Regional Disparities in Economics – Microeconometric Analyses of Labor Supply, Internal Migration, and Rental Prices

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Chapter 1

Introduction and Overview

Regional economic disparities have been one of the main subjects of economic analyses for more than a century: from Ravenstein (1885), who studied determinants for internal migration in Great Britain, to Lösch (1940), who laid out important groundwork for regional economics, up to Krugman (1991), again emphasizing the importance of studying economic events on a regional level. While early work focused predominantly on differences of economic outcomes between countries, the analysis of smaller scale spatial units became more and more popular in the last 20 years. For empirical researchers, the increasing availability of smaller scale regional data played an important role in this process. In this context, choosing the adequate regional level according to the research question is important, as the regional level of analysis should reflect the regional level where the effects of interest take place in reality. In the case of regional disparities, the argument can be made for almost all aggregation levels from countries to small-scale grid cells depending on the issue of interest.

Regional economic disparities do not only exist in most countries worldwide, but actual statistics suggest that regional differences in income inequality and unemployment are growing both between and within countries. For example, in countries like Italy, Spain and Turkey regional disparities in the local unemployment rate reach up to 20 percentage points. On the country-level, the difference between the national unemployment rates of Greece and Norway is of similar magnitude. These regional characteristics in turn influence the residents in that particular area, as regional characteristics are important factors in predicting individual well-being (OECD, 2016c).

Two of the most relevant issues in Germany's public debate today are the sharp rise in rental prices, especially in urban areas, and the aging of the population due to the demographic change in society. For instance, between 2010 and 2016 rents in Berlin rose by around 40 percent (Kholodilin et al., 2016). Currently, there is an ongoing debate whether a maximum rental price per square meter should be introduced for the city of

Berlin, or whether the state should consider large-scale repurchasing programs for real estate in order to keep prices down (Frankfurter Allgemeine Zeitung, 2019a; Zeit Online, 2019). Regarding the demographic change, regional variations play an important role and its investigation enables researchers to gain a much more detailed picture than the use of national averages could provide. Figure 1.1 highlights these regional patterns, showing much higher proportions of persons over 50 years especially in the East and in rural regions compared to the other German counties.[1]

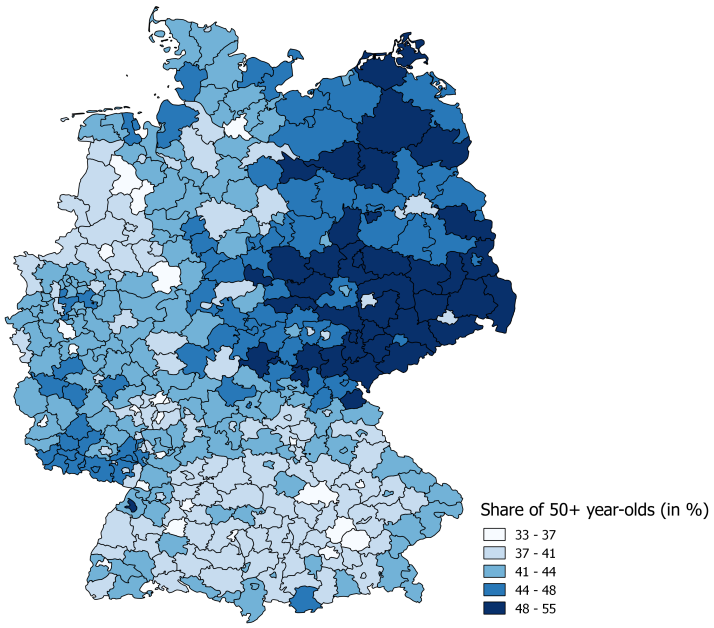


Figure 1.1: Share of Persons over 50 by County

Source: Destatis, own calculations.

From a policy perspective, substantial differences in the social structure and economic performance are not desirable, which emphasizes the importance of highlighting and understanding these regional differences and their consequences. In order to reach a better understanding of some of these regional disparities, this dissertation presents empirical contributions to three different fields of economics. During the course of the next three chapters, this dissertation analyzes female labor supply decisions, the determinants of internal migration, and the effect of property taxes on rental prices. Each chapter uses different datasets and econometric techniques suitable for the specific setting. Combining the results of these studies yields a better understanding of the aforementioned problem.

Chapter 2 analyzes the responsiveness of women's labor supply to their husband's job loss – the so-called added worker effect – at the European level. The focus lies on exploring

[1]Similar disparities can be observed concerning economic factors like the unemployment rate or GDP per capita. See for example Mitze and Reinkowski (2011).

regional variation in the added worker effect and comparing its incidence and magnitude across different welfare regimes within Europe. **Chapter 3** is concerned with internal migration in Germany at the county level. It provides a detailed descriptive picture of migration flows within Germany and analyzes the determinants of internal migration in a multivariate gravity model. In **Chapter 4**, the effect of changes in the property tax on rental prices for apartments in West Germany is analyzed at the municipality level. In particular, the role of regional differences in the incidence of the property tax and in the tax shifting behavior of landlords is investigated. In the following, the contributions of this thesis to the economic literature are clarified and the main findings and implications of the succeeding chapters are shortly summarized.

Chapter 2 – Husband's Unemployment and Wife's Labor Supply – The Added Worker Effect across Europe (co-authored by Julia Bredtmann and Sebastian Otten) investigates the responsiveness of women's labor supply to their husband's job loss – the added worker effect. We take explicitly an internationally comparative perspective and analyze the added worker effect across different welfare regimes in Europe. The added worker effect is theoretically well predicted by models of family labor supply in which the loss of household income associated with an unemployment spell of one partner is offset by an increase in the labor supply of the other partner. Previous empirical literature, which mainly focuses on the analysis of one single country, has provided mixed results. To a large degree, these diverging results can be explained by differences in the used data, in the generosity of the welfare state of the respective country, and differences in the countries' economic conditions.

We contribute to the literature by tackling these three issues. For our analysis we use data from the European Union Statistics on Income and Living Conditions (EU-SILC), covering 28 European countries from 2004 to 2013. This enables us to analyze the added worker effect for a variety of countries with a homogeneous dataset, yielding comparable results for all countries covered. Another advantage of our analysis are the heterogeneous forms of institutions between the countries covered by the data. This heterogeneity enables us to focus on the effects of the countries' different institutional regimes, offering different levels of unemployment insurance, and therefore different incentives to adjust the labor supply due to an unemployment spell of the partner. In addition, the period of the Great Recession is covered by our analysis, enabling us to estimate the variation of the added worker effect with respect the countries' general economic conditions. Lastly, we contribute to the literature by examining effects on the external as well as on the internal margin of women's labor supply. This point is of particular importance for the analysis of the added worker effect in the European context, as the countries differ largely with respect to female labor market attachment.

Overall, we find evidence for the existence of an added worker effect. The effect is mostly driven by changes from inactive women into unemployment, while the probability of changing from inactivity into employment remains largely unchanged. The results further indicate that women intensify their search behavior and are more likely to change from part-time to full-time employment. In addition, we find evidence that the added worker effect varies across different welfare regimes in Europe. Because of the traditionally tight social security systems in southern European countries, the effect is strongest among couples living in the Mediterranean countries, while it is less present in the Continental European and the Scandinavian countries, where partners are not as strongly incentivized to immediately get a job after the husbands' unemployment. Furthermore, the added worker effect varies with the countries' economic conditions – it increases as unemployment rises and it decreases with an increasing labor force participation of women.

Chapter 3 – Berlin Calling – Internal Migration in Germany (co-authored by Thomas K. Bauer and Michael M. Tamminga) – provides a detailed descriptive analysis of the patterns and determinants of internal migration flows in Germany. The focus of this Chapter is to document heterogeneities in internal migration patterns, as well as in the determinants of internal migration across different age groups. Moreover, we highlight the role internal migration plays for the regional age heterogeneity in Germany.

