self-employment, but also between individuals, depending on their characteristics and covariates. The coefficient of the selectivity term l is significant and positive in the models of earnings variance in dependent employment, both for men and women. This indicates a positive correlation between the error terms in the selection and the variance equations. In the models of earnings variance in self-employment, l is insignificant, which is similar to the results obtained from the models of self-employment earnings.

Table 11: Regression of hourly gross earnings

Variable	Coefficient (Robust Standard Error)			
	Men		Women	
	Self-employed	Dependently Employed	Self-Employed	Dependently Employed
duration	0.594	0.315	-0.305	0.358
	(0.196)**	(0.024)***	(0.378)	(0.023)***
dur_sq	-0.021	-0.005	0.039	-0.013
	(0.014)	(0.002)**	(0.033)	(0.002)***
dur_cu	0.000	0.000	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.000)***
highschool	-1.236	2.058	0.774	2.118
	(0.938)	(0.123)***	(1.170)	(0.087)***
apprenticeship	-1.715	0.166	-1.941	0.627
	(1.075)	(0.087)	(1.209)	(0.072)***
highertechncol	-3.561	1.110	-2.020	0.726
	(1.066)***	(0.107)***	(1.096)	(0.108)***
university	6.652	3.888	1.303	2.634
	(0.990)***	(0.147)***	(1.383)	(0.106)***
age_bgn	0.367	0.179	0.216	0.095
	(0.361)	(0.041)***	(0.397)	(0.036)**
age_bgn_sq	-0.004	0.001	-0.004	-0.001
	(0.005)	(0.001)*	(0.005)	(0.001)
workexp_bgn	0.176	-0.111	-0.067	0.074
	(0.120)	(0.019)***	(0.283)	(0.016)***
workexp_bgn_sq	-0.001	-0.002	0.004	-0.002
	(0.004)	(0.001)***	(0.006)	(0.001)**
unemexp	-1.819	-1.418	-2.993	-0.877
	(0.484)***	(0.059)***	(0.887)***	(0.075)***
unemexp_sq	0.105	0.103	0.449	0.069
	(0.053)*	(0.008)***	(0.226)*	(0.016)***
german	-2.060	0.589	4.115	0.824
	(1.185)	(0.094)***	(1.812)*	(0.091)***
disabled	0.095	-1.015	-2.987	-0.466
	(1.195)	(0.116)***	(2.765)	(0.135)***
Fed. state dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES
l	-1.966	-0.642	-2.082	-0.407
	(1.475)	(0.230)**	(3.789)	(0.093)***
constant	7.217	5.523	-1.275	4.833
	(9.361)	(0.704)***	(15.583)	(0.542)***
R^2	0.186	0.370	0.285	0.313
N	3075	41365	991	22076

Stars (* / ** / ***) indicate significance at the 5% / 1% / 0.1% level.
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

Table 12: Regression of hourly gross earnings variance

Variable	Coefficient (Robust Standard Error)			
	Men		Women	
	Self-Employed	Dependently Employed	Self-Employed	Dependently Employed
duration	-0.033	-0.019	-0.073	0.011
	(0.033)	(0.009)*	(0.071)	(0.013)
dur_sq	0.004	0.003	0.005	0.002
	(0.002)	(0.001)***	(0.006)	(0.001)
dur_cu	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)***	(0.000)	(0.000)
highschool	-0.093	0.269	0.177	0.347
	(0.137)	(0.039)***	(0.296)	(0.046)***
apprenticeship	-0.162	-0.031	-0.368	-0.041
	(0.122)	(0.034)	(0.217)	(0.042)
highertechncol	-0.306	0.209	-0.225	0.129
	(0.145)*	(0.039)***	(0.219)	(0.049)**
university	0.672	0.512	0.126	0.523
	(0.134)***	(0.046)***	(0.267)	(0.053)***
age_bgn	-0.011	0.037	-0.051	0.028
	(0.054)	(0.014)**	(0.079)	(0.017)
age_bgn_sq	0.000	0.000	0.000	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)
workexp_bgn	0.008	-0.012	0.004	0.020
	(0.019)	(0.007)	(0.046)	(0.009)*
workexp_bgn_sq	0.000	-0.001	0.000	-0.000
	(0.001)	(0.000)**	(0.001)	(0.000)
unemexp	-0.244	-0.245	-0.098	-0.262
	(0.102)*	(0.026)***	(0.174)	(0.032)***
unemexp_sq	0.025	0.014	0.057	0.017
	(0.008)**	(0.003)***	(0.025)*	(0.005)***
german	-0.723	0.199	-0.978	0.239
	(0.180)***	(0.044)***	(0.345)**	(0.064)***
disabled	0.069	-0.051	-0.218	0.037
	(0.309)	(0.049)	(0.537)	(0.077)
Fed. state dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES
l	-0.366	0.502	-0.451	0.298
	(0.210)	(0.092)***	(0.556)	(0.049)***
constant	4.391	-0.359	3.654	-0.656
	(1.336)**	(0.232)	(2.432)	(0.292)*
R^2	0.115	0.075	0.162	0.068
N	3075	41365	991	22076

Stars (* / ** / ***) indicate significance at the 5% / 1% / 0.1% level.
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

Using the estimated earnings and earnings variance equations, the individual expected value and variance of gross earnings in both dependent employment and self-employment can be predicted. Before net earnings and the corresponding variance can be calculated, which are needed for the structural transition models, the tax rate function (4.23) must be estimated. The results of this estimation are given in Table 13. They show that the individual average tax rate increases with gross income at diminishing rates, which reflects the progressive income tax

code in Germany. The coefficient of the self-employment dummy indicates that the average tax rate of the self-employed is roughly 3.4 percentage points lower than the rate of their dependently employed counterparts (see sections 3.2 and 5.3.2 for details on the differential tax treatment of the self-employed).

Table 13: Regression of average tax rates

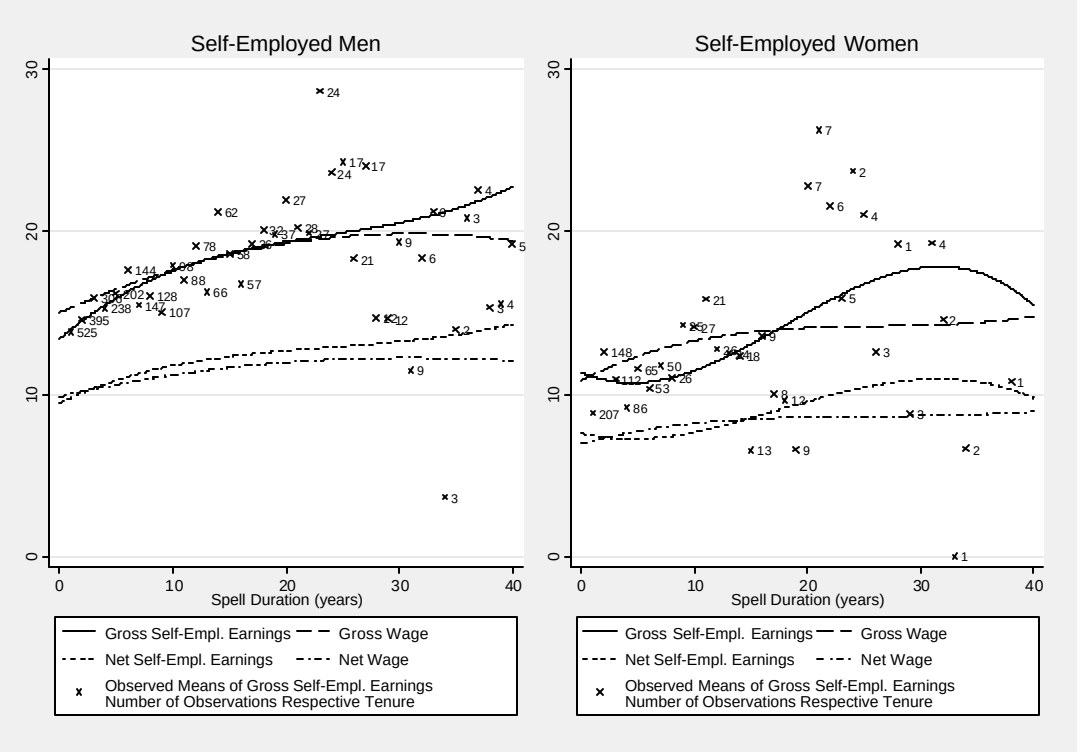
Variable	Coefficient (Robust Standard Error)
grossinc_yr	0.052
	(0.002)***
grossinc_yr_sq	-0.002
	(0.000)***
grossinc_yr_cu	1.45e-5
	(0.000)***
self-employed	-0.034
	(0.002)***
married	-0.046
	(0.001)***
married x female	0.070
	(0.001)***
nchild	-0.017
	(0.000)***
disabled	-0.008
	(0.002)***
year dummies	YES
constant	0.241
	(0.003)***
mean avg. tax rate	0.328
R^2	0.250
N	83101

Stars (***) indicate significance at the 0.1% level.
Source: Own calculations based on the SOEP 1984-2004.

As argued in section 4.3.7, not only the income in the next year, but in all future years of economic activity are likely to be relevant for an individual considering a transition from dependent employment to self-employment or vice versa. The predicted gross and net hourly income curves over the duration of a spell in self-employment or dependent employment are plotted for self-employed men and women in Figure 5, and for dependently employed men and women in Figure 6 (at mean values of the other explanatory variables). The net income curves run below the corresponding gross income curves (the gap is the tax paid), and they are also flatter, which reflects the progressive income taxation in Germany. In each diagram, the income curves in the actual employment state and in the counter-factual employment state can be directly compared. For reference, the scatter dots mark the mean gross hourly incomes of people actually observed with the respective spell duration. The numbers at the dots indicate how many observations with the respective spell duration are available in the sample.

Figure 5 shows that, on average, self-employed men would initially earn higher hourly gross income in dependent employment than in self-employment, but self-employment is rewarded higher for them after about 15 years. Interestingly, net income is higher for them in self-employment almost from the beginning on. This finding supports the hypothesis that higher net earnings in self-employment induce the self-employed to choose this state. The picture is similar for self-employed women, although women have to endure a considerable period of slightly lower net earnings in self-employment before these exceed the counter-factual wages from dependent employment.

Figure 5: Predicted hourly earnings of the self-employed (euro)



Dependently employed people would on average earn more if they were self-employed, both in gross and in net terms, as Figure 6 shows. On its own, this finding could be interpreted as a sign that earnings do not play a role in the choice of the employment state, or even of irrational behaviour. The structural model developed in this chapter offers a different explanation, however: If employees do not only have a higher expected value of earnings in the counter-factual state of self-employment, but also a higher variance of earnings, it may be rational for them to choose dependent employment if they are risk-averse.

Figure 6: Predicted hourly earnings of employees (euro)

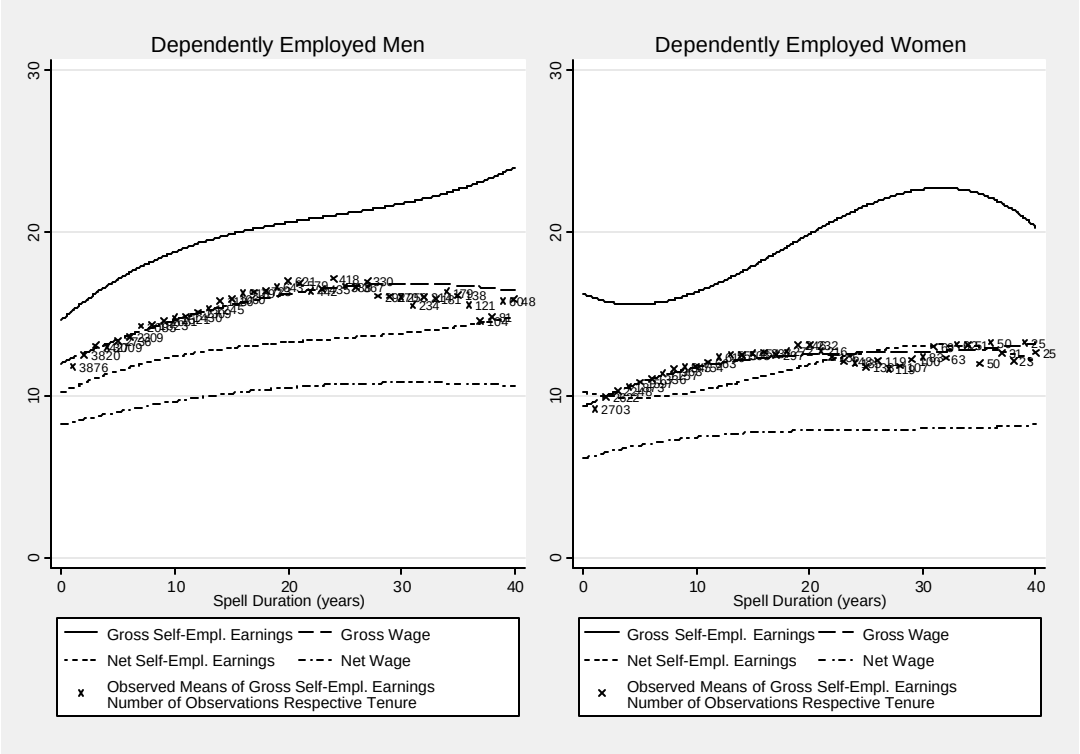


Figure 7 and Figure 8 shed light on the variance of earnings in the two different employment states. For better comparability, the variation coefficient (the standard deviation over the mean) is plotted. Again, the curves are drawn by varying the spell duration and keeping the explanatory variables fixed at their mean values, and the scatter dots indicate the actual mean variation coefficients of earnings at the respective spell durations. The four diagrams show that the variation coefficients of net earnings are smaller than those of gross earnings. This can be explained by the progressive income tax system in Germany. It can also be observed that the variation coefficient is larger in self-employment than in dependent employment for all groups, i.e. for actually self-employed and dependently employed men and women, and both before and after tax. The difference between the earnings variation in self-employment and dependent employment is more pronounced for those actually dependently employed than for those actually self-employed. Thus, switching to self-employment would require the dependently employed to tolerate a much higher earnings risk, and risk aversion could explain why employees do not switch to self-employment in spite of the higher expected value of earnings.

Figure 7: Predicted variation coefficient of hourly earnings of the self-employed

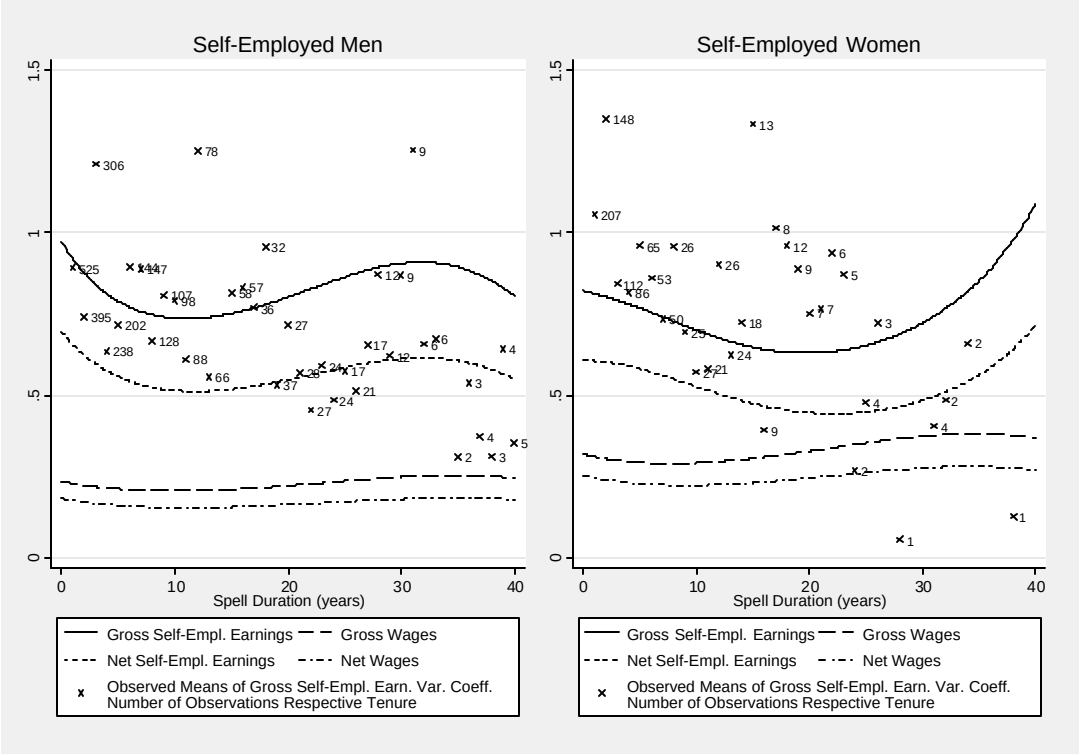
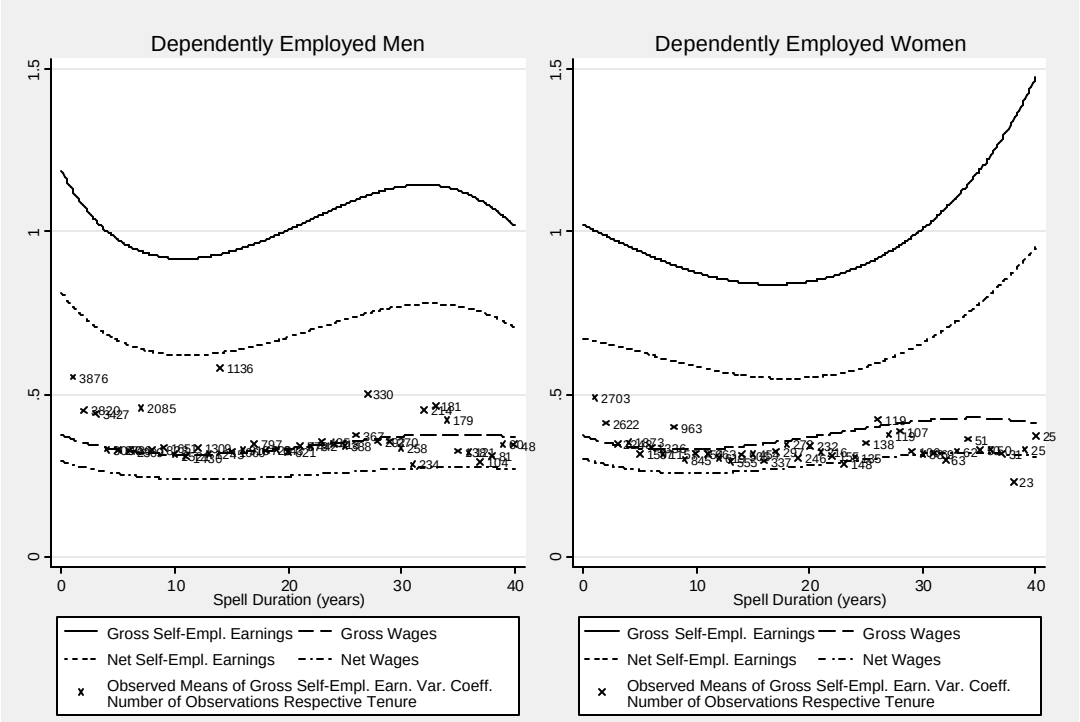


Figure 8: Predicted variation coefficient of hourly earnings of employees



Next the individually estimated net earnings and net variance profiles over time (till the age of 65) are summarised as annuities (see section 4.3.7). Table 14 summarises the mean results. The table rows correspond to the different sub-samples of relevance, which are split by gender and the actual employment status in the year of observation. The mean annuities of net earnings are higher in self-employment (first column) than in dependent employment (third column) in all the sub-samples. The mean annuities of net earnings variance are also higher in self-employment (second column) than in dependent employment (forth column) in all the sub-samples. The dependently employed would on average face higher net income variance if they were self-employment than the actually self-employed, which may deter them from choosing self-employment. Note that in contrast to the figures, which show the variation coefficients, the table gives annuities of the variance.

Table 14: Estimated net earnings annuities in self-employment and wage employment

Sample		Earnings from self-employment (mean values)		Wages from dependent employment (mean values)		N
		Estimated annuity (net earnings) $m_{y,se}$ in Euros/hour	Estim. variance annuity (net earnings) $s^2_{y,se}$	Estimated annuity (net earnings) $m_{y,se}$ in Euros/hour	Estim. variance annuity (net earnings) $s^2_{y,se}$	
Men and Women	Self-Employed	11.48	66.62	10.51	3.75	4066
	Dependently Empl.	11.79	150.15	9.53	17.47	63441
Men	Self-Employed	12.51	74.01	11.27	3.71	3075
	Dependently Empl.	12.29	96.24	10.44	24.06	41365
Women	Self-Employed	8.30	43.70	8.17	3.87	991
	Dependently Empl.	10.85	251.17	7.83	5.13	22076

Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

4.4.2 Estimation Results of the Transition Models

Using the estimated annuities, the structural models of transition probabilities between the alternative employment states dependent employment and self-employment (4.10) can be estimated.[61] Table 15 shows the coefficients resulting from the likelihood maximisation and the marginal effects in brackets where applicable. For each gender, the model of entry into self-employment from dependent employment is shown in the left and the model of exit from self-employment towards dependent employment in the right column. A positive sign of a coefficient indicates that the corresponding variable increases the probability of a transition to

[61] Estimations of the structural models based on next year's expected income and variance only are conducted and discussed in section 4.4.3.

the alternative employment state, and the marginal effects show the changes in percentage points. A university degree, for example, increases the probability of entering self-employment ceteris paribus by 0.31 percentage points for dependently employed men.

The estimates for the structural parameters r and a are given at the bottom of the table, along with their robust standard errors. The coefficient of the risk adjusted differential between net income from self-employment and from dependent employment a is significant in all models and positive in the models of entry into self-employment and negative in the models of exit. The four models thus consistently confirm the hypothesis that a higher risk adjusted net income in self-employment in comparison to dependent employment induces people both to become and to remain self-employed as the probability of entry is increased and the probability of exit is decreased.

The coefficient of constant relative risk aversion r is positive in all models, indicating risk aversion, and significant except for self-employed women, for whom the null hypothesis of risk neutrality cannot be rejected. The estimated degrees of risk aversion are low for self-employed men, moderate for dependently employed men and high for dependently employed women and lie in the range reported by the literature (e.g. Holt and Laury 2002; Binswanger 1980). Considering that far more women are dependently employed than self-employed, this finding is also in line with Dohmen *et al.* (2005), who found that women are generally more risk-averse than men. Self-employed men and women are clearly less risk-averse than employees, which is consistent with the hypothesis that risk aversion deters people from choosing self-employment. The finding that self-employed women may even be risk-neutral, and thus less risk-averse than self-employed men, is consistent with the low share of the self-employed among women in Germany, which may imply that only the least risk-averse women choose self-employment.

Table 15: Maximum likelihood estimation results of structural transition probabilities

Variable / Structural Parameter	Coefficient / Estimated Value [Marginal Effect] / (Robust Standard Error)			
	Men		Women	
	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment
duration	-0.2871***	-0.4063***	-0.3512***	0.0989
	[-0.0003]	[-0.0023]	[-0.0001]	[-0.0003]
dur_sq	0.0144***	0.0190***	0.0226**	-0.0110
dur_cu	-0.0003**	-0.0002**	-0.0004**	0.0002
highschool	0.0581	-0.3719	0.4404*	0.0379
	[0.0002]	[-0.0050]	[0.0006]	[0.0009]
apprenticeship	0.6211***	0.9556***	-0.1408	-0.2506
	[0.0022]	[0.0150]	[-0.0002]	[-0.0057]
highertechncol	1.0105***	0.7282**	0.3013	-0.5874
	[0.0052]	[0.0122]	[0.0004]	[-0.0125]
university	0.6715***	-0.1744	0.0848	-1.0386***
	[0.0031]	[-0.0024]	[0.0001]	[-0.0220]
age_bgn	0.0169	-0.1962***	0.0392	-0.0933
	[0.0001]	[-0.0028]	[0.0000]	[-0.0022]
age_bgn_sq	-0.0010	0.0018**	-0.0008	0.0005
workexp_bgn	0.0166	0.0005	0.0219	-0.0011
	[0.0001]	[0.0000]	[0.0000]	[-0.0000]
unemexp	0.0539	-0.0878	0.1292	0.0170
	[0.0002]	[-0.0013]	[0.0002]	[0.0004]
nchild	0.0649	0.0478	-0.0085	-0.3060*
	[0.0002]	[0.0007]	[-0.0000]	[-0.0072]
east	0.1612	0.1330	0.4094	0.7336*
	[0.0006]	[0.0020]	[0.0005]	[0.0193]
north	-0.0877	-0.3617	-0.1032	-0.4847
	[-0.0003]	[-0.0046]	[-0.0001]	[-0.0097]
south	-0.3348**	-0.1882	0.0658	-0.2811
	[-0.0011]	[-0.0026]	[0.0001]	[-0.0062]
otherhhinc	-0.0016	0.0020*	-0.0134*	0.0019
	[-0.0000]	[0.0000]	[-0.0000]	[0.0000]
spouse_empl	0.2786*	-0.0337	-0.1052	-0.3828
	[0.0011]	[-0.0005]	[-0.0001]	[-0.0083]
spouse_selfempl	0.6076	0.0999	1.6129***	0.9143***
	[0.0030]	[0.0015]	[0.0047]	[0.0298]
spouse_notempl	0.1447	0.3190	0.0323	
	[0.0006]	[0.0051]	[0.0000]	
constant	-4.4727***	1.9618	-5.2585***	-0.5257
r	0.3909***	0.1675***	1.2933***	0.0394
robust standard error	(0.0508)	(0.0500)	(0.2295)	(0.0396)
a	0.2621***	-0.2336***	0.1362***	-0.3744***
robust standard error	(0.0217)	(0.0342)	(0.0242)	(0.0839)
Wald χ^2	141.121	131.807	81.581	38.704
log likelihood	-1579.148	-522.740	-611.885	-198.598
transitions (N)	388	232	133	78
transitions (rate)	0.009	0.075	0.006	0.083
N	41365	3075	22076	945

The estimations are based on estimated annuities of net earnings and net earnings variance in self-employment and dependent employment. For self-employed women in the data, an unemployed/not working husband predicted a negative outcome (no transition) perfectly, so the 46 corresponding observations and the variable *spouse_notempl* were excluded from this estimation. Stars (* / ** / ***) indicate significance at the 10% / 5% / 1% level, based on heteroscedasticity robust standard errors.
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

Table 16 reports partial point elasticities of the transition probabilities with respect to the annuities of the expected value m_y and the variance s_y^2 of net income in self-employment and in dependent employment. They were calculated by evaluating the estimated structural transition model at the mean values of the independent variables. All elasticities are significant except for the variance elasticities of the probability of exit from self-employment for women. All elasticities have the expected sign, indicating that higher net earnings in self-employment in comparison to dependent employment attract people to this state, whereas higher relative variance deters people from choosing this option. For example, the leftmost column shows that a 1% rise in the annuity of expected hourly net income in self-employment increases the probability of entering self-employment by 1.4% if net income in dependent employment and the variance in both employment states do not change. Similarly, a 1% drop in net wages also raises the probability of entry into self-employment by 1.15 % if the variance of net wages and the prospects in self-employment remain constant. The elasticities do not equal in absolute terms because of the different mean variance in the two employment states. If the annuity of the net hourly income variance in self-employment increases by 1%, the probability of entry decreases by 0.16%, ceteris paribus, and analogously, a 1% rise in the variance of wages increases the probability of entry by 0.05%.

Table 16: Partial elasticities of transition rates with respect to after-tax m_y and s_y^2

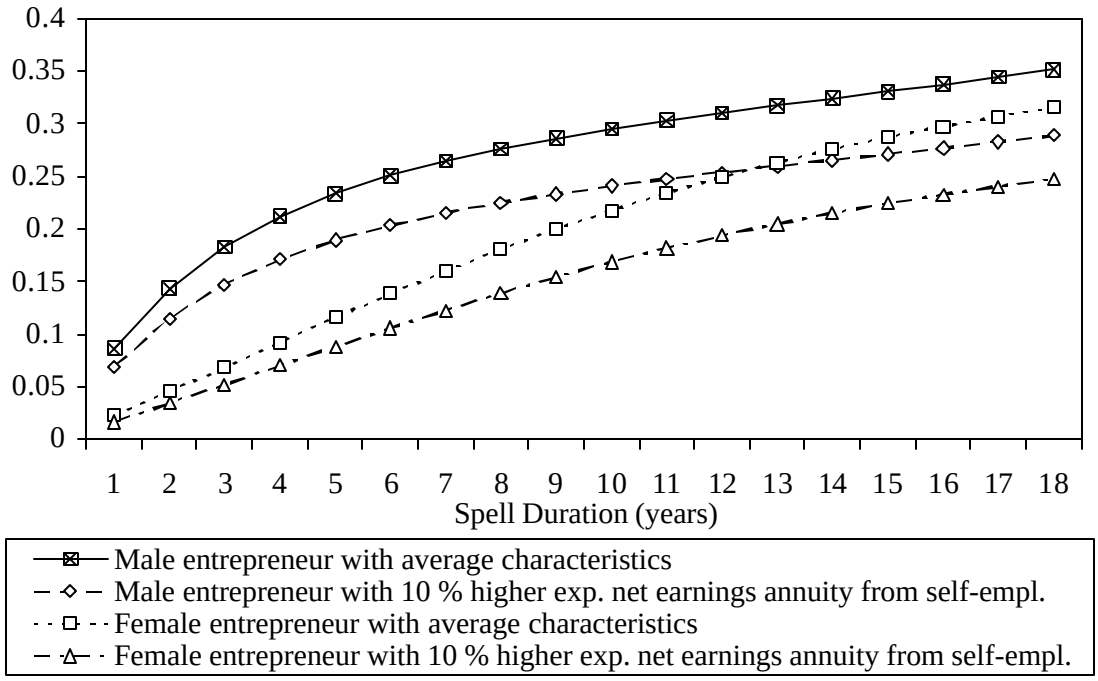
Variable: Annuity of...	Partial Elasticity (Robust Standard Error)			
	Men		Women	
	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment
Hourly net earnings from self-employment	1.4292 (0.2492)***	-2.4460 (0.4593)***	1.4541 (0.6558)**	-2.8227 (0.7888)***
Hourly net earnings from dependent employment	-1.1459 (0.2057)***	1.7479 (0.4624)***	-0.0829 (0.0502)*	2.8001 (0.8489)***
Variance of hourly net earnings from self-employment	-0.1579 (0.0127)***	0.5135 (0.0384)***	-0.6082 (0.3229)*	0.0545 (0.0420)
Variance of hourly net earnings from dependent employment	0.0471 (0.0035)***	-0.0042 (0.0003)***	0.0040 (0.0018)**	-0.0031 (0.0024)

The partial elasticities give the percentage change of the transition probabilities induced by a discrete one percent change in the annuities of expected value or variance of income from one of the two employment types, evaluated at the mean values of the explanatory variables in the sample. Stars (* / ** / ***) indicate significance at the 10% / 5% / 1% level.
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

Based on the estimated hazard rates, the cumulative transition probabilities, given by the failure functions $Fail(t)$, can be calculated for spells in self-employment and dependent

employment (see equation (4.15) in section 4.3.1). Figure 9 shows the cumulative probabilities of transition from self-employment to dependent employment, dependent on the spell duration, for a male and a female entrepreneur, evaluated at the respective mean values of the explanatory variables in the samples. The male entrepreneur has a higher cumulative transition probability than the female. Those women who choose to be self-employed – a much smaller share than among men, as mentioned before – have a lower probability of giving this status up again to switch to dependent employment, especially in the initial years. For the average male entrepreneur, the growth in the cumulative transition probability is largest in the first years of self-employment, which is explained by the high failure rates in the initial years of start-up firms. As the spell duration increases, the growth in the cumulative transition probability becomes smaller, as the firm has successfully taken the hurdles in its infancy years.

Figure 9: Cumulative probabilities of transition from self-employment to dependent empl.



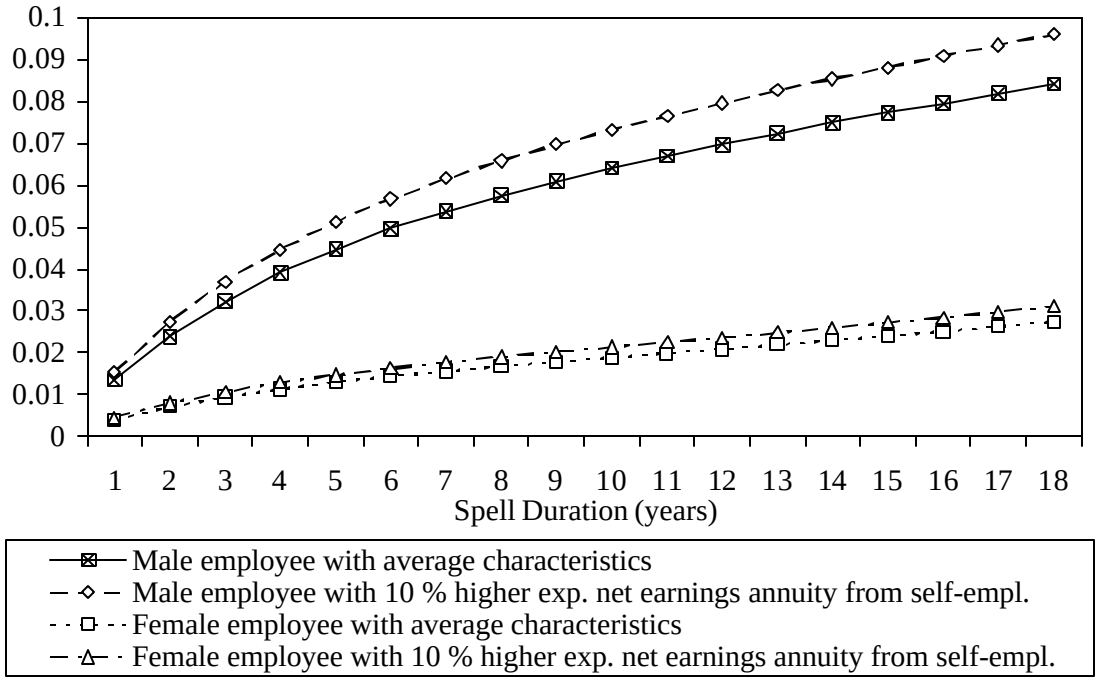
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

To illustrate the effect of net income, the figure additionally shows the cumulative transition probabilities of the man and the women if the net earnings annuity from self-employment is set to 10 % above the respective sample average. All other explanatory variables, including the annuity of net earnings from dependent employment and the variance annuities in both

employment states, are left unchanged (analogously to Table 16). These successful man and woman have lower cumulative transition probabilities at all spell durations than their average counterparts, because self-employment becomes relatively more attractive with higher expected income. The shapes of these curves are very similarly to those obtained with average net earnings annuities, however, indicating that the relative impact of net income does not change substantially over the spell duration in self-employment. The lower cumulative probabilities of exit can also be interpreted as the effect of a hypothetical tax cut which is granted exclusively to the self-employed. This interpretation is only valid if the hypothetical tax reform keeps the variance of net income unchanged.

Figure 10 shows the cumulative probabilities of transition from dependent employment to self-employment for a male and a female employee with average characteristics. A different scale of the *y*-axis is chosen than in Figure 9, as the probability of entry into self-employment is much lower than the probability of exit (relatively to the underlying populations). Men have a much higher probability of entry into self-employment than women. The growth in the cumulative transition probability decreases with longer tenure in dependent employment. Again, the figure also shows the cumulative probabilities when the annuity of expected net earnings from self-employment is set at 10 % above the average in the samples of men and women. This obviously increases the probability of transition to self-employment. The similar shapes of the curves before and after adjustment of the annuities illustrate that the relative effect of net income remains largely constant over the tenure in dependent employment. Again, the higher cumulative probabilities of entry into self-employment can be interpreted as the effect of a hypothetical exclusive tax cut for the self-employed, which does not change the variance of net income.

Figure 10: Cumulative probabilities of transition from dependent empl. to self-empl.



Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

4.4.3 Sensitivity Analysis

A number of assumptions were made in this chapter in order to take the structural model developed in section 4.2 to the data. This section assesses the sensitivity of the results with respect to these assumptions. Table 17 shows the structural parameters a and r and their robust standard errors resulting from different specifications of the models. The baseline estimation results are given in panel 1 at the top of the table for reference. Overall, the estimated parameters are similar in the different specifications and the basic results are thus found to be robust.

The first set of robustness tests consisted in excluding certain explanatory variables from the specification of the structural transition models. I excluded variables that may arouse some suspicion of being endogenous (income of other individuals living in the same household, number of children, and the spouse's employment state, panels 2-3; furthermore an individual's unemployment experience, panel 4). The point estimates of the structural parameters almost do not change.

Next, I analysed the sensitivity of the results with respect to the functional form of the hazard rate models. Specifying the baseline hazard as a polynomial of forth degree (instead of

third degree) virtually does not change the estimates (panel 5). I also tested specifying F as the cumulative normal distribution instead of the cumulative logistic distribution (probit specification, panel 6). Using the probit specification, the optimisation procedure did not converge for the exit model of men. In the remaining three models, the estimated probit coefficient of the risk adjusted income differential α can be multiplied by 1.6 for a rough comparison with the logit coefficient (Amemiya 1981). Again, this comparison indicates that the results for a are similar. The coefficient of relative risk aversion r does not need to be converted, as it does not depend on the specification of the binary choice model. Comparison shows that qualitatively the point estimates for r obtained by the probit and logit models are similar. The probit model yields somewhat higher risk aversion for dependently employed men.

In the baseline models, transitions from full-time dependent employment to part-time self-employment or from full-time self-employment to part-time dependent employment are treated as censored. The reason is that the focus of this paper is on the decision to be self-employed or dependently employed, once somebody has decided to work full-time. I tested the sensitivity of the results to this modelling decision by additionally counting transitions into part-time self-employment or dependent employment as positive outcomes (panel 7). The estimates of the structural parameters are only affected to a minor degree.

I also tested the robustness of the results with respect to the assumed real interest rate used in the calculation of annuities (panels 8-9). The point estimates for the structural parameters do not change much if the real interest rate is assumed to be 8% or 2% instead of 5% in the main estimation.

Only one specification yields qualitatively different results than the baseline estimation: When instead of annuities over the individually remaining years of economic activity only the expected value and variance of net income in the next year are used in the transition models (panel 10), large standard errors result and the structural coefficients in the transition models for men become insignificant. For women, the results remain qualitatively similar to those obtained from the main estimation. As argued in section 4.3.7, it seems unlikely that agents only look at next year's income prospects when making a decision as important as a transition between dependent employment and self-employment, and it would be irrational; thus, this special estimation may not be very informative.

Last not least, I estimated the models on the joint sample of men and women, including a dummy variable for women (panel 11). As expected, the point estimates of the structural parameters lie in between the estimates obtained by the separate estimations for men and women. This model serves as a reference model in chapter 5, which represents a further extended sensitivity analysis.

Table 17: Sensitivity analysis of structural parameters in the transition models

Structural Parameter	Estimated Value (Robust Standard Error)			
	Men		Women	
	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment
Panel 1: Main estimation				
r	0.390	0.167	1.288	0.039
	(0.051)***	(0.050)***	(0.229)***	(0.040)
a	0.263	-0.234	0.138	-0.374
	(0.022)***	(0.034)***	(0.025)***	(0.084)***
Panel 2: Exclusion of other household income				
r	0.390	0.168	1.287	0.039
	(0.051)***	(0.050)***	(0.219)***	(0.040)
a	0.262	-0.233	0.136	-0.374
	(0.022)***	(0.034)***	(0.023)***	(0.084)***
Panel 3: Exclusion of number of children, other household income and spouse's employment state				
r	0.394	0.167	1.213	0.042
	(0.052)***	(0.050)***	(0.240)***	(0.040)
a	0.261	-0.233	0.146	-0.367
	(0.022)***	(0.034)***	(0.027)***	(0.082)***
Panel 4: Exclusion of unemployment experience				
r	0.390	0.168	1.302	0.040
	(0.051)***	(0.050)***	(0.225)***	(0.039)
a	0.262	-0.234	0.135	-0.374
	(0.022)***	(0.034)***	(0.024)***	(0.083)***
Panel 5: Baseline hazard is a polynomial of forth degree				
r	0.390	0.166	1.284	0.039
	(0.051)***	(0.050)***	(0.224)***	(0.040)
a	0.262	-0.234	0.139	-0.374
	(0.022)***	(0.034)***	(0.024)***	(0.084)***
Panel 6: Probit specification of the hazard rate				
r	0.480		1.225	0.081
	(0.055)***	did not	(0.192)***	(0.051)
a	0.107	converge	0.068	-0.164
	(0.009)***		(0.010)***	(0.034)***
Panel 7: Transitions to part-time self-employment / dependent empl. counted as positive outcome				
r	0.389	0.175	1.233	0.068
	(0.048)***	(0.051)***	(0.199)***	(0.043)
a	0.270	-0.236	0.152	-0.362
	(0.021)***	(0.033)***	(0.024)***	(0.073)***
Panel 8: Real interest rate 8 % (q=1.08)				
r	0.428	0.175	1.256	0.043
	(0.061)***	(0.046)***	(0.221)***	(0.040)
a	0.237	-0.221	0.136	-0.364
	(0.022)***	(0.031)***	(0.024)***	(0.083)***
Panel 9: Real interest rate 2 % (q=1.02)				
r	0.364	0.157	1.319	0.039
	(0.045)***	(0.056)***	(0.246)***	(0.040)
a	0.288	-0.248	0.140	-0.386
	(0.022)***	(0.038)***	(0.026)***	(0.084)***
Panel 10: Consideration of next year's expected income only instead of lifetime annuity				
r	-0.489	-0.073	2.242	0.049
	(0.701)	(0.240)	(0.630)***	(0.101)
a	-0.008	-0.037	0.116	-0.310
	(0.022)	(0.051)	(0.135)	(0.075)***
Panel 11: Combined estimation for men and women (including dummy variable for female)				
r	0.477	0.123		
	(0.050)***	(0.033)***		
a	0.242	-0.256		
	(0.017)***	(0.031)***		

Stars (* / ** / ***) indicate significance at the 10% / 5% / 1% level. Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

4.5 Conclusion

The results of the analysis conducted in this chapter show that not only the expected value, but also the variance of an individual's future after-tax income play a role in the choice between self-employment and dependent employment. The probability of entry into self-employment and also the probability of exit are in general found to be significantly elastic with respect to both the first and the second moments of net income in the two alternative employment states, and the elasticities have the expected signs: Higher expected net earnings in self-employment relative to dependent employment attract people to become and to remain entrepreneurs, whereas higher variance discourages them from choosing this option. The results are similar when looking at cumulative transition probabilities over longer time periods. The findings can be inferred from the estimated coefficient of relative risk aversion which indicates that agents are moderately risk-averse. Women's higher risk aversion in comparison to men could be an explanation for the low share of female entrepreneurs in Germany. The finding that entrepreneurial choice is at least in part determined by a trade-off between monetary returns and risks – in the sense of Kanbur (1982) and Kihlstrom and Laffont (1979) – is further supported by the empirical analysis of incomes in dependent employment and self-employment. The estimated curves show that controlling for selection, both the expected value and the variation coefficient of hourly net earnings are on average higher in self-employment than in wage work in Germany, at least after the initial years have passed.

The sensitivity of the results has been tested by estimating a variety of different model specifications. The point estimates of the structural parameters are found to be robust. Among other things, I tested variations in the set of explanatory variables, the functional form of the hazard rate model, the definition of the outcome variable, and the real interest rate.

The estimated structural models of self-employment entry and exit are relevant for policy makers wishing to estimate the effect of changes to the progressive income tax code on self-employment. An income tax reform generally influences both the mean of net income (through the change in the individual average tax rate) and the variance of net income (through the change in the progressiveness of the tax code). The effect of a reform on the transition rates between dependent employment and self-employment can thus be simulated

ex-ante using the estimated structural transition models. This is especially interesting if the tax reform is explicitly intended to promote the creation and survival of small businesses.

4.6 Appendix

Table A 12: Number of person-year observations in the different employment states

Employment State Category	Men	Women
Unemployed/inactive	7976	26244
Full-time employed	41365	22076
Part-time employed	1460	13089
Full-time self-employed	3075	991
Part-time self-employed	281	764
Total	54157	63164

Source: Own calculations based on the SOEP 1984-2005.