For the empirical analysis, we use data on county-to-county migration for the years 2007 to 2014 based on changes in the place of residence as captured by the German population registers, containing every person changing residency in the covered years. The data is disaggregated by age groups and German citizenship and is augmented with information on the county's unemployment rate, GDP per capita, and population figures. Additionally, migration distance is included in the data. We further extended the data by information on average age-specific wages in the sending and host county, and a rental price index. Therefore, we are able to contribute to the literature by analyzing internal migration on the smallest regional level currently available using an extended gravity model. By the use of the unique dataset, we are able to control for regional living costs and age-specific earning perspectives.

Our results reveal that migration behavior differs substantially between age groups, not only in the absolute numbers of migrants, but also in the location choices. By far the largest group of internal migrants is made up of 18 to 29 year-old individuals. This is also the age group with the highest urbanization tendencies, leading to an increasing age heterogeneity between urban and rural areas in Germany, since, fueled by these movements, cites get relatively younger over time, whereas rural areas become older at the same time.

In line with the majority of existing empirical studies we confirm the implications of the neoclassical migration model. We are able to show that age-specific wages have a high

explanatory power, probably because they reflect earning perspectives relatively accurate. Our results further suggest that labor market indicators such as the unemployment rate and GDP per capita have a high explanatory power for internal county-to-county migration. However, the extent of this effect varies across age groups, being most pronounced for younger and prime working age group. Taken together, the results confirm a strong variation in migration behavior over the life cycle. Surprisingly, the cost of living, in this case proxied by the rental price index, has only a minor impact on internal migration.

Chapter 4 – Rental Housing and Property Taxation – analyzes the effect of changes in the property tax on rental housing prices in Germany. The amount of property taxes is determined on the municipality level, and I analyze the influence of these changes on the object level. According to the German tax system, the property tax is paid by the landlord. However, it can be legally shifted towards the tenants, which raises the question of the economic incidence of the tax burden. Standard economic theory predicts the tax burden to be higher for the more inelastic side of the rental market, i.e. the tax can be shifted towards the tenants to a large degree, if housing demand is less elastic than housing supply.

The empirical analysis is based on a geo-referenced dataset provided by *Immobilien-Scout24*, the leading online broker for real estate in Germany. The data contains comprehensive information on advertised apartments for the period 2008 to 2015. It provides information on the rent and on an extensive range of characteristics of the apartment such as the size, the number of rooms, and the year of construction. The housing data is supplemented with information on the municipality level, allowing me to estimate a hedonic price model including information on the apartment and its location.

The results show that – at least in the short run – the biggest part of an increased tax burden is borne by the landlord. This result, however, differs for urban and rural municipalities: In urban municipalities, the landlord is able to shift most of the increased tax incidence towards the tenant, while the tax cannot be fully shifted in rural municipalities. Intuitively, this supports the standard theory on how costs can be shifted in a setting like this. This can partly be explained by different demand elasticities for urban and rural housing, with the demand for housing in cities being less elastic compared to rural areas.

In summary, **Chapter 2** and **Chapter 4** capture the impact of policy on economic outcomes on different regional levels, whereas **Chapter 3** deals with the influence of regional economic characteristics on economic behavior, in this case migration. This dissertation shows that regional policies as well as regional economic conditions have a sizable impact on the economic behavior of individuals, and that differences between regions play an important role for different economic and social aspects. Overall, this dissertation underlines the fact that the causes and consequences of regional disparities

are complex and highlights certain aspects of them. The results show that the analysis of regional differences in their many manifestations is an important topic for economists and that the proper choice of the regional scale and the availability of high-quality regional data improves the quality of the insights stemming from econometric analyses.

Chapter 2

Husband's Unemployment and Wife's Labor Supply – The Added Worker Effect across Europe*

2.1 Introduction

Theoretical models of family labor supply predict that the unemployment of one spouse should increase the labor supply of the other spouse (see, e.g., Ashenfelter, 1980). In order to offset the income loss associated with the partner's job loss, inactive spouses newly enter the labor market and become so-called 'added workers' and already participating spouses increase the amount of hours worked. We investigate these theoretical predictions by focusing on the responsiveness of women's labor supply to their husband's job loss. Previous empirical literature on this topic mainly concentrates on a single country and provides mixed results. These might be explained by the crowding-out effect of the countries' unemployment insurance (Cullen and Gruber, 2000; Ortigueira and Siassi, 2013) or by individual unobserved heterogeneity obscuring the added worker effect (Maloney, 1991). Cross-country evidence on the added worker effect, however, is scarce.[1]

Yet, it seems obvious to assume that women's response to their husbands' job loss varies across welfare regimes. Even within the European framework, countries differ largely with respect to their institutional settings, their social policies and the structure of their labor markets, and therefore offer different incentives for women to adjust their labor supply. As Bentolila and Ichino (2008) argue, the role of family support and thus wives'

*Co-authored with Julia Bredtmann (RWI, IZA Bonn, CReAM) and Sebastian Otten (CReAM, University College London, RWI). This chapter is published in *Industrial and Labor Relations Review*, 71(5), 1201–1231, 2018. A preliminary version of this chapter has been published as Ruhr Economic Paper #484.

[1]Exceptions are McGinnity (2002) and Prieto-Rodriguez and Rodriguez-Gutierrez (2003).

reactions to their husbands' job loss should be stronger whenever the welfare state fails to mitigate the consequences of unemployment.[2] In this regard, Reher (1998) shows a 'dividing line' between southern European societies, with their history of depending on strong family networks, and northern European societies, with their weaker family systems and greater reliance on extended welfare states. Following this argumentation, we would expect the behavioral response of wives to their husbands' unemployment to be stronger the lower the generosity of the welfare system.

In order to test this hypothesis, we take an explicit internationally comparative perspective and analyze whether the added worker effect varies across the welfare regimes in Europe. In doing so, we use longitudinal data from the European Union Statistics on Income and Living Conditions (EU-SILC) covering 28 European countries over the period 2004 to 2013. Observing households over the time of the Great Recession, which forced many families to devise strategies to cope with negative income shocks due to job loss, further provides a fresh opportunity to investigate couples' labor supply. While previous studies of the added worker effect during recessions focus on single countries[3] and limit their analysis to before-after comparisons, we are able to investigate the role of the added worker effect in Europe's economic crisis by explicitly analyzing its variation with the countries' economic conditions.

Lastly, we contribute to the literature by considering a variety of behavioral responses of wives to their husbands' job loss, covering reactions at both the extensive and the intensive margin of women's labor supply. Although the importance of distinguishing between the extensive and intensive margin of labor supply has long been recognized (cf. Blundell et al., 2011; Blundell and MaCurdy, 1999), previous literature mainly concentrates on analyzing the labor market entry of non-participating wives, while the labor supply adjustments of already participating wives are mostly ignored (exceptions are Gong, 2011; Kohara, 2010; Stephens, 2002). Given that female labor force participation rates have increased remarkably over the last decades and that the countries within Europe vary largely with respect to the structure of their labor markets, addressing this issue in an internationally comparative perspective is of particular importance.

For our pooled sample covering all European countries, we find evidence for the existence of an added worker effect. Women whose husbands become unemployed show a significantly higher probability of entering the labor market than women whose husbands

[2]The authors also point to the fact that the nexus of causality between the roles of the welfare state and the family is not obvious. One could argue that a greater generosity of the welfare system is a response to the weakness of family networks or, alternatively, that the latter retreated when the welfare state was strengthened (Bentolila and Ichino, 2008, p. 261).

[3]See Parker and Skoufias (2004) investigating the Peso crisis in Mexico, Mattingly and Smith (2010) and Starr (2014) looking at the Great Recession for the US, and Bryan and Longhi (2018) conducting a similar analysis for the UK.

remain employed. This effect is mainly driven by wives' transitions into unemployment, while wives' probabilities of becoming employed seem to be independent of their husbands' job loss. Furthermore, we find that wives of newly unemployed husbands are more likely to start searching for a job and to change from part-time to full-time employment.

Our results further reveal that the added worker effect varies with the countries' economic conditions. While wives' probability of entering the labor market increases as unemployment rises, it decreases with rising female labor force participation rates. The results of our subsample regressions for five different country groups further reveal that the magnitude and the significance of the added worker effect varies over the welfare regimes within Europe. Overall, the added worker effect is strongest among couples living in the Mediterranean countries and weakest among those living in the Anglo-Saxon countries. Furthermore, we find large differences in the type of behavioral response between the country groups. These results suggest that contextual factors, such as the countries' labor market conditions, culture or institutions, ultimately affect household decision-making and thereby the existence and the magnitude of the added worker effect.

The remainder of the paper is as follows. In Section 2.2, we shortly outline the theoretical framework underlying the added worker hypothesis and summarize previous literature. In Section 2.3, we describe our empirical strategy and present the data used in the empirical analysis. The results of our analysis are discussed in Section 2.4 and Section 2.5 concludes.

2.2 Theoretical Framework and Literature

The theory underlying the notion of spousal labor supply as insurance against unemployment is developed in Ashenfelter (1980), Heckman and MaCurdy (1980), and Lundberg (1985). Assuming leisure time to be a normal good, the reduction in family income associated with the husband's unemployment induces the wife to increase her labor supply. If the gained leisure time of the husband serves as a substitute for the wife's leisure time, the wife's reservation wage will decrease and thus her probability of entering the labor market will increase. As a result, the wife will partly increase her labor supply due to the reduction in household income and partly due to the substitution effect associated with the husband's wage decrease.[4] While, in its traditional sense, the added worker effect refers to a situation in which a non-participating wife enters the labor market due to her husband's unemployment, behavioral responses may also occur at the intensive margin of

[4]If, however, the leisure time of the wife and the husband are complements, the labor supply of married women may also decrease. If the substitution effect outweighs the income effect, the total change in labor supply can even be negative.

women's labor supply. I.e., already participating wives may increase their labor supply in terms of an increase in their working hours or a change from part-time to full-time employment as a response to their husbands' unemployment.

The literature in analyzing the added worker effect can be dated back to the 1940s (cf. Woytinsky, 1940). Despite the theoretical well-known effect, the existing empirical literature misses a clear consensus on its magnitude or even its existence. Most of the early empirical literature focuses on the labor supply of non-participating women in the US. For this case, the added worker effect is usually found to be small or non-existing (e.g., Lundberg, 1985; Maloney, 1987, 1991; Spletzer, 1997). Those studies that do uncover an added worker effect usually conclude that the small responses are optimal because the husband's unemployment only leads to a transitory reduction in earnings, which are considered to be small in a life-cycle framework (Heckman and MaCurdy, 1980).

Furthermore, it is argued that the added worker effect is expected to be less present during times of economic prosperity (Spletzer, 1997). This is due to the fact that in economically prosperous phases, the absence of liquidity constraints may enforce other opportunities of smoothing family income, i.e., couples are more able to rely on credits or savings to maintain their consumption (Sullivan, 2008). Moreover, when employment rates are high, job losses are more likely to be transitory and the expected income losses to be small. It is therefore not surprising that previous literature concludes that the added worker effect tends to be more present in periods of economic downturns (Bryan and Longhi, 2018; Mattingly and Smith, 2010; Parker and Skoufias, 2004).

Another factor lowering the magnitude of the added worker effect is the unemployment benefit system. For the US, Cullen and Gruber (2000) find that the added worker affect is partly crowded out by unemployment benefits and that the labor supply response of females whose husbands became unemployed would be 30 percent larger in the absence of these benefits. Ortigueira and Siassi (2013) come to a similar conclusion and further show that the crowding-out effect of unemployment insurance is stronger among liquidity-constrained households.

Some more considerable effects are found by Stephens (2002), Kohara (2010), and Gong (2011), who focus on the intensive margin of wife's labor supply. For the US, Stephens (2002) finds that women whose husbands have been displaced significantly increase their paid working time. Similar effects are found by Kohara (2010) for Japan and by Gong (2011) for Australia.

Cross-country evidence on the existence of the added worker effect, however, is still scarce. Exceptions are McGinnity (2002) comparing Britain and West Germany and Prieto-Rodriguez and Rodriguez-Gutierrez (2003) analyzing the added worker effect for 11 European countries, both focusing on the extensive margin of women's labor supply

responses. While McGinnity (2002) finds evidence for the existence of an added worker effect in West Germany, no effect can be identified for Britain. An explanation for the non-presence of an added worker effect in Britain is given by the country's unemployment benefit system, which is based on means-tested benefits and therefore sets disincentives for women to enter the labor market after their husbands become unemployed. Prieto-Rodriguez and Rodriguez-Gutierrez (2003) reveal that the added worker effect is only present in a few countries in the European Union, which include Italy and, to a lesser extent, Germany, the Netherlands, Portugal, and Spain.[5]

While the existing cross-country studies limit their analysis to wives' entries into the labor market due to their husband's unemployment, it seems obvious to assume that the type of the wives' behavioral response varies across countries. While the female labor force participation rate is relatively low in most Mediterranean countries, it is higher in most Western societies.[6] Therefore, it is not surprising that most of the empirical literature that identifies an added worker effect deals with countries in which the labor force attachment of women is comparatively low (see, e.g., Ayhan, 2018; Başlevent and Onaran, 2003; Bentolila and Ichino, 2008; Prieto-Rodriguez and Rodriguez-Gutierrez, 2000). In most Western societies, the ability of married women to newly enter the labor market and become additional workers is limited, because most women already participate in the labor market. In these countries, wives' reaction to their husbands' job loss is more likely to be observed in terms of an increase in their hours of work.

The main conclusion that can be drawn from previous literature is that the existence and the magnitude of the added worker effect highly depend on the considered circumstances. While every single study provides a valuable hint on which circumstances matter, the literature lacks an all-encompassing empirical investigation of the responsiveness of wives' labor supply to their husbands' unemployment. Our aim is therefore to unify previous literature and reconcile the different results by providing a large-scale investigation of the added worker effect. Analyzing its variation across different welfare regimes and its fluctuation over the business cycle while at the same time considering a variety of behavioral responses of the wife at both the extensive and the intensive margin of labor supply should give us a better understanding of the circumstances that facilitate or hamper spousal labor supply as an insurance device against unemployment shocks.

[5]The countries for which no added worker effect is found are Belgium, Denmark, France, Great Britain, Greece, and Ireland.

[6]In 2014, the average female labor force participation rate for the EU-28 is 66.5%. It is the lowest in Malta (52.1%), Italy (54.4) and Greece (59.0%) and the highest in Sweden (83.4%), Norway (75.9%) and Denmark (75.0%) (Eurostat, 2015).

2.3 Empirical Strategy and Data

2.3.1 Econometric Model

To test the added worker hypothesis for the European case, we estimate different Probit models of the form

$$\Delta Y_{it}^{m} = \Phi(X_{it}^{'}\beta^{m} + \gamma^{m}\Delta E_{it} + \sum \phi_{j}^{m} C_{j} + \sum \theta_{t}^{m} T_{t} + M_{jt}^{'}\alpha^{m} + (\Delta E_{it} \times M_{jt})^{'}\delta^{m} + \varepsilon_{it}^{m}), \quad (2.1)$$

which describe women's behavioral response in household i at time t in country j. The above models mainly differ with respect to their dependent variable as denoted by the superscript m, with $m = (1, \ldots, 5)$. First, for $m = 1$, ΔY_{it} indicates a binary variable that equals unity if the wife was out of the labor force (IA) in $t-1$ and is in the labor force (A) in t, i.e., $\Delta Y_{it} = (IA_{t-1} \rightarrow A_t | IA_{t-1})$. In a second step, we distinguish between two types of labor market activity. For $m = 2$, the dependent variable equals unity if the wife is unemployed (U) in t and for $m = 3$, it equals unity if the wife is employed (E) in t, given that she was out of the labor force in $t-1$.[7] For $m = 4$, the dependent variable equals unity if the wife was not searching for a job in $t-1$ and is searching for a job in t (ΔJS). Lastly, for $m = 5$, ΔY_{it} is set to unity if the wife was part-time employed (PT) in $t-1$ and is full-time employed (FT) in t.