Table A 13: Definition of variables used in the structural models

Variable	Definition
duration	Duration of current spell (self-employment or employment). For left-censored spells, the duration since the last job change is reported, which may be shorter than the overall duration in the current employment state if somebody switched jobs within one of these states before entering the panel
dur_sq, dur_cu	Square and cube of duration variable
highschool	Dummy for individuals who have a high school degree ("Fachhochschulreife" or "Abitur")
apprenticeship	Dummy for individuals who finished an apprenticeship ("Lehre")
highertechnical	Dummy for individuals who finished a higher technichal college or similar ("Berufsschule", "Schule Gesundheitswesen", "Fachschule", "Meister", "Beamtenausbildung", or "Sonstige Ausbildung")
university	Dummy for individuals who have a university degree
age_bgn	Age at the beginning of the current spell in self-employment or dependent employment
workexp_bgn	Years of work experience at the beginning of the current spell
unemexp	Years of unemployement experience
nchild	Number of children under 17 in the household
east	Dummy for individuals who live in one of the 5 new eastern federal states or East Berlin
north	Dummy for individuals who live in one of the northern federal states (Schleswig Holstein, Lower Saxony, Hamburg, or Bremen)
south	Dummy for individuals who live in one of the southern federal states (Baden-Wuerttemberg or Bavaria)
female	Dummy for women
otherhhinc	Income of other individuals living in the same household per year (in €1000)
married	Dummy for married individuals
spouse_empl	Dummy for married individuals whose spouse is dependently employed and living in the same household
spouse_selfempl	Dummy for married individuals whose spouse is self-employed and living in the same household
spouse_notempl	Dummy for married individuals whose spouse is unemployed or inactive and living in the same household
german	Dummy for individuals with German nationality
disabled	Dummy for handicapped / physically challenged individuals
fatherse	Dummy for individuals whose father is/was self-employed
grossinc_yr	Gross income per year (€10,000)
self-employed	Dummy for self-employed individuals

*x*_sq indicates the square and *x*_cu the cube of variable *x*. Dummy variables are equal to one if the condition holds and zero otherwise.

Table A 14: Means and standard deviations of variables used in the structural models

Self-Employed					
		Men		Women	
Variable	Unit	Mean	Std Deviation	Mean	Std Deviation
duration	years	7.641	7.589	6.226	6.392
highschool	binary	0.349		0.306	
apprenticeship	binary	0.434		0.364	
highertechncol	binary	0.292		0.287	
university	binary	0.306		0.341	
age_bgn	years	36.838	9.204	38.532	9.567
workexp_bgn	years	13.581	9.680	13.911	9.352
unemexp	years	0.312	0.805	0.363	0.798
nchild	number	0.824	1.009	0.592	0.840
east	binary	0.228		0.386	
north	binary	0.155		0.127	
south	binary	0.264		0.210	
otherhhinc (yr)	€1000	12.328	30.524	15.907	20.437
married	binary	0.724		0.719	
spouse_empl	binary	0.319		0.237	
spouse_selfempl	binary	0.074		0.154	
spouse_notempl	binary	0.127		0.046	
german	binary	0.945		0.964	
disabled	binary	0.035		0.015	
fatherse	binary	0.209		0.145	
transitions (N)		232		78	
transitions (rate)		0.075		0.079	
N		3075		991	
Dependently Employed					
		Men		Women	
Variable	Unit	Mean	Std Deviation	Mean	Std Deviation
duration	years	9.915	8.559	8.110	7.611
highschool	binary	0.215		0.200	
apprenticeship	binary	0.565		0.529	
highertechncol	binary	0.205		0.210	
university	binary	0.182		0.202	
age_bgn	years	31.043	9.402	30.692	9.284
workexp_bgn	years	9.271	9.209	8.374	8.393
unemexp	years	0.390	0.965	0.371	0.866
nchild	number	0.779	0.992	0.387	0.696
east	binary	0.244		0.358	
north	binary	0.127		0.116	
south	binary	0.286		0.243	
otherhhinc (yr)	€1000	12.682	20.808	16.209	20.368
married	binary	0.700		0.531	
spouse_empl	binary	0.283		0.264	
spouse_selfempl	binary	0.017		0.034	
spouse_notempl	binary	0.180		0.039	
german	binary	0.911		0.935	
disabled	binary	0.054		0.046	
fatherse	binary	0.066		0.082	
transitions (N)		388		133	
transitions (rate)		0.009		0.006	
N		41365		22076	

Standard deviations are given for continuous variables only.
Source: Own calculations based on the SOEP 1984-2005, full-time self-employed and dependently employed individuals.

Chapter 5: Ex-Ante Effects of German Tax Reforms on Self-Employment

5.1 Introduction

In the previous chapter, I developed and estimated structural models of transitions between dependent employment and self-employment and vice versa. I found evidence that both the expected value and the variance of net income in dependent employment and in self-employment are significant determinants of the choice between these two alternative employment states. While a higher expected value of net income in self-employment in comparison to dependent employment makes self-employment more attractive, a higher variance deters people from choosing this option. This is explained by a positive and significant point estimate for the coefficient of relative risk aversion. The estimated transition models are in line with Kanbur (1982) and Kihlstrom and Laffont (1979) who modelled entrepreneurial choice as trading off risk and returns.

An income tax reform, i.e. a change in the progressive tax schedule, influences both the expected value and the variance of after-tax earnings in the two alternative employment states. As these two moments of net earnings enter the structural transition models, tax policy has a direct effect on the estimated probability of choosing self-employment. Thus, the structural models are suitable for the ex-ante evaluation of the effects of certain tax reforms on self-employment.

In this chapter I use the models to estimate the impact of three tax reform scenarios for Germany on self-employment. The first scenario refers to the tax reform 2000, which delivered a significant reduction in income tax rates and an increased basic allowance. It was the largest income tax reform in Germany at least after the introduction of the linear-progressive tax code in 1990. Specifically, the question of interest here is how the transition rates into and out of self-employment would be different if the tax reform 2000 had not been

in effect in 2005. The year 2005 is chosen for the simulations because interviews for the most recent wave of the SOEP were conducted in 2006 and inquired relevant retrospective information about 2005. The second and third reform scenarios I simulate are revenue neutral flat tax scenarios with different flat tax rates and basic allowances. Flat tax policies have been discussed intensively recently. After a flat tax system was introduced in Estonia in 1994, several Eastern European countries, including Russia, have followed the example. In Germany, Kirchhof (2003), Mitschke (2004) and the council of economic advisors to the ministry of finance (2004) presented proposals for tax reforms with (almost) flat tax schedules. This raised a controversial public and academic debate, which for the time being peaked before the federal election in 2005.

In the discussion both of the actual tax reform 2000 and of hypothetical flat tax reforms, possible effects on small enterprises are often taken into consideration. In spite of the important role in the economy frequently attributed to entrepreneurs both by policy makers and researchers, quantitative estimations of ex-ante effects of tax policy reforms on self-employment based on microeconometric research are to my knowledge not available in Germany. The intention of this chapter is to contribute to filling this gap. By shifting the focus to self-employment, it extends existing microsimulation studies, which analyse the effects of the tax reform 2000 and of flat tax scenarios on the income distribution and on labour supply in Germany. These studies include Haan and Steiner (2005), who investigated the tax reform 2000, Fuest *et al.* (2007), who examined the two flat tax scenarios considered here, the parameters of which they defined, and Bönke and Corneo (2006), who analysed the tax reform 2000, a flat tax scenario, and other reform options.

The previous chapter had a more general research aim, it investigated the roles of risk and returns in the decision to enter or exit self-employment. Therefore, complexity in the model was limited to a degree which enhanced transparency and facilitated the interpretation of the results. Germany's income tax system was integrated into the empirical models using a comparably simple regression approach. Individual average tax rates, which were calculated using gross and net earnings as reported by the respondents in the SOEP, were regressed on polynomials of gross earnings and individual characteristics relevant for taxation. This yielded an estimated tax function reflecting Germany's progressive tax code (see section 4.3.6).

In contrast, the research aim in this chapter is to simulate the effects of specific tax reform scenarios for Germany on self-employment. This requires representing the actual and hypothetical tax systems as accurately as possible to be able to draw policy conclusions. Hence, the complex system of taxes, social security contributions, and transfers in Germany has to be brought into the models explicitly and consistently. This is achieved by integrating and further developing the tax-transfer microsimulation model STSM for Germany (Steiner *et al.* 2005). The extended STSM allows calculating net incomes from estimated gross incomes in self-employment and in dependent employment in the current law (baseline scenario) and in the three reform scenarios. The different legislations can be simulated by changing parameters in the tax-benefit model. The STSM has been used to estimate the ex-ante effects of tax and social reforms on the income distribution, work incentives and labour supply (e.g. Steiner and Wrohlich 2004 and 2005, Haan and Steiner 2005). Neither the STSM nor other microsimulation models have been used to estimate transition rates into or out of self-employment before.

The other reason for the explicit modelling of the German tax-benefit system is technical. In the model estimated in the previous chapter, net income was measured with error due to the simplified tax function, and the measurement error may be endogenous. The detailed modelling of taxes and transfers reduces the measurement error and any bias possibly connected to it. To investigate if this changes the estimated parameters of the structural transition models developed in the previous chapter, these models are re-estimated after precise net incomes are calculated using the STSM. Apart from solving the measurement error issue, the explicit modelling of the complexity and heterogeneity of the tax-benefit system introduces additional and, more importantly, exogenous variation in net incomes. This is expected to increase the efficiency of the point estimators for the parameters in the transition models and should also alleviate possible concerns with endogeneity of the tax rates and net incomes. In this respect, this chapter also serves as additional sensitivity analysis and plausibility check for the model developed in the previous chapter.

In the following section, the three hypothetical tax reforms of interest are introduced – the tax reform 2000 and the two flat tax policies. Section 5.3 describes the tax-benefit model STSM and new extensions I introduced to account for contributions of the self-employed to private health insurance and pension funds. It also explains the method of ex-ante simulation with behavioural response. Section 5.4 provides the results from re-estimating the structural

transition models and the microsimulation results for the three tax reform scenarios. Section 5.5 concludes.

5.2 Income Tax Reform in Germany

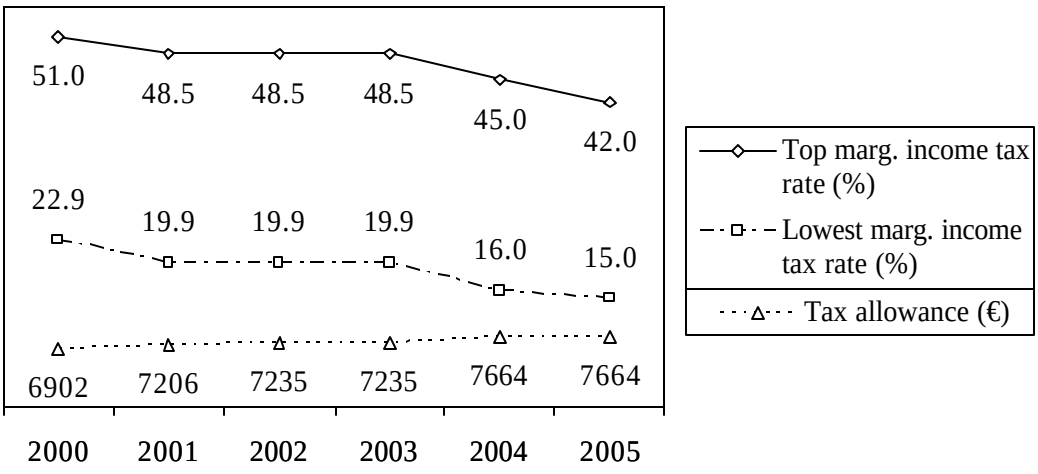
The German income tax is based on the comprehensive income taxation paradigm. In principle, income from different sources is summed up and taxed without differentiation between the sources. Some exceptions exist in practice, especially with regard to capital income and pensions. Nevertheless, the same progressive tax schedule applies for wages and salaries from dependent employment and for earnings (i.e. profits) from self-employment. The limitation of the top marginal income tax rate for tradesmen (see chapter 3) represented an exception from the rule, but it was abolished with the tax reform 2000.[62]

The tax reform 2000, which comprises the Tax Reduction Act of October 23rd, 2000 and the Supplementary Tax Reduction Act of December 19th, 2000, reduced the general statutory income tax rates and simultaneously increased the basic tax allowance in three steps between January 1st, 2000 and January 1st, 2005 (Figure 11).[63] The top marginal income tax rate dropped from 51 % in 2000 to 42 % in 2005, the lowest marginal tax rate from 22.9% to 15 %, and the basic allowance increased from €6,902 to €7,664. Overall the tax reform 2000 reduced the progressivity of the income tax schedule (cf. Corneo 2005; Bönke and Corneo 2006; Haan and Steiner 2005 report increasing inequality). According to the financial report of the Federal Ministry of Finance (2001), the changes in the income tax schedule in sum reduced tax revenues by €45,387 million per year,[64] which indicates the high economic significance of the reform. A business tax reform was launched simultaneously on January 1st 2001. Among other measures, it reduced the corporate income tax rate from 40 % for retained and 35 % for distributed profits to uniformly 25 %, introduced the half-income system for distributed dividends,[65] and replaced the limitation of the top marginal personal income tax rate for tradesmen (§ 32c of ESt) with a lump sum credit of the local business tax deductible from the personal income tax liability.

[62] For an overview on German income taxation, see Wellisch (2002).
[63] The first step of tax rate reductions in 2001 had already been scheduled for 2002 by the Tax Reduction Act 1999/2000/2002 of March 24th, 1999, but was pulled forward one year by the Tax Reduction Act. This step is treated as part of the tax reform 2000.
[64] The revenue losses are estimated for the years of introduction of each of the three steps and then summed up.
[65] Under the half-income system, only half of the dividends received by an individual shareholder are included as part of his or her taxable income In return, shareholders can no longer credit the corporate income tax paid by the company against their personal income tax.

In this chapter, I will exclusively consider the changes in the general income tax schedule, and will refer to this part of the reform as "tax reform 2000". The possibility of analysing the effect of an explicitly defined reform and abstracting from complementary measures and shocks is an advantage of the ex-ante simulation technique used in this chapter. Precisely, I will simulate a hypothetical scenario which assumes the government had repealed the change in the income tax code introduced with the tax reform 2000 in 2005 (and thus re-introduced the pre-reform tax law). I will compare this scenario with a baseline simulation of the actual law of 2005, which includes the tax reform 2000; the difference can be attributed to the reform.

Figure 11: Changes in the income tax schedule between 2000 and 2005 (tax reform 2000)



The other two tax reform scenarios I consider in this chapter are flat tax policies. In the strictest sense, a flat tax is a uniform tax rate on the total tax base. In practice, a flat income tax rate is usually combined with a basic tax allowance, which leads to an implicitly progressive tax schedule. Thus, if the tax base is left unchanged, a flat tax policy is defined by two parameters, the flat tax rate and the basic allowance. Fuest *et al.* (2007) examined the distributional and labour supply effects of two flat tax scenarios for Germany using a microsimulation model. The first policy is defined by a low tax rate and a low basic allowance (scenario "flat tax LL"), and the second by higher values for the two parameters (scenario "flat tax HH"). The authors chose the balance of each scenario's two parameters such that they establish revenue neutrality in their simulation for 2007 assuming that there are no

behavioural responses such as labour supply reactions. The tax base is left unchanged. Tax base broadening measures often suggested in conjunction with a flat tax are not considered in order to reveal the effect of the changed tax schedule alone. In scenario LL, the basic allowance is left unchanged at €7,664, and the tax rate that establishes revenue neutrality is found to be 26.9%. In scenario HH, a higher basic allowance of €10,700 and a higher revenue neutral flat tax rate of 31.9 % are chosen.[66] The distinctive feature of this flat tax scenario is that it does not change the Gini index of inequality compared to the situation without the reform, according to the simulations of Fuest *et al.* (2007) (again without behavioural responses). This is explained by the high basic allowance, which reduces taxes for low income people.[67] Table 18 summarises the two scenarios.

Table 18: Definition of flat tax scenarios

	Basic Allowance in Euro	Marginal Tax Rate in %
Legislation 2005	7,664	15-42
Scenario "Flat Tax LL"	7,664	26.9
Scenario "Flat Tax HH"	10,700	31.9

I will simulate the effects of these two flat tax scenarios on transitions into and out of self-employment in the year 2005, like the hypothetical repeal of the tax reform 2000 and the baseline (current law) scenario. As the most recent wave of the SOEP available was carried out in 2006, providing retrospective income information about 2005, the year 2005 is the most recent year with this data available.

Table 19 shows the effects of the three hypothetical reform scenarios on the individual yearly net incomes of full-time working people (the sample relevant for this analysis) in 2005 by gross income deciles.[68] These are the first round effects as calculated using the tax-benefit microsimulation model STSM, which will be described in section 5.3.1, before any behavioural effect is taken into account. In the flat tax scenarios the average absolute change in net income is below 0.15% in this sample, which reflects that the scenarios are designed to

[66] The council of economic advisors to the ministry of finance (2004) suggested a similar (but not revenue neutral) flat tax with a basic allowance of €10,000 and a tax rate of 30%.
[67] Davies and Hoy (2002) demonstrated that revenue neutral flat tax reforms with lower basic allowances than in the pre-reform graduated rate tax schedule result in higher inequality compared to the pre-reform situation according to any inequality index. If a higher basic allowance is chosen, a certain revenue neutral combination of the flat tax rate and the basic allowance exists which does not change a given inequality index, e.g. the Gini coefficient, in comparison to the situation without the reform. This combination is found in scenario HH.
[68] The split-up of household net income between individuals within households is described in section 5.3.1.

be revenue neutral.[69] Distributional effects are evident: in the flat tax scenario LL, the top decile gains 2.96 % and the 9th decile 1.35 % in comparison to the baseline scenario, whereas the other deciles loose net income. In the more progressive scenario HH, redistribution is not as pronounced. Due to the higher marginal tax rate, net income in the top decile increases by only 0.69 %, and the two lowest deciles also gain due to the higher basic allowance. As the tax reform 2000 constituted a tax relief for income tax payers, its repeal in 2005 would have decreased net incomes by 4.5% on average. The higher deciles, which gained most from the tax reform 2000 – not only in absolute, but also in relative terms –, would consequently loose most from its reversal.

Table 19: Mean individual yearly net income in baseline and reform scenarios by deciles

Gross Income Decile	Yearly Net Income 2005 in Baseline Scenario in Euro	Change in Comparison to Baseline Scenario in %			N
		Scenario "Repeal of Tax Reform 2000"	Scenario "Flat Tax LL"	Scenario "Flat Tax HH"	
1	7,048	-1.65	-0.95	0.60	
2	15,262	-2.95	-1.70	0.32	
3	17,851	-3.64	-1.62	-0.29	
4	21,503	-3.98	-1.34	-0.35	
5	24,000	-4.24	-1.03	-0.52	
6	26,029	-4.54	-0.86	-0.57	
7	28,997	-4.57	-0.77	-0.56	
8	30,958	-4.89	-0.03	-0.53	
9	34,621	-5.23	1.35	-0.02	
10	45,660	-5.31	2.96	0.69	
All	25,188	-4.50	0.08	-0.13	3664

Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

5.3 Microsimulation of Income Taxes and Transfers

5.3.1 The Microsimulation Model STSM

The behavioural tax-benefit microsimulation model STSM developed by Steiner *et al.* (2005) is based on individual-level, representative data from the German Socio-Economic Panel

[69] The scenarios are not exactly revenue neutral in 2005, as Fuest *et al.* (2007) simulated the revenue neutral flat tax scenarios for the year 2007, after having updated their data using a static ageing technique. There were no major changes in income taxation between 2005 and 2007, however. The introduction of a new top tax bracket with a top marginal tax rate of 45% for people with income above €250,000 in 2007 (profit incomes are exempted in 2007) is expected to have only a minor revenue impact – estimations range from €300 million by the government down to zero by the ifo institute (German Bundestag 2006). Using the same tax parameters as Fuest *et al.* (2007) for the year 2005 has the advantages of comparability and at the same time avoidance of data ageing, which by nature would require assumptions about the growth rates of the various income components and the demographic changes.

(SOEP, see section 3.6.2) and basically consists of two parts: (i) a tax-benefit calculator that computes net household incomes for each sample household on the basis of information on gross incomes, for different (hypothetical) legislations, and if required, for different working hours of individuals; and (ii) an empirical labour supply model with household utility depending on net household income and leisure of both spouses (in case of couple households). In contrast to the static microsimulation model BizTax introduced in chapter 2, which calculates business taxes for a representative sample of German firms, the STSM derives personal income taxes, social security contributions and transfers for a representative sample of individuals in German households. The STSM has been used primarily to analyse the ex-ante effects of tax and social reforms on the income distribution, work incentives and household labour supply (e.g. Steiner and Wrohlich 2004 and 2005, Haan and Steiner 2005). Correspondingly, the behavioural part of the STSM is designed to model the labour supply decision of households, assuming that married couples maximise a joint household utility function.

The research question this and the previous chapter of this dissertation thesis deal with is different. It is assumed individuals have already decided to work full-time (selection was controlled for in the previous chapter, taking into account the household context) and are faced with the decision to work in dependent employment or self-employed. To model this decision, the individual utility function introduced in the previous chapter is more appropriate than a joint household utility function, as risk attitudes, which are a crucial concept in this setting, are understood as individual characteristics. This analysis uses the static tax-benefit model of the STSM, which will be described next, with some extensions related to the self-employed (see section 5.3.2). Instead of the behavioural household labour supply model of the STSM, this analysis draws on the individual self-employment decision models derived in the previous chapter. As both the data sample used in the previous chapter and the STSM are based on the SOEP, the models can be integrated.[70] The SOEP provides information about the relevant income components, expenses, transfers, and household characteristics required to calculate net income precisely. Most of these items are collected retrospectively, so for the computation of year t the STSM draws on information from wave $t+1$.

In the STSM's tax-benefit model, gross income of a household is calculated as the sum of all income components of all household members. Although an individual utility function

[70] The sample used is defined as in chapter 4 (see section 4.3.2). Particularly, farmers and family members helping in a family business are excluded.

will be used in the behavioural model, precise net income must be calculated on a household basis because married couples are taxed jointly in Germany with full income splitting.[71] Taxable income is derived from gross household income by deducting special expenses such as employees' social security contributions, extraordinary expenses such as sickness costs, and child and other allowances. The income tax is computed by applying the progressive income tax function to the taxable income of each unmarried person in the household or the joint income of married couples. The reform scenarios can be simulated by changing parameters of this tax schedule. Social transfers such as child benefits, child-rearing benefits, unemployment compensation, housing benefits and social assistance are added to calculate net household income.

Individual net income is relevant for the decision to enter or exit self-employment according to the individual utility function derived in the previous chapter. Thus, for this analysis the calculated household net income must be allocated to the household members. It cannot be observed how net income is actually distributed between household members. A plausible assumption may be that the relevant part of net household income in the individual's utility function is the share of net household income which equals the share of his or her contribution to gross household income from dependent or self-employed work.

5.3.2 Extensions for the Self-Employed

For each person in the sample, in the previous chapter gross incomes were estimated for the two alternative employment states dependent employment and self-employment, one of which is counter-factual. In previous research, which used the STSM to estimate labour supply, the focus was on accurately calculating net incomes in different categories of working hours (in dependent employment) or unemployment, and self-employment was not considered (see for instance Haan and Steiner 2005). In contrast, in this analysis, net incomes in both states dependent employment and self-employment enter the structural transition equations, and thus net income in self-employment must be modelled accurately.

The comprehensive income taxation principle in Germany ensures that most income tax regulations are identical for the dependently employed and the self-employed. Differences are primarily found in the domains of social security and insurance contributions.[72] Employees

[71] The income tax of married couples is calculated by applying the tax function to half of the sum of the spouses' taxable incomes and then doubling the resulting tax amount.
[72] For an overview on German social security law, see the Federal Ministry of Labour and Social Affairs (2006).

are obliged to contribute to statutory health and long term care insurance and statutory pension insurance unless their income exceeds certain thresholds, which allows them to contract out. Furthermore, they have to contribute to unemployment insurance. These social security contributions are (largely) equally split between employees and employers. The contributions reduce net income, while they also grant benefit entitlements. In contrast, for the self-employed provisions for sickness, old age and unemployment are generally left at their own responsibility.

The self-employed in Germany can be covered by three different types of health (and long term care) insurance: private health insurance, voluntary membership in statutory health insurance, or coverage by family statutory health insurance.[73] Voluntary membership in statutory health insurance is only possible if the person had contributed to statutory health insurance for at least the last 12 months or for at least 24 months within the last 5 years before entering self-employment. Family insurance is only available to self-employed working less than 18 hours per week, so it is irrelevant for the sample of full-time working self-employed people. In the SOEP sample used here, 60 % report that they were privately insured in 2005.[74] The SOEP also provides the amount contributed by self-employed people with private health insurance per month.

In the following I will assume that the relevant health insurance costs that people take into account when considering self-employment are given by private health (and long term care) insurance contributions. To be able to estimate hypothetical private health insurance contributions for dependently employed people in the counter-factual state of self-employment, I first use the sub-sample of privately insured self-employed individuals and regress the monthly contributions on relevant individual characteristics (age and age squared, gender, marital status and the number of children), separately for each year. The estimated equation can then be used to predict counter-factual private health insurance contributions per month, which are multiplied by 12 to obtain contributions per year. Table 20 shows the regression results for the year 2005.[75] Contributions increase with higher age, as agreed by contract. They also increase with the number of children, as private health insurance has to be paid for them separately, in contrast to statutory health insurance. The mean private health

[73] As an exception, artists and publicists are covered by mandatory statutory health insurance if certain requirements are met.
[74] About 0.85% of the self-employed in Germany were not covered by any health insurance in 2003 (Greß *et al.* 2005). From January 1st 2009 on, health insurance will be obligatory for all self-employed.
[75] The regression results for the other years are available upon request.

insurance contributions reported by the full-time self-employed in the SOEP were €352.19 per month in 2005 (the standard deviation of the distribution is 160.42). For comparison, statutory health (and long term care) insurance contributions, as calculated by the STSM for the full-time dependently employed in 2005, amount to €433.84 per month (standard deviation of the distribution: 149.78). This includes both the employee's and the employer's share (both contribute 50%). Self-employed people who are voluntary members in statutory health insurance have to pay the full amount. The comparison shows that on average the self-employed are better off choosing private health insurance. Self-employed persons with several children and a non-employed spouse may still opt for voluntary membership in statutory health insurance, if possible, as in this case spouse and children are covered by family insurance without additional contributions.

Table 20: Estimation of private health insurance contributions per month, SOEP 2005

Variable	Coefficient (Robust Standard Error)
age	17.8170 (4.5149)***
age squared	-0.1106 (0.0488)**
number of children in household	21.4603 (9.3520)**
married	-11.7228 (16.1937)
male	-43.2149 (19.3662)**
constant	-195.4995 (101.4759)*
R^2	0.246
N	381
Mean private health insurance contributions (euro)	352.19
Standard deviation of contributions	160.42

Stars (* / ** / ***) indicate significance at the 10% / 5% / 1% level.
Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

There are also different types of pension insurance schemes for the self-employed. The self-employed are not generally obliged to contribute to pension insurance. Specific groups of the self-employed (about a quarter of all self-employed) are obliged to contribute to statutory pension insurance (Schulze Buschoff 2007), however.[76] For other self-employed people the possibility of being included in the statutory pension insurance system upon application exists; opting out later is ruled out in this case. Another possibility is voluntary membership in

[76] Mandatory pension insurance applies for self-employed teachers without employees, nurses, midwifes, artists, publicists, craftsmen (who may contract out after having contributed for 18 years), and other less frequent groups.

statutory pension insurance, which allows choosing the level of the contributions (and entitlements). More relevant in practice are private pension insurance schemes, e.g. state-aided basic (or "Rürup") pension schemes (since 2005).[77] No reliable information could be obtained about actual old age provisions of the self-employed such as contributions to private pension insurance. To proceed, I assume that the yearly amount the self-employed contribute into such schemes equals the amount they would be obliged to pay into the statutory pension insurance if they were dependently employed (i.e. the employee's share). This implies that contributions increase with income from self-employment until a certain upper limit. This limit is reached when gross yearly income exceeds the threshold which allows dependently employed people to contract out of statutory pension insurance, which was €62,400 in 2005. The assumption seems plausible, as higher income first allows the self-employed to save more for old age. With yearly income exceeding the threshold they probably do not further increase their contributions to pension insurance, which is rather restrictive, but diversify additional savings into more risky and/or flexible investments. Such savings do not reduce net income, however, as they can be consumed anytime. The assumption implies that the self-employed contribute to pension insurance only half the amount that employees and employers together contribute to an employee's statutory pension insurance. It seems realistic that the self-employed contribute less than the full amount, as the principle of statutory pension insurance is pay-as-you-go financing, whereas private pension insurance follows the funding principle. Especially taking into account the ageing of the German population, the self-employed may expect a higher rate of return from private pension insurance. To assess the sensitivity of the results, I will additionally estimate the structural transition models assuming that the amount the self-employed contribute to private pension insurance equals the full contributions to statutory pension insurance, i.e. the sum of the employee's and the employer's share.

An alternative assumption could be that the amount the self-employed contribute to pension schemes equals the upper limit of provisions deductible as special expenses from taxable income. The rationale could be that the self-employed exploit this opportunity to avoid taxes by deducting the full amount possible, while they would diversify further savings into less restrictive assets. This assumption would not lead to plausible results, however, as in the law of 2005 the upper limit of deductible provisions first falls with higher income and then remains constant. This would imply that the self-employed with low income pay almost

[77] The basic pension is also available for dependently employed people who wish to supplement their statutory pension insurance.

their entire income into pension insurance, whereas self-employed people with high income would contribute only a very small share (cf. Buslei and Steiner 2006, p. 61).

Until recently there was no equivalent to unemployment insurance for the self-employed. Since February 2006 people becoming self-employed after having been dependently employed may opt to stay in unemployment insurance upon application. The precondition is that they must have been covered by mandatory unemployment insurance for at least 12 months within the last 24 months before entering self-employment. The new option is part of the so-called Hartz III reform (BGBl I 2003 No. 65, p. 2828). As it was not available in 2005, it is not relevant for the calculation of net income in the baseline or the reform scenarios analysed here. Private unemployment insurance is regarded as infeasible due to moral hazard. The self-employed may save additionally to hedge their unemployment risk. As mentioned before, such savings do not reduce net income, however, as they can be consumed anytime. Apart from that, even if reliable information on savings were available, it would be impossible to separate out savings for hedging unemployment risk from other savings and retentions within the firm. Thus, no additional amount is deducted from the net incomes of the self-employed.

Subtracting estimated contributions to private health insurance and assumed contributions to pension funds from the income of the self-employed establishes a concept of net income that is comparable to the situation of the dependently employed who pay into statutory health and pension insurance. For both groups, these contributions reduce disposable income, they are connected with at least similar entitlements,[78] and they can be deducted from taxable income as special expenses if certain prerequisites are met.[79]

[78] A difference in entitlements is that in contrast to private health insurance, statutory health insurance includes coverage of children and spouses who earn less than €400 per month (family insurance). This may induce incentives for spouses of self-employed or other privately insured persons to be dependently employed in order to be covered by statutory health insurance. I partly account for this effect in the transition models by including a dummy variable for self-employed spouses.

[79] The prerequisites for private pension insurance basically ensure that the funds are not consumed before old age (for details see Wellisch 2002, pp. 567ff). For all taxpayers (independently of the status as a dependently employed or self-employed person), upper limits of the provisions deductible as special expenses exist and are modelled in the STSM. The Retirement Income Act, the first step of which became effective on January 1st 2005, provides that the upper limits for old age provisions are increased in steps until 2025. During the transitional period until 2019, possible disadvantages for taxpayers are avoided as authorities check for every taxpayer if the old or the new law is more favourable. Buslei and Steiner (2006) provide a rigorous microsimulation study of the fiscal and distributional effects of the Retirement Income Act. As the legislation changes are faded in gradually and effects can thus be expected to be rather small initially (Buslei and Steiner (2006) estimate that households gain on average about €210 due to the changed regulations for the deduction of old age provisions in the year 2005), the Retirement Income Act is not taken into account in this analysis.

In this analysis start-up subsidies by the government are not explicitly incorporated in the model. The bridging allowance (*Überbrückungsgeld*), which was established in 1986, provided financial support during a maximum of the first six months in self-employment if certain prerequisites were met. Applications could be made by unemployed people with benefits entitlement, but also by employed people to avoid imminent unemployment (after dismissal or foreseeable dismissal). Thus, it is possible that the programme had an effect on transitions between dependent employment and self-employment. In 2005, a total of 160,000 people received bridging allowance (Baumgartner *et al.* 2006). It is assumed here that the effect of this programme on transitions between dependent employment and self-employment – if there is any – is the same in the baseline and in the three hypothetical tax reform scenarios; when the difference is taken to evaluate the impact of the reforms, the effect of the bridging allowance cancels out.[80]

The data do not allow observing if the self-employed have better tax avoidance and evasion opportunities than the dependently employed, and how many people exploit such opportunities. Based on data from the 1983 wave of the German income and consumption survey, Lang *et al.* (1997) found that the self-employed significantly underreported their income. Bach, Corneo, and Steiner (2005) also found a significant gap between gross income and taxable income due to tax avoidance in Germany, especially through renting and leasing, but also business activity. On the other hand, according to Parker (2003), tax avoidance and evasion opportunities do not influence the choice between self-employment and dependent employment. In this analysis any such effect would cancel out in the comparison between the reform and the baseline scenarios, as the reform scenarios considered here only alter the tax schedule, but not the tax base and thus do not influence avoidance and evasion opportunities.

5.3.3 Ex-Ante Simulation of Tax Reform Scenarios with Behavioural Response

As argued in the introduction to this chapter, the first step to proceed is the re-estimation of the structural transition equations derived in the previous chapter. Using the tax-benefit model STSM, the expected value and variance of net income in the two alternative states dependent employment and self-employment can be calculated more precisely. As the time period for

[80] The so-called "Ich AG" ("Me-Incorporation") programme, which came into effect in January 2003, was only available to the unemployed, so it is not relevant for this analysis. In August 2006, both the bridging allowance and the "Me-Incorporation" programmes were replaced by a single new start-up subsidy programme (*Gründungszuschuss*), which is only available to unemployed people receiving unemployment benefits, so again it is irrelevant for transitions between dependent employment and self-employment.

this analysis I choose 2002-2005, because the extension of the STSM to the whole period covered by the sample used in chapter 4 (1984-2004) is infeasible here. Furthermore, for the purpose of policy simulations in the year 2005, as pursued in this chapter, the empirical estimations should not be based on data points observed too far in the past. I also include year dummies to ensure that possible business cycle effects are taken account of. The most recently released wave of the SOEP, which refers to 2006 and includes retrospective income information about 2005, could be included additionally in the analysis for this chapter. After re-estimating the structural transition equations, the estimated parameters can be compared with the results from the previous chapter. This not only allows evaluating the robustness of the results with respect to the modelling of the German tax and transfer system, but also with respect to the selection of observation years.[81]

In the smaller 2002-2005 sample, only 32 women enter full-time self-employment and even only 9 exit this state. Because of these small numbers, I abstain from estimating the structural transition models for the sub-sample of women, and estimate the models using the pooled sample of men and women (including a dummy variable for women) and the sub-sample of men only.

In contrast to chapter 2, where microsimulation was used as a method to analyse fiscal and distributional first-round effects of certain tax reforms, here the focus is on specific behavioural (second-round) responses. The structural transition models allow an ex-ante estimation of the impact of income tax reforms on the transition rates between dependent employment and self-employment.

Individual curves of the expected value and the variance of real gross income over lifetime in both employment states have already been predicted in the previous chapter. Deviating from the procedure pursued there, now I use the STSM to calculate net incomes from these gross incomes.[82] In the baseline scenario, the parameters in the tax-benefit model STSM are set to reflect the actual legislation in 2005. The reform scenarios are implemented by adjusting the parameters of the tax schedule. Like in the previous chapter, the underlying assumption is that individuals expect the current (actual or hypothetical) legislation to stay

[81] The structural transition models are specified exactly the same way as described in section 4.3.1, except for the inclusion of time dummies. Specifically, duration dependence is controlled for using hazard rate models which take both left- and right-censored spells into account.

[82] Again, all monetary variables are deflated using the Consumer Price Index (2001 = 100). The estimated real hourly gross incomes are converted into nominal yearly gross incomes before entering the STSM, and the resulting nominal yearly net incomes are converted back to real hourly net incomes afterwards. As in chapter 4, the average number of hours worked in the sample of full-time working people is used for the conversion.

unchanged till they reach retirement age. Next, I calculate annuities of the expected value and variance of net income to summarise the estimated lifetime curves, again following the previous chapter's procedure. Now the structural transition models (section 4.3.1) can be re-estimated.

Finally, the probabilities of entry into and exit out of self-employment in the baseline scenario and the three alternative reform scenarios can be predicted for 2005 using the re-estimated structural transition equations, based on the observations in 2005. The predicted transition rates in the baseline scenario are compared to the predicted rates in the reform scenarios. The differences can be interpreted as the estimated ex-ante effects of the hypothetical tax policy reforms. I also analyse the effects of the reforms on the cumulative transition probabilities over longer time periods.

5.4 Results

5.4.1 Re-Estimation of the Structural Transition Models

The upper panel of Table 21 shows the point estimates and robust standard errors of the structural parameters r (the coefficient of constant relative risk aversion) and a (the coefficient of the differential of risk adjusted net income annuities) obtained by re-estimating the structural transition models. The left two columns show the models of transition from dependent employment to self-employment and from self-employment to dependent employment for the whole sample, and the right two columns for the sub-sample of men. All point estimates for r and a are significant at the 1% level, in spite of the smaller sample size in comparison to the estimations in the previous chapter (due to the limitation to the years 2002-2005).

The coefficient of the differential between the risk adjusted net income annuities from self-employment and from dependent employment a is positive in the models of entry into self-employment and negative in the models of exit. The four models thus consistently confirm the hypothesis that a higher risk adjusted net income in self-employment in comparison to dependent employment induces people both to become and to remain self-employed as the probability of entry is increased and the probability of exit is decreased. The estimated coefficients of constant relative risk aversion r are positive in all models, indicating

that people are risk-averse. The estimated degrees of risk aversion are low for the self-employed and moderate for the dependently employed.

Below, the results obtained in the previous chapter are shown for comparison (from Table 15 and Table 17). The point estimates for r in the four models are very similar. With regard to a, the difference is somewhat larger, especially in the model of entry into self-employment for the full sample. This may be explained by a misspecification of the models estimated in the previous chapter, as net income was approximated only roughly there. Altogether, the similarity of the estimates demonstrates that the qualitative (and to a large extend also the quantitative) estimation results are very robust with respect to the modelling of the tax-benefit system, the introduction of additional exogenous variation in net incomes, and the selection of observation years.

The bottom panel of the table shows the results from the sensitivity test concerning the private pension insurance contributions of the self-employed (see section 5.3.2). In the main estimation shown in the top panel of the table, it is assumed that the amount the self-employed contribute to private pension insurance equals the amount they would be obliged to contribute to statutory pension insurance if they were dependently employed (i.e. the employee's share, which is 50 % of the full contributions). In this robustness check, I alternatively assume that the self-employed contribute the equivalent of the full statutory pension insurance contributions (i.e. the sum of the employee's and the employer's shares). The estimation results are shown to be robust to the choice of these assumptions. In the models of entry into self-employment for the joint sample of men and women and for the sample of men, the point estimates for r and a change only slightly. In the models of exit, the somewhat higher r of the self-employed indicates that the self-employed must be more risk-averse to explain the data under the assumption of high pension insurance contributions. a is somewhat larger in absolute terms in the exit models, indicating that the difference in the risk adjusted net earnings annuities plays a moderately more important role in the decision to exit self-employment than under the assumption of low pension insurance contributions.

Table 21: Results from the re-estimation of the structural transition probabilities

Structural Parameter	Estimated Value (Standard Error)			
	Men and Women		Men	
	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment
Net incomes calculated using the STSM				
r	0.470	0.155	0.388	0.183
	(0.114)***	(0.059)***	(0.080)***	(0.067)***
a	0.174	-0.209	0.199	-0.202
	(0.026)***	(0.044)***	(0.029)***	(0.041)***
Wald χ^2	83.469	61.998	82.079	76.954
log likelihood	-579.797	-193.037	-409.726	-164.570
transitions (N)	133	81	101	72
transitions (rate)	0.008	0.052	0.009	0.061
N	16390	1555	10831	1172
For reference: Net incomes calculated using the estimated tax function (chapter 4)				
r	0.477	0.123	0.391	0.168
	(0.050)***	(0.033)***	(0.051)***	(0.050)***
a	0.242	-0.256	0.262	-0.234
	(0.017)***	(0.031)***	(0.022)***	(0.034)***
N	63441	4066	41365	3075
Sensitivity analysis: Full pension insurance contributions by the self-employed				
r	0.470	0.171	0.381	0.205
	(0.126)***	(0.067)**	(0.079)***	(0.078)***
a	0.172	-0.221	0.202	-0.215
	(0.027)***	(0.048)***	(0.029)***	(0.044)***
N	16390	1555	10831	1172

Stars (***) indicate significance at the 1% level, based on heteroscedasticity robust standard errors.
Source (upper panel): Own calculations based on the SOEP 2002-2006, full-time self-employed and dependently employed individuals.

Table 22 provides the partial elasticities of the transition probabilities with respect to the annuities of the expected value and variance of net earnings based on the re-estimated structural transition equations, evaluated at the mean values of the explanatory variables in the sample. The left two columns refer to entries into and exits out of self-employment for men and women, and the right two columns for men only. All elasticities are significant at the 1 % level.[83] The estimated elasticities for men can be compared to the results obtained in the previous chapter (Table 16). The differences are small and in most cases within the level of precision that the standard errors indicate. This is another indication for the robustness of the estimation results. For the following policy simulations, the re-estimated transition models presented here will be used, as they more accurately represent taxes, transfers, social security contributions and analogous contributions by the self-employed.

[83] For the interpretation of the elasticities, one has to consider that isolated changes in μ_y and σ_y as evaluated here are artificial. In practice, an increase in net μ_y will usually come along with an increase in net σ_y (but not automatically so, if the variation coefficient of income decreases at the same time). Thus, to estimate the effects of a tax reform on self-employment transitions, one must simulate its specific effect using the estimated transition equations.

Table 22: Re-estimated elasticities of transition rates with respect to net m_y and s_y^2

Variable: Annuity of...	Elasticity (Robust Standard Error)			
	Men and Women		Men	
	Dep. Employment to Self-Empl.	Self-Employed to Dep. Employment	Dep. Employment to Self-Empl.	Self-Employed to Dep. Employment
Hourly net earnings from self-employment	1.2339	-2.1645	1.2070	-2.0383
	(0.3581)***	(0.7301)***	(0.3221)***	(0.6972)***
Hourly net earnings from dependent employment	-0.6833	1.9947	-1.0056	1.8876
	(0.2468)***	(0.7052)***	(0.2859)***	(0.6780)***
Variance of hourly net earnings from self-employment	-0.3334	0.0736	-0.1355	0.0751
	(0.0640)***	(0.0099)***	(0.0200)***	(0.0111)***
Variance of hourly net earnings from dependent employment	0.0250	-0.0083	0.0315	-0.0076
	(0.0041)***	(0.0011)***	(0.0044)***	(0.0011)***

The elasticities give the percentage change of the transition probabilities induced by a discrete one percent change in the annuities of expected value or variance of income from one of the two employment types, evaluated at the mean values of the explanatory variables in the sample. Stars (***) indicate significance at the 1% level.
Source: Own calculations based on the SOEP 2002-2006, full-time self-employed and dependently employed individuals.

5.4.2 Ex-Ante Effects of Tax Reforms in Germany

This section provides the simulated effects of the three hypothetical tax reform scenarios outlaid in section 5.2 – the repeal of the tax reform 2000 and the flat tax scenarios LL and HH – for Germany in the year 2005. I first describe the effects of the policies on the transition rates into and out of self-employment in 2005 and on the cumulative transition probabilities over several years. Then the results are discussed by taking a closer look at the impact of the policies on net income.

Table 23 shows the predicted transition rates from dependent employment to self-employment and from self-employment to dependent employment in the baseline scenario and the three hypothetical reform scenarios, both for the combined sample of men and women and the sub-sample of men. The first line gives the observed transition rates in 2005, i.e. the shares of the respective populations in 2005 who actually make a transition between 2005 and 2006.[84] The predicted transition rates in the baseline scenario (second line), which are used for comparison with the reform scenarios, are not significantly different from the observed rates.