The vector X_{it} includes a set of individual and household characteristics as described in more detail below. The vector C_j contains a full set of country dummies and the vector T_t contains a full set of year dummies.[8] M_{jt} is a vector of macroeconomic conditions of the country, which vary over time.

The variable ΔE_{it} is the variable of main interest, in the following referred to as the 'added worker dummy'. This variable is a binary indicator which equals unity if the wife's spouse became unemployed from $t-1$ to t and zero if he stayed employed. Its coefficient is expected to be positive and significant in each specification if an added worker effect is present in the particular sample. The magnitude of its marginal effect can be interpreted as the increase in wife's probability of adjusting her labor supply as a response to her husband's unemployment.

In identifying a causal added worker effect, however, Maloney (1991) points to the importance of discriminating between 'permanent' and 'transitory' factors leading to the husband's unemployment. On the one hand, the unemployment of the husband might proxy

[7] As entering employment or unemployment is a mutually exclusive decision, we also estimated these labor market transitions by applying a Multinomial Logit model. The results are similar to those of the simple Probit models and are shown in Table 2.B1.

[8] We further checked the robustness of our results by including country-year dummies instead of single country and year dummies in the regressions in order to control for country-time specific heterogeneity. The results are similar to those presented in the following and are shown in Table 2.A3.

for predominantly 'transitory' factors that are unrelated to the personal characteristics of the household, such as the closure of a plant that directly results in the layoff of the husband. On the other hand, the unemployment of the husband might proxy for predominantly 'permanent' characteristics of the household. The husband's unemployment propensity might be correlated with unobserved characteristics of the household, such as the sorting mechanism that initially formed the household, which matches spouses with similar levels of human capital or similar preferences for leisure. In the latter case, we are likely to underestimate the true added worker effect, since wives of frequently unemployed husbands are likely to face low market wage rates themselves and thus to show similarly low labor supply patterns as their husbands. In order to identify a causal effect of husband's unemployment on wife's labor supply, it is therefore important to disentangle permanent and transitory unemployment spells and income shocks, respectively. While we aim to accomplish this goal by controlling for a variety of individual and household characteristics to be correlated with husbands' unemployment probability and conduct a series of sensitivity analyses to verify the robustness of our results, we cannot entirely rule out that unobserved heterogeneity still biases our estimation results.[9] We keep that in mind when interpreting our estimation results.

Lastly, we aim at identifying whether the magnitude of the added worker effect varies with the macroeconomic conditions of a country. In doing so, an interaction of the added worker dummy and variables included in the vector M_{jt} is further included in the model.

In addition to the pooled regressions for all European countries, we separately estimate Equation (2.1) for several subsamples of countries to test whether the added worker effect differs across the welfare regimes in Europe. In doing so, we group countries according to a modified Esping-Andersen welfare regime typology (Esping-Andersen, 1990).

In order to ensure representativeness, we use combined individual and population weights in all regressions. While the former correct for different selection probabilities of individuals within each country as well as panel attrition, the latter ensure that each country is represented in proportion to its actual population size.

2.3.2 Data

The data used in this study is taken from the European Union Statistics on Income and Living Conditions (EU–SILC) covering the periods 2004 to 2013. The EU–SILC data includes all European Union member states as well as Norway and Iceland. Due to insufficient data quality, Iceland and Malta had to be excluded from the analysis, which

[9] One way to address the problem of unobserved heterogeneity would be to add individual (or household) fixed effects to the model. Unfortunately, this is not possible in our study, as we observe households only over a short period of time and thus lack sufficient variation in spouses' labor market status over time.

leaves us with a sample of 28 countries. Since we are interested in wives' labor supply adjustments as a reaction to their husbands' unemployment, we use the longitudinal version of the EU–SILC data. The longitudinal version is a 4–year rotating panel, which allows us to follow households and individuals for a maximum of 4 years.

The data was collected by Eurostat for the first time in 2004. In the first wave, 15 countries were surveyed, while most of the other countries (except for Bulgaria (2006), Romania (2007), and Croatia (2010)) followed in 2005. While the majority of countries is surveyed until 2013, some countries either left the survey (Germany in 2006) or did not provide any data for 2013 yet (Croatia, Greece, Romania, and Sweden).

In our analysis, we restrict the sample to married or cohabiting couples in which both individuals are aged between 16 and 65 and neither partner is retired or unable to work.[10] For the analysis of wives' labor supply responses at the extensive margin, we further restrict our sample to 'traditional couples', i.e., we condition on the husband being employed and the wife being out of the labor force in $t-1$. In analyzing the labor supply adjustments of wives already participating in the labor market, the sample is restricted to couples in which the woman is working part-time and the husband is employed in $t-1$.

Information on husband's and wife's labor market status is obtained from a variable that contains information on the self-defined current economic status of an individual, distinguishing between full-time and part-time employment, unemployment, and different types of inactivity (e.g., schooling, retirement, fulfilling domestic tasks). This variable is used to define different labor market transitions of the wife. First, we ignore the type of labor market activity and define a variable that equals one if the wife enters the labor market (i.e., if she either becomes employed or unemployed) and zero otherwise. In a second step, we explicitly distinguish between the two types of labor market activity in order to discriminate between mechanisms occurring on the supply and the demand side of the labor market. In doing so, we create two variables that take value one if the wife enters into employment and unemployment, respectively, and zero otherwise. In a third step, we acknowledge the fact that the individual's self-defined economic status only captures the person's own perception of their main activity at present. It therefore differs from the strict criteria of the ILO concept, as, for instance, some people who consider themselves 'unemployed' may not take active steps to find work and being immediately available. Therefore, we further use information on the individual's job-search behavior by making use of a question that asks respondents whether they have been actively looking for a job within the last 4 weeks. The respective variable takes value one if the wife has not been

[10] In order to check the robustness of our results, we further conducted our analysis for a restricted sample of individuals aged between 25 and 59 years in order to avoid variation in women's labor supply due to differences in education leaving ages and statutory retirement ages across countries. The results are similar to those for the larger sample and are shown in Table 2.A4.

searching for a job in $t-1$ but is doing so in t, and value zero if she is not searching for a job in both periods. Lastly, we use information on the individual's self-defined current economic status to define a variable equal to unity if the wife has been working part-time in the period $t-1$ and is working full-time in the period t. This variable is equal to zero if the wife continuously remains in part-time employment.

Instead of using information on the current employment status, husband's labor market transitions are identified by using retrospective information on the husband's employment history in the last 12 month. In doing so, a husband is considered to be unemployed if he had at least one unemployment spell within the last 12 months. This means that a husband might be considered as being unemployed even if he is currently employed. The reasoning behind using this criterion to define husband's unemployment is that we assume that even small or transitory reductions in household income might change the optimal behavior of the household and thus result in individual labor supply responses.[11,12]

In our regressions, we control for a variety of individual and household characteristics.[13] At the household level, we control for whether the couple is married, the number of children, and whether the youngest child is aged 0 to 3 years and 4 to 6 years, respectively. In order to capture the couple's financial background, we include the logarithm of the household's equivalized disposable income as a regressor.[14] Moreover, we include a binary variable indicating whether the household currently has to repay some non-housing related debts and control for the dwelling type the couple inhabits, i.e., we distinguish between couples living in a detached house, a semi-detached house and an apartment or a flat.

On the individual level, we include both spouses' age and its square and control for their highest level of education, distinguishing between low-skilled (ISCED 0-2), medium-skilled (ISCED 3-4), and high-skilled (ISCED 5) individuals. Furthermore, we control for the husband's occupational status in $t-1$ in all models and for the wife's occupational status in $t-1$ when considering wives who actively participate in the labor market, i.e., when analyzing women's transitions from part-time to full-time employment. In doing so, we differentiate between white collar high-skilled (ISCO 1-3), white collar low-skilled (ISCO 4-5), blue collar high-skilled (ISCO 6-7), and blue collar low-skilled (ISCO 8-9)

[11] We further checked the robustness of our results by considering the husband to be unemployed only if he had at least three months of unemployment within the last 12 months. The results are robust to changing the definition of husband's unemployment and are shown in Table 2.A6.

[12] For a descriptive comparison of the transition probabilities of those women whose husbands became unemployed within the last year and those women whose husbands stayed employed, see Table 2.A1.

[13] The descriptive statistics of all variables included in our analysis for the three different samples considered are shown in Table 2.A2.

[14] The equivalized household income is calculated by dividing household income by the equivalized household size, which itself is defined by assigning the first household member a weight of 1, any other adult household member a weight of 0.5, and any child under the age of 16 a value of 0.3. In order to avoid the problem of reverse causality, we control for household income in the previous year instead of household income in the current year.

individuals.[15]

As outlined in Section 2.3.1, it is important to discriminate between 'permanent' and 'transitory' factors leading to the husband's unemployment. A standard way to accomplish this goal is to control for the husband's (and the wife's) labor market experience. Although the EU-SILC data contains information on the individual's years in employment, in some countries this information is not surveyed for all household members, but only answered by one person, the 'selected respondent'. This is true in all Scandinavian countries, as well as Ireland, the Netherlands, and Slovenia. As a result, the EU-SILC data does not allow to control for both partners' labor market history, and even if only the husband's years of employment is included, the number of observations for the above named countries is significantly reduced. We therefore decided to exclude this variable from our basic regression, but conduct a sensitivity analysis in which the husband's labor market experience, as measured by his share of years in employment in all years since entering the labor market, is additionally controlled for. In these regressions, we further control for the husband's previous job type, i.e., whether the job was permanent or temporary, information on which is also only available for selected respondents.[16]

In addition to analyzing the existence and the magnitude of the added worker effect in general, we aim at investigating its variation with the countries' economic conditions. In contrast to previous literature, we do not only compare its magnitude in times of economic up- and downswings, but apply a more flexible approach in interacting the added worker dummy with time-variant macroeconomic indicators, namely the country's GDP growth rate, its unemployment rate, and its female labor force participation rate. Both GDP growth and unemployment rates capture the country's state of the economy at present and are as such strongly correlated. Nevertheless, it is plausible to consider both factors in a single regression. While the GDP growth rate proxies the country's economic situation in general, the unemployment rate explicitly captures the current situation of the labor market. As the Great Recession has shown, not every downturn of the economy (directly) translates to increasing unemployment rates. If the economy struggles, firms may have other ways to cut costs, such as cutting back on investments or resorting to short-time work.[17] It is therefore important to distinguish between the current situation of the economy in general and the conditions of the labor market in particular, and to separately analyze their impact on the existence and the magnitude of the added worker effect.

[15]Individuals working for the armed forces (ISCO 10) are excluded from the analysis.

[16]Please note that we adjusted the weights delivered with the data to account for the new data structure, so that the remaining observations are still representative for the whole population.

[17]In fact, it is argued that short-term work has strongly contributed to the surprisingly mild response of the German labor market to the 2008-09 economic crisis, which has hardly translated in decreasing employment rates (Burda and Hunt, 2011).

As outlined above, we additionally estimate our model separately for specific subsamples of countries to test whether the added worker effect differs across the welfare regimes in Europe. The subsamples are chosen according to a modified Esping-Andersen welfare regime typology (Esping-Andersen, 1990), which was suggested by Bonoli (1997). Bonoli's typology is based on a two-dimensional approach that classifies countries according to the 'quantity' and the 'quality' of welfare provision.[18]

According to Bonoli's classification, we distinguish between four types of welfare states: (i) high quantity/high quality countries, i.e., Denmark, Finland, Norway and Sweden (referred to as Scandinavian countries), (ii) high quantity/low quality countries, i.e., Austria, Belgium, Germany, France, Luxembourg, and the Netherlands (referred to as Continental countries), (iii) low quantity/high quality countries, i.e., Ireland and the United Kingdom (referred to as Anglo-Saxon countries), and (iv) low quantity/low quality countries, i.e., Greece, Italy, Portugal, and Spain (referred to as Mediterranean countries). Since the countries of Central and Eastern Europe are not covered by Bonoli's typology, we add a fifth category that includes these countries, i.e., Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.[19]

2.4 Results

2.4.1 Basic Results for the Pooled Sample

The results of the estimation of our basic model (Equation (2.1)) are shown in Table 2.1. With respect to our control variables, the results are overall as expected from economic theory. Married women and women with a higher number of children are less likely to increase their labor supply, irrespective of which labor market transition is considered. Women whose youngest child is younger than three years are less likely to enter the labor market, to start searching for a job and to increase their working hours. Women whose youngest child enters preschool age (4 to 6 years), on the other hand, are more likely to enter the labor market, while the presence of preschool children does not affect women's job-search and part-time to full-time transitions.

The household's disposable income has a diverse effect on women's labor supply: While household income is positively correlated with women's employment transitions, it is negatively correlated with their unemployment and job-search transitions. This result is

[18] 'Quantity' and 'quality' of welfare provisions are measured by social expenditure as a proportion of GDP and by contribution-financing as a proportion of social expenditure, respectively.

[19] In its original version, Austria has also not been covered by Bonoli's classification. We decided to categorize this country to the Continental countries, according to both its values on the above named indicators and its geographical position.

likely to be driven by unobserved heterogeneity, in a sense that there exist unobserved characteristics, such as the couples' preferences for leisure or their productivity in the labor market and in household production, that are correlated with both household income and wife's attachment to the labor market. A similar diverse effect is also found for the dwelling type the couple inhabits. In households that live in an apartment/flat, wives' are less likely to enter employment but more likely to become unemployed and to start looking for a job than couples living in a detached house. In households that have to repay non-housing related debts, women are significantly more likely to enter the labor market or to start searching for a job, while the repayment of debts is uncorrelated with wives' changes from part-time to full-time work. This result is in line with the theoretical argument that labor supply adjustments are more common among households that are financially constrained.

Women's probability of entering the labor market is further decreasing with their age and increasing with their level of education. Moreover, women working in low-skilled blue collar or white collar jobs are less likely, and women working in high-skilled blue collar positions are more likely to change from part-time to full-time employment than high-skilled white collar workers. This result might be explained by the fact that as compared to high-skilled jobs, low-skilled jobs offer less flexibility in terms of enabling women to increase their working hours in the short term. The age and the education of their husband are only correlated with women's transitions into employment, while they are uncorrelated with their unemployment or job-search transitions. Overall, women tend to make fewer labor market transitions the higher their husband's occupational status, suggesting that women are more likely to stay out of the labor market the higher their husband's earnings potential.

The country's GDP growth rate has a diverse effect on women's labor supply transitions. As the economy grows, women are more likely to become employed and change from part-time to full-time employment, while their unemployment and job-search transitions are uncorrelated with the GDP growth rate. With increasing unemployment rates, women are more likely to enter the labor market and to start searching for a job. The latter result contradicts the hypothesis of the 'discouraged worker effect', which states that individuals who would otherwise have been looking for work tend to remain out of the labor market as the unemployment rate increases and their chances of getting a job fall. Overall, these results suggest that the country's economic conditions, as measured by its GDP growth and its unemployment rate, do not affect the individual decision to participate in the labor market itself, but rather the success in finding a job and entering in employment given that the labor supply decision has already been made. The country's female labor force participation rate, in contrast, is negatively correlated with all transition probabilities

considered except for the part-time to full-time transitions, i.e., the more women already participate in the labor market the less women enter into it.