If the changed tax schedule introduced with the tax reform 2000 had been repealed in 2005, the models predict that the transition rate between dependent employment and self-

[84] Each (unweighted) transition rate and its standard error are obtained from a regression of the transition indicator dummy on a constant, based on the corresponding sub-sample of the cross-section 2005.

employment would have increased by 0.0188 percentage points, which corresponds to a relative increase of 2.2 %. The transition rate from self-employment to dependent employment would have decreased by 0.312 percentage points (-6.8%). For the sub-sample of men the effects have the same sign; all the effects are significant at the 5%-level. In summary, the repeal would have made self-employment more attractive – in reverse this means the original tax reform 2000 deters people from choosing self-employment.[85]

Table 23: Transition rates in 2005, baseline and reform scenarios

	Transition Rate in % (Standard Error)			
	Men and Women		Men	
	Dep. Employment to Self-Empl.	Self-Employed to Dep. Employment	Dep. Employment to Self-Empl.	Self-Employed to Dep. Employment
Baseline scenario (observed)	0.8580	4.5775	0.9400	4.1860
	(0.1587)***	(1.2424)***	(0.2042)***	(1.3690)***
Baseline scenario (estimated)	0.8579	4.5774	0.9399	4.1860
	(0.1493)***	(0.9668)***	(0.1930)***	(1.1546)***
Scenario "Repeal of Tax Reform 2000"	0.8767	4.2654	0.9473	3.9131
	(0.1538)***	(0.9185)***	(0.1948)***	(1.0924)***
Difference (effect of repeal)	0.0188	-0.3120	0.0073	-0.2729
	(0.0056)***	(0.1008)***	(0.0033)**	(0.1053)***
Scenario "Flat Tax LL"	0.8141	4.5955	0.9222	4.1770
	(0.1416)***	(0.9530)***	(0.1890)***	(1.1512)***
Difference (effect of reform)	-0.0438	0.0180	-0.0178	-0.0090
	(0.0101)***	(0.0336)	(0.0042)***	(0.0296)
Scenario "Flat Tax HH"	0.8361	4.5209	0.9362	4.1199
	(0.1444)***	(0.9401)***	(0.1916)***	(1.1311)***
Difference (effect of reform)	-0.0218	-0.0565	-0.0037	-0.0662
	(0.0082)***	(0.0437)	(0.0028)	(0.0417)
N	3380	284	2234	215

Stars (** / ***) indicate significance at the 5% / 1% level.
Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

The two flat tax scenarios have negative effects on the entry rate into self-employment which are significant at the 1 % level (except for the change in men's entry rate in scenario HH). The flat tax scenario with low basic allowance and tax rate (LL) would reduce the entry rate by 0.0438 percentage points (-5.1%), whereas the scenario with higher values (HH) would reduce the entry rate by only 0.0218 percentage points (-2.5%). The flatter the tax schedule,

[85] In the sensitivity test concerning the private pension insurance contributions of the self-employed (see section 5.3.2), it turns out that the effects are very robust. If the self-employed are assumed to contribute the equivalent of the full statutory pension insurance contributions (instead of the employee's share only), a repeal of the tax reform 2000 would have increased the entry rate into self-employment by 0.0183 %-points (instead of 0.0188 %-points) and decreased the exit rate by 0.328%-points (instead of 0.312 %-points).

the more the flat tax scenarios seem to discourage people from entry. In contrast, the effects on the exit rate from self-employment are small in relative terms and statistically insignificant, both for the full sample and the sample of men.

The predicted transition rates are translated into transition numbers in Table 24, based on the population sizes of full-time dependently employed and self-employed people in Germany in 2005. In the baseline scenario, the model predicts that 172,200 people switch from dependent employment to self-employment and 129,600 the other way in 2005, which results in a net increase in the number of the self-employed of 42,600 people. If the tax reform 2000 had been repealed in 2005, the models predict that 3,800 additional people would have entered self-employment, and 8,800 less would have exited. Thus, in comparison to the baseline scenario, the number of the self-employed would have grown by an additional 12,600 people in 2005 as a result of the hypothetical repeal. The net effects of the flat tax reform scenarios on the change in the number of the self-employed have the opposite sign. In the HH scenario, the number of the self-employed would have grown by 2,800 people less than in the baseline scenario in 2005, and in the LL scenario, even 9,300 less. The net effects are driven by the reduced number of entries. In scenario HH, the lower number of exits reduces the net effect. If the statistically insignificant effect on the exit rate in this scenario (see above) is interpreted as an effect of zero, the net effect is even -4,400 instead of -2,800. The absolute effect is still smaller than in scenario LL, however, so the finding that flatter tax schedules increasingly discourage people from self-employment remains valid.

Table 24: Predicted transitions in 2005 (men and women), baseline and reform scenarios

	Predicted Transition Numbers		Change in Number of the Self-Employed
	Dep. Employment to Self-Employment	Self-Employed to Dep. Employment	
Baseline scenario	172,211	129,628	42,583
Scenario "Repeal of Tax Reform 2000"	175,977	120,792	55,185
Difference (effect of repeal)	3,766	-8,836	12,602
Scenario "Flat Tax LL"	163,424	130,139	33,285
Difference (effect of reform)	-8,787	511	-9,298
Scenario "Flat Tax HH"	167,834	128,027	39,807
Difference (effect of reform)	-4,377	-1,601	-2,776
Population	20,073,678	2,831,886	

Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

Which effects would the tax policies have over longer time periods? For an individual with given characteristics, one can evaluate the cumulative transition probability (CTP) at different

durations of the spell in self-employment or dependent employment. The CTP (or failure function) equals 1 minus the survivor function (see section 4.3.1). Figure 12 shows the CTP for a dependently employed person, evaluated at the mean values of the explanatory variables in the sample of 2005. The black bars indicate the CTP in the baseline scenario. The growth in the CTP decreases with longer tenure in dependent employment. This confirms the finding in section 4.4.2. The effect of the three tax reform scenarios on the CTP is in line with the changes in the simulated transition rates in 2005 (Table 23). A repeal of the tax reform 2000 would increase the CTP, and thus the number of entries into self-employment, and the flat tax scenarios would decreased the CTP and the entry rate. The figure shows that the length of the time period considered almost makes no difference for the evaluation of the relative effects of the reforms – the relative changes of the bars are very similar.

Figure 12: Cumulative probabilities of transition from dependent employment to self-employment in baseline and reform scenarios

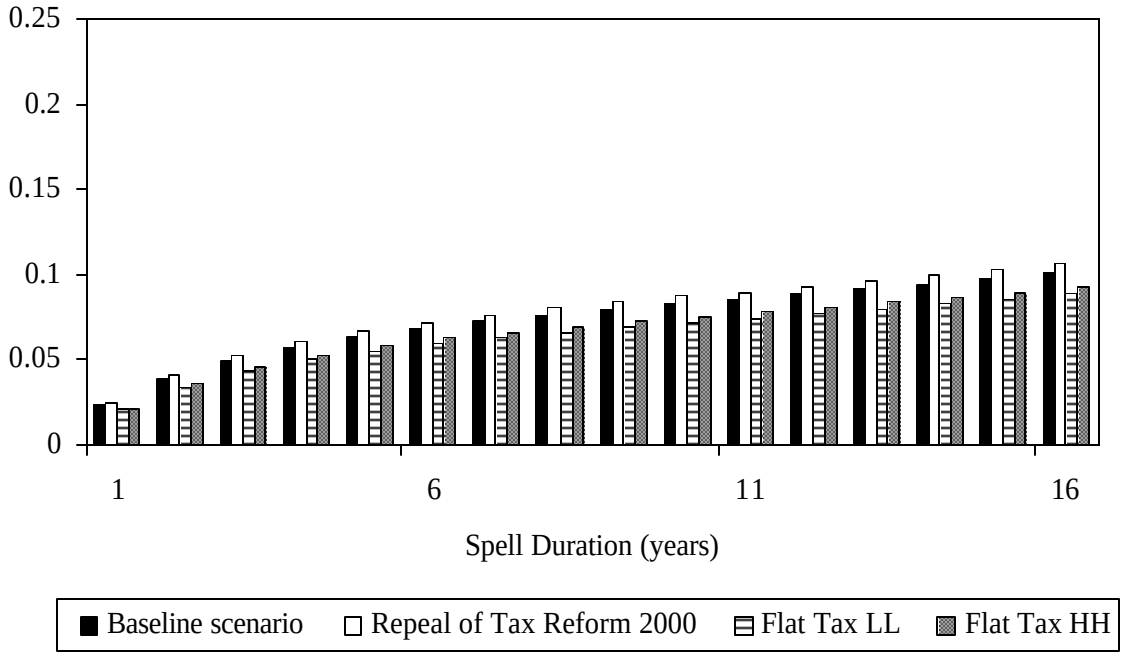
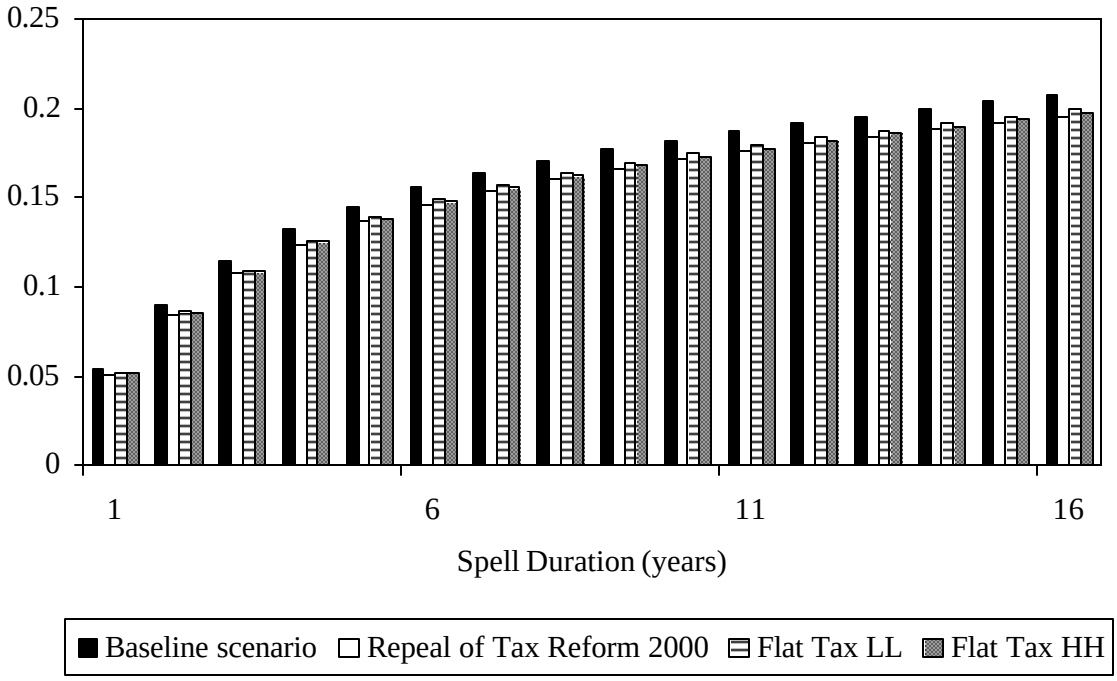


Figure 13 analogously provides the cumulative probabilities of transition from self-employment to dependent employment for an entrepreneur with average characteristics. The CTP increases rapidly in the initial years of self-employment, reflecting the high failure rate of start-up firms, and flattens with longer duration; again this confirms the finding of section 4.4.2. In the three tax reform scenarios, the average entrepreneur would have a somewhat lower CTP. Similarly to the CPT of employees, the relative changes of the entrepreneurs'

CTP due to the reforms are not very sensitive to the length of the time period considered. In the flat tax scenarios, the decrease in the CTP must be interpreted with caution, as the change in the exit rate was found to be insignificant (Table 23). The insignificant effect of flat tax scenario LL even has the opposite sign if the effect is averaged over all entrepreneurs, as in Table 23, instead of evaluating the effect at the average values of the variables.

Figure 13: Cumulative probabilities of transition from self-employment to dependent employment in baseline and reform scenarios



The figures illustrate the effects of the tax reforms on an individual employee and entrepreneur over time, starting at the first year of the spells. At a given point in time, the population represents a mixture of people with different spell durations in dependent employment and self-employment. The effects of the reforms on the population in 2005 are shown in Table 23. Here, the analysis is extended by investigating the effects of the reforms on this sample not only on the transition rates in 2005, but over a longer time period. Table 25 provides the average cumulative transition probabilities from dependent employment to self-employment and vice versa in the baseline and the reform scenarios over 1, 5, 10, and 15 years. For each person in the sample in 2005, the individual cumulative transition probability during these time spans was calculated. The table also shows the relative changes of the average CTP in the reform scenarios in comparison to the baseline scenario, i.e. the relative

effects of the reforms. In most cases, the relative mid- or long-term effects of the tax policies on the cumulative transition rates over several years are somewhat stronger than the relative short-term effects on the transition rates in 2005. The flat tax HH, for example, would increase the cumulative entry rate into self-employment by 3.2 % in the five-year period between 2005 and 2010, but only by 2.5 % in 2005 alone (as was reported before). A repeal of the tax reform 2000, in contrast, would have a stronger relative effect on the exit rate in 2005 (-6.8%) than on the cumulative exit rate in the period 2005-2010 (-5.6 %). Overall, the table shows that the estimated relative effects of the reforms reported for 2005 generally also hold for longer time periods. A complete equilibrium analysis, which would require modelling the states unemployment, non-employment, and part-time employment as well, is beyond the scope of this paper.

Table 25: Cumulative transition probabilities in baseline and reform scenarios in % (men and women)

	Dep. employment to self-employment				Self-employed to dep. employment			
Time Period	2005	2005-10	2005-15	2005-20	2005	2005-10	2005-15	2005-20
Baseline Scenario	0.8579	3.2940	5.0855	6.6018	4.5774	13.6493	18.0691	21.5163
Repeal of Tax Ref. 2000	0.8767	3.3770	5.2113	6.7643	4.2654	12.8823	17.1130	20.4410
Percentage Change	2.19	2.52	2.47	2.46	-6.82	-5.62	-5.29	-5.00
Flat Tax LL	0.8141	3.1247	4.8227	6.2595	4.5955	13.5101	17.8979	21.3186
Percentage Change	-5.10	-5.14	-5.17	-5.18	0.39	-1.02	-0.95	-0.92
Flat Tax HH	0.8361	3.1878	4.9132	6.3728	4.5209	13.3186	17.6464	21.0280
Percentage Change	-2.54	-3.22	-3.39	-3.47	-1.24	-2.42	-2.34	-2.27

Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

5.4.3 Discussion of the Results

Which factors drive the estimated ex-ante effects of the three hypothetical reform scenarios on the transition rates? To answer this question, in this section a closer look on the effects of the reforms on net income will be taken. Table 26 summarises the effects on net-income for the two sub-samples of the actually self-employed (left column) and the actually dependently employed (right column) in 2005. The top panel refers to the baseline (actual law 2005) scenario and the panels below to the three hypothetical alternative scenarios. Each panel provides the means of the estimated annuities of the expected value of net income m_y and the variance of net income s^2_y in self-employment (*se*) and in dependent employment (*e*), one of

which is the actual and the other the counter-factual state.[86] Furthermore the means of the risk-adjusted net earnings annuities $V(y)$ and the mean differentials between the two employment states $V(y_{se})$ - $V(y_e)$ are shown for each scenario. $V(y)$ summarises m_y and s^2_y using the values of the coefficient of relative risk aversion r estimated in section 5.4.1 (the definition of $V(y)$ is given in equation (4.8) in section 4.2). On an individual basis, the differentials between self-employment and dependent employment $V(y_{se})$ - $V(y_e)$ enter the structural transition probability equations.

At the bottom of the table the three reform scenarios are compared with the baseline scenario by showing the changes in the mean differentials $V(y_{se})$ - $V(y_e)$. For an individual, a positive change in the differential means that a reform improves his or her risk adjusted net income annuity in self-employment in comparison to dependent employment. Given the estimated values for the structural parameters a (section 5.4.1), a positive change due to a reform implies a higher probability of transition from dependent employment to self-employment and a lower probability of transition in the opposite direction in comparison to the baseline scenario. Moreover, as the transition probabilities are strictly monotonous in the differential $V(y_{se})$ - $V(y_e)$, larger absolute changes imply a larger response in the transition probability. Because of the non-linearity of the logistic probability function, it is however not possible to infer the direction of the changes in the aggregate transition rates directly from the mean changes in the differentials shown in this table. The transition probabilities have to be predicted for each individual in both scenarios before the aggregate change can be computed, as done in Table 23. Comparing Table 26 with Table 23, it turns out that the direction and the rank order of the effects of the three reforms on the transition rates correspond to the effects the changes in the mean differentials would suggest whenever the estimated changes in the transition rates are statistically significant. Specifically, the mean differentials of the dependently employed decrease in both flat tax scenarios, and correspondingly the entry rates also decrease. Both the drop in the mean differential and in the entry rate are stronger in

[86] When comparing these results to those obtained in chapter 4 (Table 14), one can observe that the estimated means of the real net income annuities are higher in 2005 (Table 26) than in the period 1984-2004 (Table 14). Correspondingly, the net variance annuities are also higher in Table 26 (except for self-employed men's income variance in self-employment). The higher estimated net annuities in Table 26 reflect higher average real gross wages in 2005 in comparison to the average of the years 1984-2004. In the sample of full-time working people in 2005, the weighted mean of real hourly gross income from the primary activity (self-employment or dependent employment) is €14.68; in the sample covering 1984-2004, the weighted mean is €13.31 (deflated by cpi, 2001 = 100). This difference may be explained by productivity growth. The differences in the net annuities may also be related to changes in the income tax (e.g. tax reform 2000), and to the different methods used to calculate net income.

scenario LL than in scenario HH. Likewise, as the mean differential would have increased for both the dependently employed and the self-employed if the tax reform 2000 had been repealed in 2005, the entry rate would have increased and the exit rate decreased

Table 26: Earnings in self-empl. and dependent empl. in baseline and reform scenarios

		Sample	
		Self-Employed	Dependently Employed
	Baseline scenario		
Earnings from self-employment (mean values)	Estimated annuity (net earnings) $m_{y,se}$ in euro/hour	12.44	14.53
	Estim. variance annuity (net earnings) $s^2_{y,se}$	58.40	505.09
	Risk adjusted net earnings annuity $V(y_{se})$	9.17	5.40
Wages from dependent employment (mean values)	Estimated annuity (net earnings) $m_{y,e}$ in euro/hour	12.85	11.64
	Estim. variance annuity (net earnings) $s^2_{y,e}$	10.34	39.05
	Risk adjusted net earnings annuity $V(y_e)$	10.08	6.55
Mean differential of risk adjusted net earnings annuities $V(y_{se})$-$V(y_e)$		-0.90	-1.16
	Scenario "Repeal of Tax Reform 2000"		
Earnings from self-employment (mean values)	Estimated annuity (net earnings) $m_{y,se}$ in euro/hour	12.31	13.79
	Estim. variance annuity (net earnings) $s^2_{y,se}$	52.52	385.01
	Risk adjusted net earnings annuity $V(y_{se})$	9.13	5.52
Wages from dependent employment (mean values)	Estimated annuity (net earnings) $m_{y,e}$ in euro/hour	12.25	11.10
	Estim. variance annuity (net earnings) $s^2_{y,e}$	8.57	29.92
	Risk adjusted net earnings annuity $V(y_e)$	9.68	6.40
Mean differential of risk adjusted net earnings annuities $V(y_{se})$-$V(y_e)$		-0.55	-0.88
	Scenario "Flat Tax LL"		
Earnings from self-employment (mean values)	Estimated annuity (net earnings) $m_{y,se}$ in euro/hour	13.01	14.86
	Estim. variance annuity (net earnings) $s^2_{y,se}$	74.76	741.03
	Risk adjusted net earnings annuity $V(y_{se})$	9.49	4.80
Wages from dependent employment (mean values)	Estimated annuity (net earnings) $m_{y,e}$ in euro/hour	13.01	11.71
	Estim. variance annuity (net earnings) $s^2_{y,e}$	12.96	51.07
	Risk adjusted net earnings annuity $V(y_e)$	10.17	6.54
Mean differential of risk adjusted net earnings annuities $V(y_{se})$-$V(y_e)$		-0.68	-1.75
	Scenario "Flat Tax HH"		
Earnings from self-employment (mean values)	Estimated annuity (net earnings) $m_{y,se}$ in euro/hour	12.92	14.67
	Estim. variance annuity (net earnings) $s^2_{y,se}$	68.41	649.73
	Risk adjusted net earnings annuity $V(y_{se})$	9.47	5.00
Wages from dependent employment (mean values)	Estimated annuity (net earnings) $m_{y,e}$ in euro/hour	12.88	11.67
	Estim. variance annuity (net earnings) $s^2_{y,e}$	11.53	49.13
	Risk adjusted net earnings annuity $V(y_e)$	10.09	6.55
Mean differential of risk adjusted net earnings annuities $V(y_{se})$-$V(y_e)$		-0.63	-1.55
	Comparison with baseline scenario		
Change of mean differential $V(y_{se})$-$V(y_e)$	Scenario "Repeal of Tax Reform 2000"	0.36	0.28
	Scenario "Flat Tax LL"	0.23	-0.59
	Scenario "Flat Tax HH"	0.28	-0.39
N		284	3380

Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

A deeper understanding of the effects is achieved by looking at the changes in mean m_y and s^2_y due to the reforms that lead to the changes in the mean differentials $V(y_{se})$ - $V(y_e)$. In the flat tax reform scenarios the mean annuities of expected income m_y increase in both the samples of the full-time dependently employed and self-employed in both employment states in comparison to the baseline scenario. Although the revenue neutral flat tax scenarios hardly change average net incomes in 2005 (Table 19), people expect to enter higher income deciles in the future because of rising expected real gross income over their lifetime and thus to gain from the flat tax. This expectation is reflected in the higher annuities. Simultaneously s^2_y increases in both samples and employment states, indicating that the less progressive tax schedules in the flat tax scenarios increase variation in net income. For the sample of the dependently employed, the risk adjusted net income annuities $V(y)$ decrease (or stay constant) in both employment states, which means that the higher s^2_y outweighs the higher m_y; for the self-employed it is the other way round.[87] For the dependently employed, who would have both higher m_y and s^2_y if they were self-employed in all scenarios, the mean decrease in $V(y)$ is stronger in self-employment. Consequently, the change in the mean differential is negative, and entry into self-employment becomes less attractive. All the effects described here are stronger in the flatter LL scenario than in the HH scenario which is more progressive and thus more similar to the baseline scenario. In summary, one can conclude that the higher relative income risk in self-employment brought by a flat tax outweighs the higher relative net returns and discourages the risk-averse dependently employed from entry into self-employment.