Our result of main interest is the estimated effect of the added worker dummy, which indicates whether the husband became unemployed between $t-1$ and t. In order to compare the magnitude of women's behavioral response across our different outcomes, we do not only present the estimated marginal effect of the added worker dummy, but further calculate the percentage change in women's probability of adjusting their labor supply due to their husbands' unemployment.[20]

The results suggest that women whose husbands lost their job at any time during the last 12 months have a 2.6 percentage point (14 percent) higher probability of entering the labor market than those with a continuously employed husband. However, this effect is only driven by wives' changes into unemployment. Women with an unemployed husband are 2.9 percentage points more likely to enter unemployment and 4.6 percentage points more likely to start searching for a job, which corresponds to relative changes in transition probabilities of 69 and 68 percent. Women's probability of becoming employed, however, is not significantly affected by the husband's employment status. This result is consistent with the findings of Lundberg (1985), who shows that married women in the US are more likely to enter the labor market when their husband is unemployed, but even less likely to become employed. This suggests that husband's unemployment indeed affects the wife's willingness to work in the labor market. However, as stressed by Maloney (1991), some wives may have the will to enter the labor market, but may not be able to find a job in the short term and this way offset the associated loss in household income.

We further find a strong behavioral response at the intensive margin of women's labor supply. Women whose husband became unemployed have a 6.3 percentage points (32 percent) higher probability of changing from part-time to full-time employment than women with a continuously employed husband. That we find no evidence for an added worker effect in terms of women's employment transitions, but a strong effect in terms of their part-time to full-time transitions may be explained by the fact that part-time work provides greater scope for labor supply adjustments, as it is harder for women to increase their labor market activities by entering the labor market than it is by increasing working hours when already working. This result is consistent with the finding of Gong (2011), who finds evidence for the existence of an added worker effect for married women in Australia, but also shows that this effect is mainly driven by part-time to full-time transitions of already participating wives.

Overall, the results for our pooled sample covering all European countries reveal the

[20]The respective values are calculated by deriving predictions for Y at both categories of the added worker dummy (i.e., $\hat{Y}_{AWD=0}$ and $\hat{Y}_{AWD=1}$), such that $\Delta\% = (\hat{Y}_{AWD=1} - \hat{Y}_{AWD=0})/\hat{Y}_{AWD=0}$.

existence of an added worker effect at both the extensive and the intensive margin of wives' labor supply. A remaining concern of our analysis, however, is the problem of unobserved heterogeneity. In particular, there is a doubt whether the husband's job loss is exogenous to wife's labor supply. First, the husband's unemployment might not be transitory, but rather of a more permanent nature and therefore be anticipated by the household. Such anticipated unemployment would not induce an added worker effect, because it would already have translated into household adjustments in either consumption or labor supply. Furthermore, as pointed out by Maloney (1991), the permanent nature of the husband's unemployment might be correlated with the characteristics of the wife. Given assortative matching in the marriage market, wives of frequently unemployed husbands are likely to face low market wage rates themselves and thus to show similarly low labor supply patterns as their husbands.

One way to overcome these problems is to search for exogenous variation in husband's unemployment, e.g., by focusing on unemployment caused by plant closures, which are assumed to be exogenous to the characteristics of the husband and the household, respectively. While this is not possible in our study, we control for the permanent nature of the husband's unemployment by proxying for his unemployment probability. Specifically, we add controls for the husband's labor market experience, as measured by his share of years in employment, and his previous job type, i.e., whether the job was permanent or temporary. The respective estimation results are shown in Table 2.A5. The results reveal that the more stable the husband's employment, as measured by his share of years in employment, the less likely his wife enters the labor market and changes from part-time to full-time employment. Moreover, wives of husbands who had a temporary job in the previous year are significantly more likely to enter employment or increase their working hours than those whose husbands had a permanent position. The estimated marginal effects of the added worker dummy, however, remain significant and only slightly decrease in magnitude, suggesting that unobserved factors that are correlated with the husband's unemployment probability do not impose a major problem for our analysis.[21]

Second, the husband's unemployment might not be involuntary, but voluntarily chosen by the husband. In his decision to quit his job, the husband might therefore have already taken his wife's labor supply decision into account. In this case, we would overestimate the true added worker effect due to reverse causality and joint decision-making within the household, respectively. On the other hand, one might argue that voluntary job losses are long known by the household, such that the observed added worker effect is

[21] In order to assess whether the added worker effect is robust to the inclusion of the additional control variables, we also estimated the basic specification reported in Table 2.1 for the reduced sample as considered in Table 2.A5. The results are robust toward the exclusion of these observations and shown in Table 2.B2.

an underestimate of the true effect, since some women might already have adjusted their labor supply to the husband's expected job loss. Although the data do not allow us to distinguish between voluntary and involuntary job losses, we try to test whether reverse causality caused by voluntary job losses imposes a problem for our analysis. We do so by assuming that voluntary job losses should, on average, last shorter than involuntary job losses, because those quitting their jobs have more time to search for a job or might already have found a new job before giving notice. If we therefore condition on at least three instead of one month of husband's unemployment in defining our added worker variable, thereby reducing the share of voluntary job losses, we would expect the estimated added worker effect to decrease if reversed causality is indeed a problem in our analysis. In fact, we find the opposite: When defining husband's unemployment as the husband having had at least three months of unemployment within the last year, the estimated added worker effect increases for all outcomes (see Table 2.A6), suggesting that reverse causality is of minor relevance in our analysis.

Lastly, it is important to note that although we cannot rule out that unobserved heterogeneity might lead us to under- or overestimate the true added worker effect in general, there is no reason to believe that this sort of unobserved heterogeneity varies over the business cycle or differently affects the estimation results in the respective country groups. Hence, our analysis of the variation of the added worker effect – both over time and across countries – which is the main focus of this paper, should not be affected by unobserved heterogeneity.

2.4.2 Variation over the Business Cycle

There are many arguments why the added worker effect may depend on the economic context. Previous literature has concentrated on comparing the added worker effect in times of economic up- and downturns, arguing that wives' responsiveness to their husband's job loss should be higher during recessions due to both the reduced ability to borrow against income losses and the more permanent nature of unemployment shocks during recessions. However, it is also possible that the added worker effect decreases during times of economic downturn. Whenever unemployment rates are high, the chance of getting a job and thus the expected wage of those without jobs fall. People who would otherwise have been looking for work might therefore become discouraged in a recession and tend to remain out of the labor market.[22] According to this, we would expect the labor supply response of wives to their husband's job loss to be smaller if unemployment is high. Moreover, there is more than the country's economic situation in general that might

[22]The reduction of the labor force associated with discouraged workers in a recession is called the 'discouraged worker effect', and is as such a force working against the added worker effect.

affect the presence of the added worker effect. If the share of women already participating in the labor market is high, the potential of inactive wives to newly enter the labor market is low, suggesting that the size of the added worker effect in its traditional sense should be small whenever female labor force participation rates are high.

To see whether the magnitude of the added worker effect varies with the countries' macroeconomic conditions, interactions of the added worker dummy and (i) the GDP growth rate, (ii) the unemployment rate, and (iii) the female labor force participation rate are further added to the model.[23] The marginal effects of the added worker dummy at each point of the countries' GDP growth rate are shown in Figure 2.1. Overall, we find hardly any variation in the added worker effect over the country's GDP growth rate. If anything, women's probability of starting to search for a job slightly decreases and their probability of changing from part-time to full-time employment slightly increases as the economy grows. Although the latter result contradicts previous literature, which finds the added worker effect to be more present in times of economic downturns, the finding is quite intuitive. As the economy shrinks, firms might first cut down the working hours of those already employed, before having to rely on personnel layoffs to reduce their overall costs. As the economy recovers and GDP grows, women might therefore find it easyier to increase their working hours and this way expand their labor supply.

For the interactions of the added worker dummy with the country's unemployment rate (Figure 2.2), however, a different pattern emerges: As the unemployment rate rises, women become more likely to increase their labor supply as a reaction to their husband's unemployment. Except for women's part-time to full-time transitions, which do hardly vary over the unemployment rate, this finding holds for all labor supply responses considered, but is most pronounced for women's unemployment and job-search transitions. While these results contradict the 'discouraged worker hypothesis', they are consistent with the findings of Parker and Skoufias (2004), Mattingly and Smith (2010), and Bryan and Longhi (2018), who find that the added worker effect is more present in periods of economic downturns. Bryan and Longhi (2018), in particular, show that women in the UK substantially increased their job-search activity following a partner's job loss during the 2008-2011 recession, while the increase in search during boom was smaller and did not appear to translate into more success in finding work. These findings support the hypothesis that in times of high unemployment, husband's job losses are less likely to be transitory and therefore more likely to result in a behavioral response of the wife.

[23] In doing so, we do not include a quadruple interaction, but estimate the model separately for each set of interactions. While the results shown in Table 2.1 include the interactions of the added worker dummy with the countries' unemployment rate, the marginal effects of all other covariates are similar in both their magnitude and their significance when including an interaction of the added worker dummy with the GDP growth rate or with the female labor force participation rate (see Tables 2.B3 and 2.B4).

The respective interaction effects for the country's female labor force participation rate are shown in Figure 2.3. Overall, the added worker effect appears to decrease with the country's female labor force participation rate, i.e., the more women participate in the labor market, the less likely it is that a wife enters the labor market due to her husband's unemployment. This relationship is particularly pronounced for women's employment transitions and their job-search transitions, while women's part-time to full-time transitions do hardly vary over the distribution of the female labor force participation rate. The result that women's labor supply adjustments at the extensive margin are more strongly related to the country's female labor force participation rate than their adjustments at the intensive margin is quite intuitive, as the ability of women to newly enter the labor market is the lower the higher the share of women already participating in the labor market, while women's ability to increase their working hours should hardly be affected by the female labor force participation rate.

2.4.3 Variation across Country Groups

In the last part of our analysis, we separately estimate our basic regression for specific subsamples of countries to test whether the added worker effect differs across the welfare regimes in Europe. As outlined in Section 4.3, we distinguish between five welfare regimes, namely (i) Scandinavia, (ii) Continental Europe, (iii) the Anglo-Saxon countries, (iv) the Mediterranean countries, and (v) Central and Eastern Europe. The estimated marginal effects of the added worker dummy obtained from these subsample regressions are shown in Table 2.2.[24] The results reveal large differences in both the existence and the magnitude of the added worker effect across Europe.

In Scandinavia and Continental Europe, we only find weak evidence for the existence of an added worker effect. In Scandinavia, non-participating women are more likely to enter the labor market when their husband becomes unemployed, while women's likelihoods of entering employment, unemployment, starting to search for a job, or changing from part-time to full-time employment are not affected by their partners' job loss. This result is consistent with the findings of Hardoy and Schøne (2014), who investigate wives' behavioral responses to their husband's job displacement in Norway. The authors find hardly any added worker effect at the intensive margin, but show that three years after the husband's displacement, previously non-working wives of displaced husbands have labor market earnings that exceed those of wives of non-displaced husbands by approximately 5 percent.

In Continental Europe, in contrast, women of newly unemployed men are more likely

[24]Full estimation results are shown in Tables 2.A7 to 2.A11.

to change from part-time to full-time employment, while we do not find any behavioral response at the extensive margin of women's labor supply in these countries. The difference in the type of behavioral response between the two country groups might be explained by differences in the structure of the workforce. While both the Scandinavian and the Continental European countries are characterized by comparatively high female labor force participation rates, the share of part-time employment in all employment is particularly high in the Continental European countries and as such, part-time work may provide a greater scope for labor supply adjustments in these countries.[25] Moreover, many of the Continental European countries (i.e., Germany, France, Luxembourg and, partially, Belgium) are characterized by tax systems of income splitting, which might create disincentives for women to enter the labor market.[26] If the difference between the husband's and the wife's (potential) earnings is high and the unemployment duration of the husband expected to be low, then the couple might not be better off if the wife enters the labor market, as her gained earnings might be completely offset by the reduced amount of tax savings.

In general, the limited responsiveness of wives to their husband's job loss in the Scandinavian and the Continental European countries might be explained by the fact that these countries are characterized by guaranteeing a high level of social protection. Among the European countries, the Scandinavian and the Continental countries rank highest with respect to both the length and the amount of unemployment benefits, and it might be the generosity of the welfare state that partly crowds out the family as an insurance device.[27] The hypothesis that the state plays an important role in smoothing out income fluctuations caused by external shocks is also supported by Hardoy and Schøne (2014), who show that the initial negative wage effect of husband's displacement is reduced by approximately 65 percent after adjusting for welfare benefits and lower tax payments. This suggests that in a generous welfare state, households are well insured against negative shocks in the labor market.

In the Anglo-Saxon countries, we also find hardly any evidence for the existence of an added worker effect. Indeed, we even find a negative added worker effect. Women

[25]The share of part-time employed women is particularly high in the Netherlands (76.7%), followed by Germany (46.3%), Austria (46.3%), and Belgium (41.2%) (2014 values, Eurostat, 2015).

[26]Income splitting is the legal concept of fusing a married couple into a single economic entity for purposes of tax filing status. In a jurisdiction with progressive taxation and different tax filing statuses for married and for single filers, income splitting penalizes dual earners and benefits single breadwinning couples.

[27]Over the time period considered, the maximum unemployment benefit duration is on average 32.4 months in the Continental countries and 28.5 months in the Scandinavian countries and thus much higher than in the Mediterranean (17.3) or the Central and Eastern European countries (9.0) (OECD, 2016a). Accordingly, the average net replacement rate in the Continental and the Scandinavian countries amounts to 46.7 and 48.8 percent, respectively, as compared to 34.2 percent in the Mediterranean countries, 29.4 percent in the Anglo-Saxon countries and 22.4 percent in Central and Eastern Europe (OECD, 2016b).

in these countries are significantly less likely to become employed when their husband becomes unemployed. While this result might be driven by unobserved heterogeneity, in a sense that spouses with low labor market prospects or similar preferences for leisure select together, it might also reflect the incentives set by the social security system in these countries. The UK and Ireland are the only countries within Europe that are characterized by a means-tested unemployment benefit system.[28] The fact that unemployment benefits are means-tested against family income may discourage women from entering the labor market to offset the loss of household income or even encourage working women to leave the labor market. This is consistent with the findings of Kell and Wright (1990), who find large negative effects of means-testing on the labor force participation of wives married to unemployed husbands in the UK. In their cross-country comparison of the labor force participation of married women in the UK, Ireland, the US, Sweden, and Denmark, Dex et al. (1995) come to a similar conclusion. They find that in unemployment benefit regimes that take a wife's earnings into account in allocating benefit, there is a significant negative effect on those wives' labor force participation.

In contrast, we find a strong and significant added worker effect for the Mediterranean countries. In the Mediterranean countries, women whose husbands became unemployed within the last 12 months are significantly more likely to become employed (10-percent level), to enter unemployment, to start searching for a job, and to change from part-time to full-time employment than women with a continuously employed husband. In fact, the Mediterranean countries are the only countries in which an added worker effect at both the extensive and the intensive margin of women's labor supply is observed. Moreover, the effects are quite large, ranging from a 42 percent increase in women's probability of entering full-time employment to an 82 percent increase in their job-search probability.

The finding of a strong relationship between husband's and wife's labor supply in the Southern European countries supports previous literature on this topic (e.g., Prieto-Rodriguez and Rodriguez-Gutierrez, 2000). The Mediterranean welfare states are characterized by offering a low level of social protection and by a strong reliance on the family. In his analysis of family ties across societies, Reher (1998) shows a 'dividing line' between southern European societies, with their history of depending on strong and extended families to care for the elderly and the poor, versus northern European and North American societies, with their weaker family systems and greater reliance on public and private organizations to provide social assistance. The strong added worker effect in the Mediterranean countries might therefore be explained by low social protection and a

[28] In fact, the unemployment benefit system in Ireland is characterized by a combination of earnings-related unemployment benefits and means-tested unemployment allowances. However, individuals who are only entitled to a reduced rate of unemployment benefits may be better off on unemployment allowance, which means that low-income households are more likely to be subject to means-testing.

strong reliance on the family in these countries.