The hypothetical repeal of the tax reform 2000 would decrease m_y in both samples and both employment states, which reflects that the tax reform 2000 lowered the tax burden for income tax payers. At the same time, the repeal would also decrease s^2_y in both samples and states. Overall, the mean risk adjusted net income differential would increase in both samples due to the repeal and make self-employment more attractive. The income risk reduction, which is stronger in self-employment than in dependent employment, dominates this effect. In reverse, this implies that the tax reform 2000 discourages people from choosing self-employment.

After having discussed the changes in the means of the decision-relevant differentials of the risk adjusted net earnings annuities $V(y_{se})$ - $V(y_e)$ induced by the reforms, an analysis of

[87] As the changes in the exit rates for the self-employed due to the flat tax scenarios are not significant, the sample of the self-employed is not discussed here further.

the distribution of these changes by deciles may further clarify the ways the reforms take effect. Table 27 shows the changes induced by the three reforms compared to the baseline scenario by deciles of risk adjusted gross income annuities in the actual employment state. This table represents an expansion of the comparison panel at the bottom of Table 26 by deciles. The upper panel shows the sample of the self-employed and the lower panel the sample of the dependently employed. No monotonous trends of the changes by deciles become apparent. This reflects the heterogeneity in the sample together with the complex tax-benefits system in Germany. Especially in the small sample of the self-employed in 2005, where only 28-29 observations are available per decile, the changes seem to vary unsystematically between deciles. In the flat tax scenarios the differential for the self-employed increases particularly strongly in the 10^{th} decile. Those self-employed individuals who enjoy the largest risk adjusted earnings annuities would increase extraordinarily their advantage in comparison to dependent employment if a flat tax was introduced. The top decile drives the increase in the mean differentials in the flat tax scenarios.

In combination with the non-linearity of the logit function, this may explain why the changes in the rates of exit from self-employment due to the flat tax scenarios are not significant despite the positive changes in the mean differentials. At first sight one would have expected a significant decrease in the exit rates. The analysis by deciles showed that without the top decile, the mean differentials would increase only slightly in the flat tax scenarios. As the members of the top decile have a very low probability of exiting self-employment in the baseline scenario already (because of their high risk adjusted earnings annuities), their exit probability cannot decrease much in absolute terms due to the flat tax reform scenarios. As a result, the aggregate exit rate does not change significantly.

Table 27: Change of mean differential of risk adjusted net earnings annuities $V(y_{se})$-$V(y_e)$ compared to baseline scenario in 2005 by deciles

Risk Adjusted Income Decile[1)]	Scenario "Repeal of Tax Reform 2000"	Scenario "Flat Tax LL"	Scenario "Flat Tax HH"	N
		Full-time self-employed individuals		
1	0.61	0.00	0.06	
2	0.35	-0.06	0.03	
3	0.45	0.18	0.25	
4	0.33	0.05	0.15	
5	0.35	0.09	0.24	
6	0.29	0.04	0.18	
7	0.43	0.20	0.35	
8	0.24	-0.09	0.05	
9	0.16	0.43	0.35	
10	0.35	1.47	1.11	
All	0.36	0.23	0.28	284
		Full-time dependently employed individuals		
1	0.28	-0.89	-0.57	
2	0.31	-0.69	-0.49	
3	0.33	-0.68	-0.50	
4	0.34	-0.70	-0.48	
5	0.28	-0.55	-0.39	
6	0.20	-0.43	-0.31	
7	0.41	-0.78	-0.50	
8	0.19	-0.36	-0.22	
9	0.22	-0.46	-0.28	
10	0.20	-0.35	-0.17	
All	0.28	-0.59	-0.39	3380

[1] Deciles are calculated with respect to risk adjusted gross earnings annuities in the actual employment state.

Source: Own calculations based on the SOEP 2005-2006, full-time self-employed and dependently employed individuals.

5.5 Summary and Conclusion

In this chapter I simulated the effects of three hypothetical tax reform scenarios for Germany on transition rates into and out of self-employment. The purpose of the first scenario was to assess the impact of the tax reform 2000. Therefore, I defined a hypothetical scenario which assumes the government had repealed the change in the income tax code introduced with the tax reform 2000 in the year 2005 (and thus re-introduced the pre-reform tax law). The other two scenarios represent revenue neutral flat tax policies, again for 2005. The first flat tax scenario defines a low basic allowance and a low flat tax rate, and the second one higher values for these parameters. The ex-ante effects of the three reform policies were calculated by comparing the estimated transition rates in these scenarios to those estimated in the

baseline scenario, which represents the current law of 2005. Gross incomes in the two alternative employment states dependent employment and self-employment were estimated in chapter 4 for each individual and each year until retirement. To calculate net incomes precisely in the different scenarios, in this chapter the tax-transfer microsimulation model STSM was used. This model was extended to include private health and pension insurance contributions of the self-employed. The structural transition equations developed in chapter 4 were used to predict the behavioural responses of the individuals. For this purpose, these equations were re-estimated based on the net incomes which were calculated using the STSM. The re-estimation results indicate that the estimated structural coefficients are robust to the different methods used for calculating net income in chapters 4 (estimated tax function) and 5 (tax-transfer microsimulation model) and to the observation years included in the sample. An additional sensitivity test shows that the results are robust to assumptions about the private pension insurance contributions of the self-employed as well.

The simulation results indicate that a hypothetical repeal of the tax reform 2000 in 2005 would have increased the entry rate into self-employment from dependent employment by 2.2% and decreased the exit rate by 6.8% (relatively to the respective rates in the baseline scenario). In absolute numbers, this implies that in comparison to the baseline scenario, the number of the self-employed would have grown by an additional 12,600 people in 2005. The finding that the hypothetical repeal makes self-employment more attractive is dominated by its reduction of income risk, which is stronger in self-employment than in dependent employment. In reverse this means that the tax reform 2000, which reduced the progressivity of the tax schedule, discourages people from self-employment.

In line with this result, the flat tax reform scenarios are found to deter people from entry into self-employment; the flatter the tax schedule, the stronger this effect. The flat tax scenario with low basic allowance and tax rate reduces the entry rate by 5.1% relatively to the baseline scenario (which implies a decrease in the number of entries by 8,800 in 2005), and the scenario with higher values reduces the entry rate by 2.5% (4,400 entries less). The higher relative income risk in self-employment brought by a flat tax outweighs the higher relative net returns. There are no significant effects of the flat tax policies on the exit rate. The estimated effects of the three tax reforms on the mid- and long-term cumulative transition probabilities are similar in relative terms to the estimated effects on the short-term transition rates.

A flatter tax schedule is generally expected to increase incentives for labour supply for those whose marginal tax rate declines. Haan and Steiner (2000) found that the tax reform 2000 increased total labour supply, and Fuest *et al.* (2007) report the same result for the flat tax scenario LL. As expected gross income is, on average, higher in self-employment than in dependent employment (see section 4.4.1), a flatter tax schedule delivers a larger decrease (or smaller increase, if income is low) of marginal tax rates to the self-employed than to the dependently employed. With these considerations in mind, policy makers often argue that flatter taxes should increase incentives for engaging in entrepreneurship. However, this is an invalid shortcut which does not take into account appropriately that people are risk-averse. Progressive taxes reduce the variation of net income, and this is more important in self-employment than in dependent employment because entrepreneurship is considerably more risky. The microsimulation analysis conducted in this chapter shows that this insurance effect dominates behaviour in the scenarios considered here.

For policy the results somewhat surprisingly imply that reforms aiming at flattening the tax schedule are no suitable instruments to promote entrepreneurship. Hence, in the discussion of flat tax policies and of changes to the progressive tax schedule in general, the impact on income risk should receive more attention. In this respect, flat tax reform proposals loose some of their alleged attractiveness, at least if the stimulation of entrepreneurship is stated as a policy objective.

Chapter 6: Conclusion

6.1 Main Results and Policy Implications

The empirical results derived in this dissertation thesis show that taxes play a significant role in the decision to be an entrepreneur instead of a salaried employee. This is confirmed by an ex-post analysis of two German tax reforms and a structural microeconometric model estimated for Germany and applied to ex-ante tax policy simulations. Overall, the results are best described by a potential entrepreneur's trade-off between monetary returns and risk with respect to after-tax income. I found evidence that both the expected value and the variance of net income in self-employment and in dependent employment are significant determinants of the choice between these two alternative employment states (chapter 4). The empirical results I obtained from estimating income equations, controlling for selection, show that both the expected value and the variation coefficient of hourly net earnings are higher on average in self-employment than in wage employment in Germany, at least after the initial years of self-employment have passed. Using these individually predicted moments of net earnings, I estimated structural microeconometric models of transition probabilities from self-employment to dependent employment and vice versa. The estimated structural parameters indicate that a higher expected value of net income in self-employment in comparison to dependent employment makes self-employment more attractive, whereas a higher variance deters people from choosing this option. Correspondingly, the estimated Arrow-Pratt coefficient of relative risk aversion indicates that agents are moderately risk-averse. Dependently employed women are found to be more risk-averse than men, which may help to explain the low share of female entrepreneurs in Germany.

The sensitivity of the estimated structural parameters to a number of different model specifications was also tested in chapter 4. Overall, the estimation results are found to be robust. Chapter 5 adds an extensive robustness check with respect to the modelling of the German tax and transfer system and the selection of observation years. There I used the tax-

benefit microsimulation model STSM to calculate net income (in chapter 4 I followed a regression approach), and I limited the sample to 2000-2005 (instead of 1984-2004). Again, the results indicate that the parameter estimates are very robust. An additional sensitivity analysis in chapter 5 confirmed that the results are robust to assumptions about the private pension insurance contributions of the self-employed as well.

The results from the ex-post analysis of two German tax reforms, which exclusively reduced the top marginal income tax rate on income from trade business, show that these tax cuts increased the probability of choosing self-employment (chapter 3). This finding is in line with the structural model's intuitively appealing prediction that higher expected relative net returns from self-employment have a positive influence on the probability of choosing this state. Specifically, the German tax reforms in 1994 and 1999/2000 together reduced the top marginal income tax rate for income from trade business from 53 % to 43 %. The difference-in-difference-in-difference analysis shows that the reforms increased the probability of being self-employed for the treatment group by 0.79 percentage points, which corresponds to 25.6 % in relative terms. The implied elasticity with respect to the marginal income tax rate is -1.36. In comparison to results reported by existing ex-post evaluation studies in other countries this is a strong effect. An explanation may be that in contrast to those studies, reforms analysed here did not constitute general income tax cuts, but increased the relative net income in self-employment in comparison to dependent employment for the treatment group. The reduced top marginal tax rate lowered the "success tax" on returns from trade business. The interpretation of the results within the structural model implies that the stimulating effect of the increased expected net income from self-employment apparently outweighed the discouraging effect of the simultaneously increased variance.

In the light of the findings from this ex-post analysis, the results in chapter 2 indicate that a possible extension of the local business tax to liberal professionals may imply incentives for liberal professionals to choose a salaried job instead of working on their own account, if they are based in municipalities with high local business tax multipliers. If the municipality's multiplier is 450 %, for instance, an inclusion in the local business tax would increase the effective marginal tax rate on profit income of a liberal professional subject to the top marginal income tax rate by 1.7 percentage points. However, the impact on the tax burden is much smaller than in the reforms analysed in chapter 3, which reduced the top marginal tax rate by 10 percentage points. Thus, the behavioural response can be expected to be small. In

municipalities imposing multipliers below 401 %, the inclusion of liberal professionals in the local business tax would not affect their effective tax burden at all due to the lump sum deductibility of the local business tax from the personal income tax. The weighted average multiplier in German municipalities was 390 % in 2005 and thus below 401 %, in municipalities with more than 50.000 inhabitants the average was 430 % in 2006.

In spite of the low impact on the tax burden of non-incorporated taxpayers, the analysis of different hypothetical revenue neutral reform options for the German local business tax using the newly developed microsimulation model BizTax revealed important effects regarding the distribution of local business tax revenues. Today's high concentration of local business tax revenues on corporations with high profits and on cores of agglomeration in western Germany is found to decrease if the local business tax base is broadened by integrating more taxpayers and by including more elements of value added. In return, the tax rate could be reduced. Such a reform would provide a more stable and reliable revenue source for local governments in Germany and distribute local tax revenues per capita more equally across regions.

In chapter 5, I used the structural models estimated in chapter 4 and the tax-benefit microsimulation model STSM to simulate the effects of three hypothetical reform scenarios for the German personal income tax on transitions into and out of self-employment. The purpose of the first scenario was to assess the impact of the tax reform 2000. Therefore, I simulated a hypothetical scenario which assumes the government had repealed the change in the income tax code introduced with the tax reform 2000 in the year 2005 (and thus re-introduced the pre-reform tax law). The tax reform 2000 reduced the income tax burden in three steps between 2000 and 2005. It decreased the statutory top marginal income tax rate from 51 % in 2000 to 42 % in 2005 and the lowest marginal tax rate from 22.9% to 15 %, and increased the basic tax allowance from €6,902 to €7,664. The other two scenarios simulated represent revenue neutral flat tax policies, again for 2005. The first scenario defines a basic allowance of €7,664, as in the actual law of 2005, and a flat tax rate of 26.9 %, and the second a basic allowance of €10,700 and a flat tax rate of 31.9 %. The simulation results indicate that the hypothetical repeal of the tax reform 2000 in 2005 would have increased the entry rate into self-employment from dependent employment by 2.2% and decreased the exit rate by 6.8% (relatively to the respective rates in the baseline scenario). The finding that the hypothetical repeal makes self-employment more attractive is dominated by its reduction of

income risk, which is stronger in self-employment than in dependent employment. In reverse this means that the tax reform 2000, which reduced the progressivity of the tax schedule, discouraged people from self-employment. In line with this result, the flat tax reform scenarios are found to deter people from entry into self-employment. The flatter the tax schedule, the stronger is this effect. The flatter scenario with the low basic allowance and tax rate reduces the entry rate by 5.1% relatively to the baseline scenario, and the scenario with the higher parameter values by 2.5% (there are no significant effects of the flat tax policies on the exit rates). The effect of the higher income risk in self-employment in comparison to dependent employment, which is intensified by a flat tax, outweighs the effect of the higher increase in net returns. The estimated effects of the three tax reforms on the mid- and long-term cumulative transition probabilities are similar in relative terms to the estimated effects on the short-term transition rates. In summary, the ex-ante simulations show that in the three hypothetical tax reform scenarios considered here, the effect of the income tax to insure against income risk is decisive. In these scenarios, reducing the tax progressivity, and thus the risk-sharing by the government, discourages people from self-employment.

For policy these results imply that reforms aiming at flattening the general income tax schedule do not seem to be suitable instruments to promote entrepreneurship. Hence, in the discussion of flat tax policies and of changes to the progressive income tax schedule in general, the impact on income risk should receive more attention. In this respect, flat tax reform proposals loose some of their alleged attractiveness, at least if the promotion of entrepreneurship is stated as a policy objective.

Tax reforms targeted specifically at the self-employed may be more effective instruments to stimulate entrepreneurship than general tax cuts, as the ex-post analysis of the income tax rate limitation for income from trade business suggests. However, such a policy would compromise the comprehensive income tax principle, which states that the same tax function should apply for income from all sources, rather than distinguishing between dependent employment and self-employment. Certainly the German tax law already deviates from this principle; the most prominent example is the final withholding tax for capital income at a flat rate of 25% (26.375 % including the solidarity surcharge), which will become effective in 2009. A differential tax treatment of entrepreneurs could be introduced in the form of a dual income tax as implemented in several Nordic countries, for example. A dual income tax allows high-income entrepreneurs to declare some of their business income as capital income,

which is taxed at a lower rate. It is a political question if deviations from the comprehensive income tax principle are desired. Only the isolated effect on entrepreneurship is considered here. A possible discussion about a tax relief for the self-employed must however also take into account the impact on equity by considering distributional and legal (constitutional) implications. Moreover, for specific economic policy advice in this area further research is needed to understand if lack of entrepreneurship is really a problem in Germany, and if so, if it should be addressed by the government.

Independent of the political motivations for a certain tax reform, this thesis has shown that not even the direction, and much less the size, of the effect of a specific tax reform on self-employment is self-evident. A tax reform generally changes both the expected value and the variance of net income – usually in the same direction – in at least one of the alternative states self-employment and dependent employment. As the changes in the two moments have opposing effects on the transition probabilities, the overall effect of a tax reform can hardly be anticipated without a microeconometric analysis. Ex-post, microeconometric evaluation studies may be able to identify the effect a certain tax reform had in the past. Ex-ante evaluations using structural microeconometric models such as the one developed in this thesis provide another, more flexible solution, which can also be applied to evaluate hypothetical tax reforms in the future. The simulation results reveal if a tax policy can be expected to have a stimulating or discouraging effect on self-employment by showing if the change in the expected value or in the variance of net incomes dominates the impact, and provide an estimate of the magnitude of the effect.

6.2 Further Research

Several avenues of further research seem promising to augment the understanding of the impact of taxes on entrepreneurship beyond the contributions made in this dissertation thesis, with the aim of broadening the basis for clear evidence based policy advice.

In chapter 4, separate regressions of income from self-employment and from dependent employment were estimated. The earnings equations were specified as static Mincer-type functions of human capital, demographic and work-related variables. A dynamic income generating model like in Rosen and Willen (2002) may add to the understanding of the income process and improve the prediction of future incomes in the two alternative states.

Dynamic income could be modelled with or without autocorrelation of the time variant error component, and in case of autocorrelation, it could be an autoregressive or a moving average process or a combination of both (see for instance MaCurdy 1982). An analysis of the required panel data may give guidance as to which model is most appropriate. An estimate of the variance of earnings could be obtained on the basis of a random effects error components model. This would allow distinguishing permanent and transitory factors.

Furthermore, structural models like the one developed in chapter 4 for Germany could be estimated for other countries. The estimated structural coefficients and elasticities may reveal interesting differences between countries, which may be related to differences in the populations or in the tax-benefit systems. People in different countries may diverge in their attitudes towards risk, for instance, which may help to explain differences in the self-employment rates between countries (cf. Köllinger and Schade 2005). Moreover, a comparison study may reveal the effects of competing paradigms reflected in the various national tax and benefit systems. Panel datasets similar to the German SOEP, which may be suitable for such an analysis, exist in Britain (British Household Panel Survey) and the USA (Panel Study of Income Dynamics), for example.

The structural models developed in chapter 4 assume that the decisions to become and remain an entrepreneur are individual decisions. An agent chooses the employment state which maximises his or her individual utility function. Other household variables, particularly the employment state and income of a married person's spouse, enter the individual utility function as exogenous variables. Alternatively, entrepreneurship could be modelled as a household decision, assuming that household members maximise a joint household utility function. This approach is followed in the discrete choice labour supply model of the STSM (Steiner *et al.* 2005), drawing on van Soest (1995). Transferring this approach to models of entrepreneurship implies a theoretical challenge. A concept of risk attitudes of households would have to be developed, as risk attitudes are conventionally understood as individual preferences. The aim of this research could be an integrated discrete choice model of labour supply and entrepreneurship, which would allow comprehensive simulations of the effects of tax reforms.

The question for the welfare effects of taxation through its influence on entrepreneurship is also left for further research. This thesis has emphasised the role of progressive taxation as insurance against income risk. This is related to Varian (1980), who modelled the function of

redistributive taxation as social insurance in a theoretic framework, which allowed him to derive the optimal linear and nonlinear taxes. Empirically, Haan (2007) and Fuest *et al.* (2007) analysed the welfare effects of the tax reform 2000 and of flat tax scenarios, respectively. They took into account estimated labour supply reaction of households, but neglecting the roles of income risk and entrepreneurship. An integrated empirical model of labour supply and entrepreneurship, as sketched above, would contribute to the estimation of the welfare effects by additionally considering behavioural responses of entrepreneurs. Such a model should take into account the effect of income risk on utility and welfare in the sense of Varian (1980). The models I suggested in this thesis provide a possible starting point.

This thesis is part of the broader literature on behavioural responses of entrepreneurs to taxes. While this thesis studies the entry and exit decisions, taxation also influences other choices made by entrepreneurs. Taxes may induce behavioural responses with respect to the demand for production factors (investment decisions, labour demand), the business location, financing decisions, the selection of the legal form, and international profit shifting (e.g. through transfer pricing or intercompany loans). Auerbach (2002), Hasset and Hubbard (2002), and Devereux (2006) provide literature surveys on these topics. Individual data from balance sheets and profit and loss accounts is highly desirable for a thorough analysis of these behavioural effects. Harhoff and Ramb (2001) and Ramb (2007), for example, study the tax responsiveness of investment in Germany using the corporate balance sheet statistics of the German Bundesbank. Another possible approach is the estimation of the tax elasticity of entrepreneurs' taxable income. This measure would additionally include the effects of taxes on tax avoidance or evasion. Gruber and Rauh (2007) follow this path to study the effects of business taxation in the USA.

In the current stage, the newly developed microsimulation model for the business sector in Germany BizTax, which is introduced in chapter 2, can be used to analyse the fiscal and distributional first-round effects of business tax reforms without considering behavioural responses. It is left for further research to enrich the microsimulation model with structural models of the various potential behavioural responses of entrepreneurs and enterprises in general. This would make it possible to simulate second-round effects of business tax reforms. Moreover, an integration of the microsimulation model BizTax, which models the local business tax and is currently being extended to include the corporate income tax, and a model like the STSM, which models the income tax and transfer system, possibly based on official

income tax data, would provide a complete and consistent picture of the most important taxes relevant for the business sector in Germany and their interactions. This would allow most comprehensive analyses of the effects of changes to Germany's complex system of business taxation on entrepreneurial behaviour.

List of Tables

List of Appendix Tables

List of Figures

Bibliography

Ai, C. and E. C. Norton (2003), "Interaction Terms in Logit and Probit Models," *Economics Letters* 80(1), 123-129.

Amemiya, T. (1981), "Qualitative Response Models: A Survey," *Journal of Economic Literature* 19(4), 481-536.

Auerbach, A. J. (2002), "Taxation and Corporate Financial Policy," in A. J. Auerbach and M. Feldstein (eds.): Handbook of Public Economics, Vol. 3, Elsevier, Amsterdam, 1251-1292.

Bach, S., M. Broer, and F. M. Fossen (2008), "Sollen Freiberufler und Landwirte Gewerbesteuer zahlen? Steuersystematische Überlegungen und empirische Wirkungsanalysen," German Institute for Economic Research. DIW Discussion Paper 761.

Bach, S., H. Buslei, and N. Dwenger (2007), "Unternehmensteuerreform 2008: Positives Signal auf Kosten der Steuersystematik," *Wochenbericht des DIW Berlin* 74(18), 293-301.

Bach, S., H. Buslei, N. Dwenger, and F. M. Fossen (2007), "Aufkommens- und Verteilungseffekte der Unternehmensteuerreform 2008," *Quarterly Journal of Economic Research* 76(2), 75-85.

Bach, S., H. Buslei, N. Dwenger, and F. M. Fossen (2008), "Dokumentation des Mikrosimulationsmodells BizTax zur Unternehmensbesteuerung in Deutschland," German Institute for Economic Research. DIW Data Documentation 29.

Bach, S., G. Corneo, and V. Steiner (2005), "Top Incomes and Top Taxes in Germany," German Institute for Economic Research. DIW Discussion Paper 532.

Bach, S. and D. Vesper (2002), "Finanz- und Investitionskrise der Gemeinden erzwingt grundlegende Reform der Kommunalfinanzen," *Wochenbericht des DIW Berlin* 69(31), 505-517.

Baldwin, R., R. Forslid, P. Martin, G. Ottaviano, and F. Robert-Nicoud (2003), "Economic Geography and Public Policy," Princeton University Press, Princeton.

Baldwin, R. and P. Krugman (2002), "Agglomeration, Integration and Tax Harmonization," National Bureau of Economic Research. NBER Working Paper W9290.

Baumgartner, H. J., M. Caliendo, and V. Steiner (2006), "Existenzgründungsförderung für Arbeitslose – Erste Evaluationsergebnisse für Deutschland," *Quarterly Journal of Economic Research* 75(3), 32-48.

Binswanger, H. P. (1980), "Attitudes toward Risk: Experimental Measurement in Rural India," *American Journal of Agricultural Economics* 62(3), 395-407.

Bird, R. M. (1999), "Rethinking Tax Assignment: The Need for Better Subnational Taxes," International Monetary Fund. IMF Working Paper WP/99/165, http://www.imf.org/external/pubs/ft/wp/1999/wp99165.pdf.

Blundell, R. and M. Costa Dias (2002), "Alternative Approaches to Evaluation in Empirical Microeconomics," Institute for Fiscal Studies. cemmap working paper 10/02.

Bönke, T. and G. Corneo (2006), "Was hätte man sonst machen können? Alternativszenarien zur rot-grünen Einkommensteuerreform," *Journal of Applied Social Science Studies* 126(4), 489-519.

Borjas, G. J. and S. G. Bronars (1989), "Consumer Discrimination and Self-Employment," *Journal of Political Economy* 97(3), 581-605.

Brock, W. A. and D. S. Evans (1986), "The Economics of Small Businesses: Their Role and Regulation in the U.S. Economy," Holmes and Meier, New York.

Broer, M. (2005), "BB-Forum: Aktuelle steuerpolitische Vorschläge der Bundesregierung laut Regierungserklärung vom 17.3.2005," *Betriebs-Berater (BB)* 60(17), 916-920.

Brown, S., L. Farrel, and J. G. Sessions (2006), "Self-Employment Matching – An Analysis of Dual Earner Couples and Working Households," *Small Business Economics* 26(2), 155-172.

Bruce, D. (1999), "Do Husbands Matter? Married Women Entering Self-Employment," *Small Business Economics* 13(4), 317-329.

Bruce, D. (2000), "Effects of the United States Tax System on Transitions into Self-Employment," *Labour Economics* 7(5), 545-574.

Bruce, D. (2002), "Taxes and Entrepreneurial Endurance: Evidence from the Self-Employed," *National Tax Journal* 55(1), 5-24.

Bundesbank (2004), "Special Statistical Publication 6: Ratios from financial statements of German enterprises 2000 to 2002", http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2000_2002.en.pdf.

Bundesbank (2005), "Special Statistical Publication 6: Ratios from financial statements of German enterprises 2002 to 2003," http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2002_2003.en.pdf.

Bundesbank (2006), "Special Statistical Publication 5: Extrapolated results from financial statements of German enterprises 1994 to 2003," http://www.bundesbank.de/download/statistik/stat_sonder/statso5_1994_2003.en.pdf.

Bundesbank (2007), "Special Statistical Publication 6: Ratios from financial statements of German enterprises 2003 to 2004," http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2003_2004.en.pdf.

Bundesvereinigung der kommunalen Spitzenverbände (2003), "Vorschlag für eine modernisierte Gewerbesteuer," http://www.staedtetag.de/imperia/md/content/pressedien/2003/11.pdf.

Buslei, H. and V. Steiner (2006), "Aufkommens- und Verteilungseffekte der Besteuerung von Alterseinkünften – eine Mikrosimulationsanalyse für Deutschland," in: C. Seidl and J. Jickeli (eds.): Steuern und Soziale Sicherung in Deutschland, Physica-Verlag, Heidelberg.

Caliendo, M., F. M. Fossen, and A. S. Kritikos (2006), "Risk Attitudes of Nascent Entrepreneurs: New Evidence from an Experimentally-Validated Survey," German Institute for Economic Research, DIW Discussion Paper 600. Forthcoming in *Small Business Economics*.

Corneo, G. (2005), "The Rise and Likely Fall of the German Income Tax, 1958-2005," *CESifo Economic Studies* 51(1), 159-186.

Council of Economic Advisors to the Ministry of Finance (2004), "Flat Tax oder Duale Einkommensteuer? Zwei Entwürfe zur Reform der deutschen Einkommensbesteuerung," http://www.bundesfinanzministerium.de/lang_de/nn_25412/nsc_true/DE/Service/Downloads/Downloads__4/25706__0,templateId=raw,property=publicationFile.pdf.

Cramer, J.S., J. Hartog, N. Jonker, and C. M. Van Praag (2002), "Low Risk Aversion Encourages the Choice for Entrepreneurship: An Empirical Test of a Truism," *Journal of Economic Behavior and Organization* 48(1), 29-36.

Cullen, J. B. and R. H. Gordon (2002), "Taxes and Entrepreneurial Activity: Theory and Evidence for the U.S.," National Bureau of Economic Research. NBER Working Paper W9015.

Davies, J. B. and M. Hoy (2002), "Flat Rate Taxes and Inequality Measurement," *Journal of Public Economics* 84(1), 33-46.

Devereux, M. P. (2006), "The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence," Oxford University Centre for Business Taxation. WP 07/02, http://users.ox.ac.uk/~mast1732/RePEc/pdf/WP0702.pdf.

Devereux, M. P., R. Griffith, and A. Klemm (2002), "Corporate Income Tax Reforms and International Tax Competition," *Economic Policy* 17(35), 449-495.

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. G. Wagner (2005), "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-Validated Survey," German Institute for Economic Research. DIW Discussion Paper 511.

Dolton, P. J. and G. H. Makepeace (1990), "Self-Employment Among Graduates," *Bulletin of Economic Research* 42(1), 35-53.

Domar, E. D. and R. A. Musgrave (1944), "Proportional Income Taxation and Risk-Taking," *Quarterly Journal of Economics* 58(3), 388-422.

Döring, T. and L. P. Feld (2005), "Reform der Gewerbesteuer: Wie es Euch gefällt? – Eine Nachlese," *Perspektiven der Wirtschaftspolitik* 6(2), 207-232.

Dunn, T. and D. Holtz-Eakin (2000), "Financial Capital, Human Capital, and the Transition to Self-Employment: Evidence from Intergenerational Links," *Journal of Labour Economics* 18(2), 282-305.

European Commission (2007), "Taxes in Europe Database," http://ec.europa.eu/taxation_customs/taxation/gen_info/info_docs/tax_inventory/index_en.htm.

Evans, D. S. and L. S. Leighton (1989), "Some Empirical Aspects of Entrepreneurship," *American Economic Review* 79(3), 519-535.

Federal Constitutional Court (1977), "Entscheidungen des Bundesverfassungsgerichts," Amtliche Sammlung 46, 224-241.

Federal Ministry of Economics and Technology (2007), "Projektion der gesamtwirtschaftlichen Entwicklung in Deutschland bis 2011 – Teil III des Monatsberichtes 07/2007," http://www.bmwi.de/BMWi/Redaktion/PDF/P-R/projektion-monatsbericht-juli-2007,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf

Federal Ministry of Finance (1994), "Stand und voraussichtliche Entwicklung der Finanzwirtschaft im gesamtwirtschaftlichen Zusammenhang," Finanzbericht 1994.

Federal Ministry of Finance (1999), "Stand und voraussichtliche Entwicklung der Finanzwirtschaft im gesamtwirtschaftlichen Zusammenhang," Finanzbericht 1999.

Federal Ministry of Finance (2001), "Stand und voraussichtliche Entwicklung der Finanzwirtschaft im gesamtwirtschaftlichen Zusammenhang," Finanzbericht 2001.

Federal Ministry of Labour and Social Affairs (2006), "Übersicht über das Sozialrecht," BW Bildung und Wissen Verlag, Nürnberg.

Federal Office for Building and Regional Planning (2007), "Siedlungsstrukturelle Regions-, Kreis- und Gemeindetypen," http://www.bbr.bund.de/cln_007/nn_103086/DE/Raumbeobachtung/Werkzeuge/Raumabgrenzungen/SiedlungsstrukturelleGebietstypen/gebietstypen.html.

Federation of German Industries (BDI) and German Chemical Industry Association (VCI) (2001): "Verfassungskonforme Reform der Gewerbesteuer – Konzept einer kommunalen Einkommen- und Gewinnsteuer," div Deutscher Instituts-Verlag, Cologne.

Federal Statistical Office (2001), "Lohn- und Einkommensteuer 2001 - Statistik über die Personengesellschaften/Gemeinschaften," article no. 5731101019004, http://www-ec.destatis.de.

Federal Statistical Office (2006), "Realsteuervergleich," Fachserie 14 Reihe 10: Finanzen und Steuern, http://www-ec.destatis.de.

Federal Statistical Office (2001-2007), Fachserie 18: Volkswirtschaftliche Gesamtrechnungen, http://www-ec.destatis.de.

Feldstein, M. (1995), "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act," *Journal of Political Economy* 103(3): 551-572.

Fraser, S. and F. J. Greene (2006), "The Effects of Experience on Entrepreneurial Optimism and Uncertainty," *Economica* 73(290), 169-192.

Fuest, C. and B. Huber (2003), "Lösungsmöglichkeiten und Probleme bei der Gewerbesteuerreform," *Wirtschaftsdienst* 83(9), 560-565.

Fuest, C., A. Peichl, and T. Schaefer (2007), "Is a Flat Tax Feasible in a Grown-up Welfare State?" Institute for the Study of Labor. IZA Discussion Paper 3142.

Gentry, W. M. and R. G. Hubbard (2000), "Tax Policy and Entrepreneurial Entry," *American Economic Review* 90(2), 283-287.

Georgellis, Y. and H. J. Wall (2002), "Entrepreneurship and the Policy Environment," Federal Reserve Bank of St. Louis. Working Paper 2002-019B.

Georgellis, Y. and H. J. Wall (2004), "Gender Differences in Self-Employment," Federal Reserve Bank of St. Louis. Working Paper 1999-008C.

German Bundestag (2003), "Entwurf eines Gesetzes zur Reform der Gewerbesteuer," Bundestags-Drucksache 15/1517, http://dip.bundestag.de/btd/15/015/1501517.pdf.

German Bundestag (2006), "Finanzausschuss Wortprotokoll, 22. Sitzung," Protokoll Nr. 16/22, http://www.bundestag.de/ausschuesse/a07/anhoerungen/022/022-01_06_06-__.pdf.

German Bundestag (2007), "Gesetzentwurf der Fraktionen der CDU/CSU und SPD – Entwurf eines Unternehmensteuerreformgesetzes 2008," Bundestags-Drucksache 16/4841, p. 45, http://dip.bundestag.de/btd/16/048/1604841.pdf

Gordon, R. H. and J. D. Wilson (1986), "An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment," *Econometrica* 54(6), 1357-1373.

Gottfried, P. and H. Schellhorn (2003), "Die Elastizität des zu versteuernden Einkommens, Messung und erste Ergebnisse zur empirischen Evidenz für die Bundesrepublik Deutschland," Institute for Applied Economic Research. IAW Diskussionspapiere 14.

Greß, S., A. Walendzik, and J. Wasem (2005), "Nichtversicherte Personen im Krankenversicherungssystem der Bundesrepublik Deutschland – Bestandsaufnahme und Lösungsmöglichkeiten," University of Duisburg-Essen. Diskussionsbeitrag aus dem Fachbereich Wirtschaftswissenschaften 147.

Gruber, J. (1994), "The Incidence of Mandated Maternity Benefits," *American Economic Review* 84(3), 622-641.

Gruber, J. and J. Rauh (2007), "How Elastic is the Corporate Income Tax Base?" in: A. J. Auerbach *et al.* (eds.): Taxing Corporate Income in the 21st Century, Cambridge, 140ff.

Haan, P., "The Effects of Personal Income Taxation on Labor Supply, Employment and Welfare: Empirical Evidence for Germany," Free University of Berlin. Dissertation thesis, http://www.diss.fu-berlin.de/2007/216/

Haan, P. and V. Steiner (2005), "Distributional Effects of the German Tax Reform 2000 - A Behavioral Microsimulation Analysis," *Journal of Applied Social Science Studies* 125(1), 39-49.

Hamilton, B. H. (2000), "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment," *Journal of Political Economy* 108(3), 604-631.

Harhoff, D. and F. Ramb (2001), "Investment and Taxation in Germany – Evidence from Firm-Level Panel Data," in: German Bundesbank (ed.): Investing Today for the World of Tomorrow – Studies on the Investment Process in Europe, Springer, Heidelberg, 47-84.

Hassett, K. and R. G. Hubbard (2002), "Tax Policy and Business Investment," in: A. J. Auerbach and M. Feldstein (eds.): Handbook of Public Economics, Vol. 3, Elsevier, Amsterdam, 1293-1343.

Hausman, J. and D. L. McFadden (1984), "Specification Tests for the Multinomial Logit Model," *Econometrica* 52, 1219-1240.

Heaton, J. and D. Lucas (2000), "Portfolio Choice and Asset Prices: The Importance of Entrepreneurial Risk," *Journal of Finance* 55(3), 1163-1198.

Heckman, J. J. and B. Singer (1984), "A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data," *Econometrica* 52(2), 271-320.

Holt, C. A. and S. K. Laury (2002), "Risk Aversion and Incentive Effects," *American Economic Review* 92(5), 1644-1655.

Holtz-Eakin, D. and H. S. Rosen (2005), "Cash Constraints and Business Start-Ups: Deutschmarks Versus Dollars," *Constributions to Economic Analysis & Policy* 4(1), 1-26.

IBFD - International Bureau of Fiscal Documentation (2007), European Tax Handbook, IBFD Publications, Amsterdam.

IFSt - Institut Finanzen und Steuern e.V. (2006), "Entwicklung der Realsteuerhebesätze der Gemeinden mit 50.000 und mehr Einwohnern im Jahr 2006 gegenüber 2005," IFSt-Schrift 439. Bonn.

Jarass, L. and G. M. Obermaier (2003), "Von der Gewerbesteuer zur Kommunalen Betriebsteuer," *Wirtschaftsdienst* 83(3), 157-163.

Jenkins, S. P. (1995), "Easy Estimation Methods for Discrete-Time Duration Models," *Oxford Bulletin of Economics and Statistics* 57(1), 129-138.

Junkernheinrich, M. (2003), "Reform des Gemeindefinanzsystems: Mission Impossible?," *Quarterly Journal of Economic Research* 72(3), 423-443.

Kanbur, R. S. M. (1982), "Entrepreneurial Risk Taking, Inequality, and Public Policy: An Application of Inequality Decomposition Analysis to the General Equilibirum of Progressive Taxation," *Journal of Political Economy* 90(1), 1-21.

Kihlstrom, R. E. and J.-J. Laffont (1979), "A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion," *Journal of Political Economy* 87(4), 719-748.

Kirchhoff, P. (2003), "Einkommensteuergesetzbuch – ein Vorschlag zur Reform der Einkommen- und Körperschaftsteuer," C. F. Müller Verlag, Heidelberg.

Knight, F. H. (1921), "Risk, Uncertainty and Profit," Hart, Schaffner & Marx; Houghton Mifflin Company, Boston.

Köllinger, P. and C. Schade (2005), "Warum Amerikaner mehr Unternehmen gründen als Deutsche," *Wochenbericht des DIW Berlin* 72(45), 673-680.

König, R. J., P. Kunkel, and W. Stegmaier, "Auswirkungen der Einführung des Staffeltarifs bei der Gewerbeertragsteuer," *Deutsches Steuerrecht (DStR)* 27, 922-927.

Lang, O., K.-H. Nöhrbaß, and K. Stahl (1997), "On Income Tax Avoidance - The Case of Germany," *Journal of Public Economics* 66(2), 327-347.

Lietz, C. and D. Mantovani (2007), "A Short Introduction to EUROMOD: An integrated European tax-benefit model," in: O. Bargain (ed.): Micro-simulation in Action: Policy Analysis in Europe using EUROMOD, Research in Labor Economics, Elsevier, Amsterdam, 1-26.

Long, J. E. (1982a), "Income Taxation and the Allocation of Market Labor," *Journal of Labor Research* 3(3), 259-276.

Long J. E. (1982b), "The Income Tax and Self-Employment," *National Tax Journal* 35(1), 31-42.

MaCurdy, T. E. (1982), "The Use of Time Series Processes to Model the Error Structure of Earnings in a Longitudinal Data Analysis," *Journal of Econometrics* 18(1), 83-114.

Maddala, G. S. (1983), "Limited-Dependent and Qualitative Variables in Econometrics," Cambridge University Press, New York.

Maiterth, R. (2003), "Die Gewerbesteuer als ungerechtfertigte 'Großbetriebssteuer'? – Eine empirische Analyse, " *Journal of Applied Social Science Studies* 123(4), 545-562.

Maiterth, R. and M. Zwick (2006), "A Local Income and Corporation Tax as an Alternative to the German Local Business Tax," *Journal of Economics and Statistics* 226(3), 285-307.

McFadden, D. L. (1974), "Conditional Logit Analysis of Qualitative Choice Behavior," in: P. Zarembka (ed.): Frontiers in Econometrics, Academic Press, New York, 105-142.

Mennel, A. and J. Foerster, eds. (2006), Steuern in Europa, Amerika und Asien, 61st Edition, nwb Verlag, Herne.

Mitschke, J. (2004), "Erneuerung des deutschen Einkommensteuerrechts: Gesetzestextentwurf und Begründung," Verlag Otto Schmidt, Cologne.

Moore, K. (2004), "The Effects of the 1986 and 1993 Tax Reforms on Self-Employment," Board of Governors of the Federal Reserve System (U.S.). Finance and Economics Discussion Series Working Paper 2004-05.

Mroz, T. A. (1987), "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions," *Econometrica* 55(4), 765-799.

OECD (2006), Revenue Statistics 1965-2005 - 2006 Edition, OECD Publishing, Paris.

Olson, M. (1969), "The Principle of 'Fiscal Equivalence': The Division of Responsibilities among Different Levels of Government," Papers and Proceedings of the Eighty-first Annual Meeting of the American Economic Association, *American Economic Review* 59(2), 479-487.

Parisi, V. (2003), "A Cross Country Simulation Exercise Using the DIECOFIS Corporate Tax Model," European Commission IST Programme DIECOFIS, Work Package no. 7, Deliverable no. 7.2.

Parker, S. C. (1996), "A Time Series Model of Self-Employment Under Uncertainty," *Economica* 63(241), 459-475.

Parker, S. C. (2003), "Does Tax Evasion Affect Occupational Choice?" *Oxford Bulletin of Economics and Statistics* 65(3), 379-394.

Parker, S. C. (2005), "Entrepreneurship Among Married Couples in the United States – A Simultaneous Probit Approach," Institute for the Study of Labor. IZA Discussion Paper 1712.

Petersen, H.-G., A. Fischer, and J. Flach (2005), "Wirkungen der Einfachsteuer auf die Steuerbelastung von Haushalten und Unternehmen," *Perspektiven der Wirtschaftspolitik* 6(1), 71-94.

Pfeiffer, F. und W. Pohlmeier (1992), "Income, Uncertainty and the Probability of Self-Employment," *Recherches Economiques des Louvain* 58(3-4), 265-281.

Pratt, J. W. (1964), "Risk Aversion in the Small and in the Large," *Econometrica* 32(1-2), 122-136.

Rabe-Hesketh, S. and A. Skrondal (2004), "Generalized Latent Variable Modeling: Multilevel, Longitudinal, and Structural Equation Models," Chapman & Hall, London.

Ramb, F. (2007), "Corporate Marginal Tax Rate, Tax Loss Carryforwards and Investment Functions – Empirical Analysis Using a Large German Panel Data Set," German Bundesbank. Discussion Paper Series 1: Economic Studies 21. http://opus.zbw-kiel.de/volltexte/2007/6142/pdf/200721dkp.pdf.

Rees, H. and A. Shah (1986), "An Empirical Analysis of Self-Employment in the U.K.," *Journal of Applied Econometrics* 1(1), 95-108.

Reidenbach, M. (2006), "Zur Auswahl von Gemeindetypen für die Regionalisierung der Berechungen zur Unternehmenssteuerreform," mimeo, German Institute of Urban Affairs (Difu).

Rosen, H. and P. Willen (2002), "Risk, Return and Self-Employment," mimeo, Princeton and Chicago Universities, http://www.bos.frb.org/economic/econbios/willen/selfemp2.4pw.pdf.

Scherf, W. (2002), "Ersatz der Gewerbesteuer durch eine anrechenbare Wertschöpfungsteuer," *Wirtschaftsdienst* 82(10), 603-608.

Schuetze, H. J. (2000), "Taxes, Economic Conditions and Recent Trends in Male Self-Employment: A Canada-U.S. Comparison," *Labour Economics* 7(5), 507-544.

Schuetze, H. J. and D. Bruce (2004), "Tax Policy and Entrepreneurship," *Swedish Economic Policy Review* 11(2), 223-265.

Schulze Buschoff, K. (2007), "'Neue Selbstständige' und soziale Sicherheit – Ein europäischer Vergleich," *WSI Mitteilungen* 7, 387-393.

Spengel, C. (2003), "Internationale Unternehmensbesteuerung in der Europäischen Union – Steuerwirkungsanalyse, empirische Befunde, Reformüberlegungen," IDW-Verlag, Düsseldorf.

Sueyoshi, G. T. (1995), "A Class of Binary Response Models for Grouped Duration Data," *Journal of Applied Econometrics* 10(4), 411-431.

Steiner, V. (2001), "Unemployment Persistence in the West German Labour Market: Negative Duration Dependence or Sorting?" *Oxford Bulletin of Economics and Statistics* 63(1), 91-113.

Steiner, V., P. Haan, and K. Wrohlich (2005), "Dokumentation des Steuer-Transfer-Mikrosimulationsmodells STSM – Version 1999-2002," German Institute for Economic Research. DIW Data Documentation 9.

Steiner, V. and K. Wrohlich (2004), "Household Taxation, Income Splitting and Labor Supply Incentives – A Microsimulation Study for Germany," *CESifo Economic Studies* 50(3), 541-568.

Steiner, V. and K. Wrohlich (2005), "Work Incentives and Labor Supply Effects of the 'Mini-Jobs Reform' in Germany," *Empirica* 32(1), 91-116.

Studenski, P. (1940), "Toward a Theory of Business Taxation," *Journal of Political Economy* 48(5), 621-654.

Taylor, M. P. (1996), "Earnings, Independence or Unemployment: Why Become Self-Employed?" *Oxford Bulletin of Economics and Statistics* 52(2), 253-265.

Taylor, M. P. (1999), "Survival of the Fittest? An Analysis of Self-Employment Duration in Britain," *Economic Journal* 109(454), C140-C155.

Testa, W. A. and W. H. Oakland (1996), "A Benefits Principle Approach to State-Local Business Taxation: Policies for Midwestern Growth and Development," Federal Reserve Bank of Chicago. Assessing the Midwest Economy SL-4.

The Economist (2006), "Special Report: Germany's Export Champions," *The Economist Print Edition* 379(8478), 75-77.

Van Praag, C. M. and P. H. Versloot (2007), "What is the Value of Entrepreneurship? A Review of Recent Research," Institute for the Study of Labor. IZA Discussion Paper 3014.

Van Soest, A. (1995), "Structural Models of Family Labor Supply: A discrete Choice Approach," *Journal of Human Resources* 30(1), 63-88.

Varian, H. R. (1980), "Redistributive Taxation as Social Insurance," *Journal of Public Economics* 14(1), 49-68.

Vesper, D. (2004), "Gemeindefinanzen und Unternehmensbesteuerung," in: M. Schratzenstaller and A. Truger (eds.): Perspektiven der Unternehmensbesteuerung, Metropolis-Verlag, Marburg.

Wagner, G. G., J. R. Frick, and J. Schupp (2007), "The German Socio-Economic Panel Study (SOEP): Scope, Evolution and Enhancements," *Journal of Applied Social Science Studies* 127(1), 139-170.

Wellisch, D. (2002), "Besteuerung von Erträgen," Verlag Vahlen, Munich.

Wooldridge, J. M. (2003), "Introductory Econometrics – A Modern Approach" Thomson South Western, Mason.

Zimmermann, H. (2002), "Gewerbesteuerreform – in welche Richtung?" *Wirtschaftsdienst* 82(8), 465-470.

Zwick, M. (2007), "Alternative Modelle zur Ausgestaltung von Gemeindesteuern: mikroanalytische Quantifizierung der Einnahme-, der Einkommens- und der Verteilungseffekte," Federal Statistical Office. Dissertation thesis.

Zwick, M., N. Buschle, H. Habla, and R. Maiterth (2003), "Reform der Gemeindefinanzen – die kommunale Einnahmeseite," *Wirtschaft und Statistik* 7, 633-647.

German Summary / Deutsche Zusammenfassung

In den letzten Jahren hat die Frage nach den Faktoren, welche die Gründung kleiner Unternehmen oder ihre Schließung beeinflussen, sowohl in der Wissenschaft als auch in der Politik zunehmend Beachtung gefunden. Es wird argumentiert, dass Unternehmensgründer neue Produkte und Technologien einführen, neue Märkte erschließen und die Wirtschaft innovativ, dynamisch und wettbewerbsfähig halten. Darüber hinaus werden Selbständigkeit oft als möglicher Ausweg aus der Arbeitslosigkeit und neu entstandene Firmen als Brutstätten zusätzlicher Arbeitsplätze gesehen. Dadurch ist das Gründungsgeschehen gerade in Ländern mit hoher Arbeitslosigkeit zu einem Schlüsselthema geworden. In Deutschland etwa wurden ein gebremstes Wirtschaftswachstum und eine hohe Arbeitslosenrate mit einem Mangel an Unternehmensgründungen in Zusammenhang gebracht: „In Deutschland werden zu wenige Unternehmen geboren. [...] Was fehlt, sind [...] kleine Start-up Unternehmen, die das Geheimnis der so starken wirtschaftlichen Entwicklung in Großbritannien, Amerika und anderswo gewesen sind“ (The Economist 2006, Übers. d. Verf.). Bei einer systematischen Literaturstudie unter Berücksichtigung von 57 neuen wissenschaftlichen Studien aus der Gründungsforschung fanden van Praag und Versloot (2007) Evidenz, dass Unternehmer externe Effekte produzieren, die langfristig auch die Steigerungsraten von Arbeitsplätzen in anderen Firmen positiv beeinflussen.

Folgerichtig sind in Deutschland und anderen Ländern verschiedene Politikmaßnamen zur Förderung von Unternehmensgründungen eingeführt worden. Als mögliche stimulierende Instrumente werden häufig steuerpolitische Maßnahmen vorgeschlagen. Während Gründungszuschüsse normalerweise auf Arbeitslose abzielen, kann Steuerpolitik zusätzlich auch Anreize für abhängig Beschäftigte schaffen, den Schritt in die Selbständigkeit zu wagen.

Spielen Steuern wirklich eine Rolle in der Entscheidung, ein Unternehmer zu sein? Wie stark sind mögliche Effekte von spezifischen Steuerreformen? Zu den individuellen

Determinanten der Selbständigkeit besteht eine umfangreiche Literatur, der Einfluss von Steuern ist hingegen vergleichsweise wenig erforscht und umstritten. Ein besseres Verständnis des Einflusses von Steuern auf die Selbständigkeit ist entscheidend, um die Versuche, Unternehmensgründungen mit Hilfe der Steuerpolitik zu fördern, bewerten zu können. Empirische Studien sind aber international und erst recht in Deutschland sehr rar. Das Hauptaugenmerk dieser Dissertationsschrift ist auf den möglichen Einfluss von Einkommensteuern auf die Entscheidung zur Selbständigkeit gerichtet. Sie ist die erste mikroökonometrische Studie mit dieser Fragestellung für Deutschland. Methodisch verbindet diese Arbeit Mikrosimulation, eine ex-post Evaluierung deutscher Steuerreformen in der jüngeren Vergangenheit und ex-ante Simulationen von hypothetischen Steuerreformen in der Zukunft.

Ein erster Schwerpunkt dieser Arbeit fällt zunächst auf die Aufkommens- und Verteilungswirkungen von fünf generellen Reformvarianten für die deutsche Gewerbesteuer. Wie gezeigt wird, würde sich durch diese Gewerbesteuerreformen für einen Teil der Unternehmer ein höherer effektiver Marginalsteuersatz auf ihr Einkommen ergeben. Diese Feststellung leitet dann über zur im übrigen Teil der Arbeit behandelten Frage nach den möglichen Wirkungen auf die Selbständigenrate.

Die Gewerbesteuer ist die wichtigste Einkommensquelle für deutsche Gemeinden. Aus der jahrzehntelang währenden Debatte über eine Reform dieser Steuer wurden für diese Arbeit einige grundsätzliche Varianten identifiziert: 1. eine reine lokale Gewinnsteuer, die auch als Zuschlag auf die Körperschaft- und Einkommensteuer realisiert werden könnte (vgl. BDI/VCI-Modell), 2. eine lokale Steuer auf Gewinne vor Abzug der Zinsen und der Finanzierungsanteile von Mieten, Pachten, Leasingraten und Lizenzgebühren (vgl. „Kommunalmodell“), 3. eine Wertschöpfungsteuer und 4. eine lokale Gewerbekapitalsteuer. Bei einem internationalen Vergleich von lokalen Unternehmensteuern lassen sich diese grundsätzlichen Varianten im Spektrum von schmaler bis breiter Steuerbasis in OECD-Ländern tatsächlich finden, von einer puren lokalen Gewinnsteuer in Luxemburg und Japan bis zu einer lokalen Wertschöpfungsteuer in Italien und Ungarn; in Frankreich und teilweise in den USA wird auch Sachkapital lokal besteuert. Mit dem neu entwickelten Unternehmensteuer-Mikrosimulationsmodell BizTax für Deutschland werden die Aufkommens- und Verteilungswirkungen der genannten Reformvarianten in aufkommensneutraler Form sowie der tatsächlichen Unternehmensteuerreform 2008

bestimmt. Das Modell basiert auf einer repräsentativen Stichprobe von Einzeldaten der Gewerbesteuer- und Einkommensteuerstatistiken für 2001. Bei den betrachteten hypothetischen Reformvarianten für Deutschland werden Freiberufler und Landwirte, die heute von der Gewerbesteuerpflicht ausgenommen sind, miteinbezogen. Durch die pauschalisierte Anrechenbarkeit der Gewerbesteuer bei der Einkommensteuer würde dies aber nur bei Freiberuflern und Landwirten, die in einer Gemeinde mit einem Hebesatz von über 401 % tätig sind, zu einem moderaten Anstieg des effektiven Marginalsteuersatzes führen. Die Verteilungswirkungen der Reformvarianten auf das lokale Gewerbesteueraufkommen sind dagegen erheblich. Die Simulationen ergeben, dass die heutige starke Konzentration des Aufkommens auf Unternehmen mit sehr großen Gewinnen und westdeutsche Kernstädte abnimmt, wenn die Steuerbasis durch Einbeziehung von mehr Steuerpflichtigen und Hinzurechnung von zusätzlichen Elementen der Wertschöpfung verbreitert wird. Im Gegenzug könnte die Steuermesszahl gesenkt werden. Eine solche Reform mit breiterer Bemessungsgrundlage würde den deutschen Gemeinden eine stabilere und verlässlichere Einkommensquelle liefern und das lokale Steueraufkommen pro Einwohner gleichmäßiger über verschiedene Regionen verteilen.

Die Unterscheidung zwischen Gewerbetreibenden und Freiberuflern ist auch bei der ex-post Evaluierung zweier vergangener Steuerreformen wichtig. Ich werte zwei Einkommensteuerreformen in den Jahren 1994 und 1999/2000 in Deutschland als „natürliche Experimente“ aus. Diese Reformen führten eine Tarifbegrenzung für gewerbliche Einkünfte ein, die den höchsten marginalen Einkommensteuersatz insgesamt von 53% auf 43% herabsenkten. Davon profitierten ausschließlich Gewerbetreibende, deren gewerbliche Einkünfte gesetzlich festgelegte Schwellenwerte überschritten, die zur Anwendung des maximalen marginalen Einkommensteuersatzes führten. Die beiden Bedingungen für die Zugehörigkeit zur Behandlungsgruppe – Gewerbetreibender vs. Freiberufler und gewerbliche Einkünfte über dem Schwellenwert – erlauben es, die Wirkung der Steuersenkung mit einer „Differenzen-von-Differenzen-von-Differenzen“-Schätzung zu identifizieren. Die primäre Analyse beruht auf dem Mikrozensus, der amtlichen repräsentativen jährlichen Querschnittsbefragung von Haushalten in Deutschland. Ich untersuche den Einfluss der Reformen auf die Wahrscheinlichkeit, selbständig zu sein, und die Übergangswahrscheinlichkeiten in Selbständigkeit hinein und aus ihr heraus. Zusätzlich wird die Wirkung auf die Übergangswahrscheinlichkeiten mit Hilfe von Verweildauermodellen

untersucht, die auf dem SOEP basieren, einer repräsentativen jährlichen Panelbefragung von Haushalten in Deutschland. Diese zusätzliche Analyse brachte aufgrund der relativ geringen Zahl der Beobachtungen im SOEP jedoch keine statistisch signifikanten Ergebnisse hervor.

Die auf der wesentlich größeren Mikrozensus-Datenbank beruhende Untersuchung ergab dagegen signifikante Resultate. Es zeigt sich, dass die exklusive Steuersatzsenkung die Wahrscheinlichkeit, Selbständigkeit zu wählen, für die behandelte Gruppe um 0,79 Prozentpunkte erhöhte, was einer relativen Steigerung von 25,6% entspricht. Dies impliziert eine Elastizität mit Hinblick auf den marginalen Einkommensteuersatz von -1.36. Im Vergleich zu den Ergebnissen vorliegender ex-post Evaluierungsstudien in anderen Ländern ist dies ein starker Effekt. Eine Erklärung mag sein, dass die Reformen, die hier untersucht werden, im Gegensatz zu diesen Studien keine allgemeinen Einkommensteuersenkungen beschreiben, sondern das relative Nettoeinkommen der betroffenen Unternehmer im Vergleich zu abhängig Beschäftigten erhöhten.

Nach dieser ersten Evidenz, dass Einkommensteuern eine Wirkung auf die Selbständigkeits-Wahrscheinlichkeit haben, wird im Folgenden das Verständnis dieser Effekte vertieft, indem ein strukturelles Modell entwickelt und geschätzt wird. In einem Berufswahl-Modell werden die Agenten durch ein höheres erwartetes Einkommen nach Steuern in die Selbständigkeit gelockt, während ein riskanteres Nettoeinkommen risikoaverse Menschen abschreckt. Zunächst werden das erwartete Einkommen und die Einkommensvarianz in Selbständigkeit und in abhängiger Beschäftigung empirisch analysiert. Dabei wird Selektion in diese Zustände durch ein zweistufiges Schätzverfahren berücksichtigt. Aus den geschätzten Bruttoeinkommen wird das Nettoeinkommen näherungsweise mit Hilfe einer geschätzten Steuerfunktion berechnet. Auf Grundlage von individuell geschätzten ersten und zweiten Momenten des Nettoeinkommens werden strukturelle Modelle von Übergangswahrscheinlichkeiten von abhängiger Beschäftigung in Selbständigkeit und umgekehrt geschätzt. Die Modelle enthalten als Strukturparameter unter anderem das Arrow-Pratt Standardmaß der relativen Risikoaversion. Als Datenbasis verwende ich die Wellen 1984-2005 des SOEP.

Die Ergebnisse zeigen, dass die Übergangswahrscheinlichkeiten im Allgemeinen signifikant elastisch mit Hinblick auf die ersten und zweiten Momente des Nettoeinkommens in den beiden Erwerbsalternativen sind. Die Elastizitäten haben auch die erwarteten Vorzeichen: Ein höheres erwartetes Einkommen in Selbständigkeit relativ zur abhängigen

Beschäftigung erhöht die Wahrscheinlichkeit, selbständig zu werden und zu bleiben, während eine höhere relative Einkommensvarianz diese Wahrscheinlichkeiten senkt. Dies kann auch aus dem geschätzten Koeffizienten der relativen Risikoaversion gefolgert werden, der anzeigt, dass die Agenten moderat risikoavers sind. Die Entscheidung zum Unternehmertum ist also zumindest teilweise durch eine Abwägung zwischen monetären Rückflüssen und Risiko bestimmt, womit Modelle von Kanbur (1982) und Kihlstrom und Laffont (1979) bestätigt werden. Dieses Ergebnis wird auch durch meine Beobachtung weiter gestützt, dass in Deutschland sowohl der Erwartungswert also auch der Variationskoeffizient der Nettoeinkommen pro Arbeitsstunde in Selbständigkeit höher sind als in abhängiger Beschäftigung, zumindest nachdem die ersten Jahre in Selbständigkeit überstanden sind. Als zusätzliches Ergebnis wird im Einklang mit der vorhandenen Literatur festgestellt, dass abhängig beschäftigte Frauen risikoaverser sind als Männer. Dies könnte eine Erklärung für den geringen Frauenanteil unter den Selbständigen in Deutschland sein.

Eine Steuerreform, also eine Änderung des progressiven Steuersystems, beeinflusst sowohl den Erwartungswert als auch die Varianz der Nettoeinkommen in den beiden Alternativen Selbständigkeit und abhängige Beschäftigung. Da diese Momente des Nettoeinkommens in die strukturellen Übergangsmodelle eingehen, sagen diese Modelle eine Wirkung von Steuerpolitik auf die Selbständigkeits-Wahrscheinlichkeit voraus. Die Modelle sind daher geeignet, um ex-ante Evaluierungsstudien über die Wirkung bestimmter (auch hypothetischer) Steuerreformen auf die Selbständigkeit durchzuführen.

Im letzten Teil der Arbeit werden dementsprechend die geschätzten strukturellen Übergangsmodelle genutzt, um die Wirkungen von drei hypothetischen Steuerreform-Szenarien für Deutschland zu simulieren. Das erste Szenario untersucht den Effekt der Steuerreform 2000, indem die Wirkung einer hypothetischen Außerkraftsetzung dieser Reform im Jahr 2005 simuliert wird. Die Steuerreform 2000 senkte die gesetzlichen Einkommensteuersätze in drei Schritten zwischen 2000 und 2005. Der höchste Marginalsteuersatz wurde von 51% im Jahr 2000 auf 42% im Jahr 2005 reduziert und der niedrigste von 22,9% auf 15%. Gleichzeitig wurde der Grundfreibetrag von 6902 auf 7664 Euro angehoben. Die anderen beiden simulierten Szenarien geben aufkommensneutrale Flat Tax Reformen wieder, wiederum für 2005. Das erste Szenario definiert einen Grundfreibetrag von 7664 Euro, wie im geltenden Recht 2005, und einen einheitlichen Steuersatz von 26,9%, das andere einen Grundfreibetrag von 10.700 Euro und einen Steuersatz von 31,9%. Die ex-

ante Effekte dieser drei Reformszenarien werden berechnet, indem die geschätzten Übergangsraten in diesen Szenarien mit denjenigen verglichen werden, die im Vergleichszenario geschätzt werden. Dieses Vergleichszenario gibt das tatsächlich geltende Recht 2005 wieder. Um diese Simulationen realitätsnah durchführen zu können, wird Deutschlands komplexes System von Einkommensteuern, Sozialabgaben und Transfers explizit modelliert, indem das Steuer-Transfer Mikrosimulationsmodell STSM (Steiner *et al.* 2005) integriert wird. Dieses Modell wird um geschätzte Beiträge zur privaten Krankenversicherung und zur freiwilligen Altersvorsorge der Selbständigen erweitert. Das erweiterte Steuer-Transfer-Modell ermöglicht die konsistente Berechung von Nettoeinkommen aus den geschätzten Bruttoeinkommen in Selbständigkeit und in abhängiger Beschäftigung, sowohl in den drei Reformszenarien als auch im Vergleichsszenario. Es zeigt sich, dass die geschätzten Strukturparameter in den Übergangsmodellen robust im Hinblick auf die unterschiedlichen Methoden sind, die zur Berechnung des Nettoeinkommens verwendet wurden (geschätzte Steuerfunktion oder Steuer-Transfer-Mikrosimulationsmodell).

Die Simulationsergebnisse zeigen, dass die hypothetische Außerkraftsetzung der Steuerreform 2000 im Jahr 2005 die Eintrittsrate in Selbständigkeit aus abhängiger Beschäftigung heraus um 2,2% erhöht und die Austrittsrate um 6,8% verringert hätte, relativ zu den entsprechenden Übergangsraten im geltenden Recht. Im Umkehrschluss bedeutet das, dass die Steuerreform 2000, welche die Progressivität der Einkommensteuer verringert hat, potentielle Unternehmer eher von der Selbständigkeit abschreckt. In die gleiche Richtung deuten die Simulationsergebnisse der Flat Tax Szenarien. Je flacher der Einkommensteuertarif, desto geringer ist die Neigung, sich selbständig zu machen. Das flachere Szenario mit den geringeren Werten für Grundfreibetrag und Steuersatz ergibt eine um 5,1% verringerte Eintrittsrate relativ zum Vergleichsszenario, das progressivere Szenario mit den höheren Werten – eine relative Verringerung um 2,5% (es gibt keine signifikante Wirkung der Flat Tax Reformen auf die Austrittswahrscheinlichkeit). Das höhere Einkommensrisiko in Selbständigkeit gegenüber abhängiger Beschäftigung, das durch eine Flat Tax verstärkt wird, überwiegt in der Wirkung den ebenfalls größeren Zuwachs beim erwarteten Nettoeinkommen. Zusammenfassend lässt sich feststellen, dass bei den drei hier betrachteten hypothetischen Reformszenarien die Wirkung der Einkommensteuer als Versicherung gegen das Einkommensrisiko ausschlaggebend ist. In diesen Szenarien schreckt

eine Verringerung der tariflichen Progressivität, und damit der Risikopartnerschaft des Staats, die Agenten von der Selbständigkeit ab.

Für die Politik bedeutet dies, dass Steuerreformen, die auf ein Abflachen des allgemeinen Einkommensteuertarifs abzielen, keine geeigneten Mittel zur Förderung von Unternehmensgründungen zu sein scheinen. Bei der Diskussion um Flat Tax Szenarien oder andere Tarifreformen verdienen die Auswirkungen auf das Einkommensrisiko mehr Aufmerksamkeit. Unter diesem Gesichtspunkt verlieren die einschlägigen Flat Tax-Vorschläge an Attraktivität, zumindest, wenn die Stimulierung von Gründungen explizit als Politikziel formuliert wird.

Das Ergebnis der ex-post Analyse der Tarifbegrenzung für gewerbliche Einkünfte legt nahe, dass spezifische Steuersenkungen für Selbständige ein effektiveres Förderinstrument sein könnten. Damit würde aber das Prinzip der synthetischen Einkommensteuer verletzt. Ob dies in Kauf genommen werden sollte, ist eine politische Frage, die auch die Verteilungsgerechtigkeit und Verfassungsmäßigkeit berücksichtigen muss.