In the countries belonging to Central and Eastern Europe, we also find some evidence for the existence of an added worker effect. In contrast to the Scandinavian and the Continental European countries, however, women's responsiveness to their husband's job loss is only reflected in their increased likelihood of entering unemployment and starting to search for a job. Women's probabilities of entering employment or changing from part-time to full-time employment, on the other hand, are not affected by husband's unemployment. This suggests that women in Central and Eastern Europe are willing to increase their labor supply due to their husband's job loss, but may be limited from the demand side of the labor market, in a sense that they are not able to find a job or increase their working hours in the short term in order to offset the associated loss in household income.

Though we cannot claim that the estimated added worker effects as shown in Table 2.2 represent causal effects, we argue that the difference in the size and the direction of the added worker effect between the country groups is solely due to differences in the countries' institutional and macroeconomic conditions and can thus be interpreted accordingly. While assortative mating or reverse causality might lead us to over- or underestimate the added worker effect in general, there is no reason to believe that this sort of unobserved heterogeneity affects the country groups differently and is thus able to explain the difference in the added worker effect across welfare regimes.

A last concern, though, is that our results are driven by transitory shocks to the household, which affect the employment probability of husbands and wives alike. As outlined by Maloney (1991), a closure of a local plant, for instance, might directly result in the layoff of the husband, and indirectly lower the market wage rate or employment opportunities of the wife, thereby masking the existence of her behavioral response. In contrast to unobserved heterogeneity in general, such local transitory shocks are likely to vary over the country groups and are thus able to explain the observed difference in the added worker effect across welfare regimes.

In order to rule out that local (unemployment) shocks are the main driver of our results, we conduct two robustness checks. First, we re-estimate our country-group regressions by adding country-time fixed effects instead of single country and time fixed effects to our model in order to allow for country-specific shocks to the labor market. The respective estimation results are shown in Table 2.A12. Overall, the estimated added worker effects remain stable in both significance and magnitude, suggesting that the difference in wives' behavioral responses across countries is not simply a result of country-specific unemployment shocks.

Although country-time fixed effects sop up all of the variance in women's labor market transitions that is due to time-variant differences between the countries, they might not

fully capture shocks to the households' local labor market. In a second step, we therefore add region-time instead of country-time fixed effects to our regressions. Information on the households' place of residence within their country is available on the NUTS-2 or NUTS-1 level, which subdivide countries into smaller administrative units in the size of regions or provinces.[29] As can be seen from Table 2.A13, adding region-time fixed effects does not alter our results substantially. In fact, the estimated added worker effects remain stable in both significance and magnitude.[30] These results make us confident that the cross-country variation in the added worker effect documented in this paper is not only an artifact of region-specific transitory shocks to the households, but indeed reflects differences in the macroeconomic and institutional conditions between the welfare regimes.

2.5 Conclusion

In this paper, we analyze the responsiveness of women's labor supply to their husband's loss of employment – the so-called added worker effect. While previous empirical literature on this topic mainly concentrates on a single country, we take an explicit internationally comparative perspective and analyze whether the added worker effect varies across the countries in Europe. In doing so, we follow the argumentation of Bentolila and Ichino (2008), who point out that the role of family support should be stronger whenever the welfare state fails to mitigate the consequences of unemployment.

In our analysis, we use longitudinal data from the European Union Statistics on Income and Living Conditions (EU-SILC) covering the period 2004 to 2011. As we observe households over the time of the Great Recession, we are further able to investigate the role of the added worker effect in Europe's economic crisis by analyzing its variation with the countries' economic conditions. Lastly, we contribute to the literature by considering a variety of behavioral responses of wives to their husband's unemployment, covering reactions at both the extensive and the intensive margin of labor supply, which is of particular interest and importance in any international comparative framework.

For our pooled sample consisting of 28 European countries, we find evidence for the existence of an added worker effect. Women whose husbands become unemployed show a

[29] While there exist some minimum and maximum population thresholds for the average size of the NUTS regions, the actual size of the regions might vary both across and within countries. Overall, we have 176 regions within Europe.

[30] An exception is the former negative added worker effect for women's transitions from inactivity to employment in the Anglo-Saxon countries, which becomes insignificant in Table 2.A13. However, this is not the result of the inclusion of region-time fixed effects, but of the reduced sample size. By adding region-time fixed effects to the model, we lose some observations due to a lack of variation in women's labor force transitions within specific regions at a given point of time. For the resulting smaller sample we therefore re-estimated our model without region-time fixed effects in order to allow for a straightforward comparison of estimation results (see Table 2.B5).

significantly higher probability of entering the labor market than women whose husbands remain employed. However, this effect is mainly driven by wives' changes from inactivity to unemployment and increases in their job-search efforts, whereas wives' probability of becoming employed seems to be independent of the husbands' job loss. However, we find that wives are more likely to increase their working hours in reaction to their husbands' unemployment. These results suggest that in Europe, marriage (or cohabitation) still functions as an intra-household risk-sharing mechanism to smooth inter-temporal income shocks (Attanasio et al., 2005; Ortigueira and Siassi, 2013).

Our results further reveal that the magnitude of the added worker effect varies with the countries' economic conditions. While wives' likelihood of increasing their labor supply as a response to their husband's job loss increases with the country's unemployment rate, their responsiveness hardly varies with the country's GDP growth rate. This suggests that it is rather the current conditions of the labor market than the country's economic situation in general that affects couples' labor supply behavior. In addition, we are able to show that women's probability of entering the labor market in response to their husband's unemployment decreases with the country's female labor force participation rate. As female labor force participation rates have increased remarkably over the last decades in most developed countries, this result might provide one explanation why more recent studies find hardly any evidence for the existence of an added worker effect in its traditional sense (see, e.g., Gong, 2011; Prieto-Rodriguez and Rodriguez-Gutierrez, 2003).

Furthermore, we show that the existence and the magnitude of the added worker effect largely varies over the different welfare regimes within Europe. Overall, the added worker effect is strongest among couples living in the Mediterranean countries, while it is less present in the Continental European and the Scandinavian countries. Although we are the first to provide comprehensive evidence on the added worker effect across Europe, our results are in accordance with previous literature, which tends to find no or small added worker effects in high-welfare countries, such as Norway (Hardoy and Schøne, 2014), but stronger effects for low-welfare countries, such as Italy (Prieto-Rodriguez and Rodriguez-Gutierrez, 2003), Spain (Prieto-Rodriguez and Rodriguez-Gutierrez, 2000), and the US (Stephens, 2002). Hence, our results support the view that the role of the family as an insurance device against unemployment might be crowded out by the generosity of the welfare state. In addition, our finding of a 'negative' added worker effect in the Anglo-Saxon countries, which are the only European countries to be characterized by a means-tested unemployment benefit system, lends to the important role of the unemployment insurance system in compensating for income losses caused by involuntary job losses, but at the same time maintaining incentives for intra-household labor supply adjustments.

Lastly, we find large differences in the type of behavioral response to husbands' job loss

across countries. While women in the Scandinavian countries are more likely to increase their labor supply at the extensive margin, women in Continental Europe are more likely to do so at the intensive margin. Furthermore, we find that women in the Central and Eastern European countries are highly limited from the demand side of the labor market, in that they respond to their husband's unemployment in terms of increased job-search activity, but that these attempts do not translate into more success in finding work. These results stress the importance of considering different behavioral responses of wives to their husband's job loss, including measures of both the extensive and the intensive margin of labor supply, in providing a meaningful comparison of the added worker effect across countries.

Tables

Table 2.1: Probit Estimations: Pooled Regressions

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	Δ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0313^{\dagger}$	-0.0125^{***}	-0.0207^{***}	$-0.0202^{\dagger}$	$-0.0278^{\dagger}$
	(0.0075)	(0.0043)	(0.0065)	(0.0057)	(0.0066)
No. of children	$-0.0235^{\dagger}$	$-0.0071^{\dagger}$	$-0.0164^{\dagger}$	$-0.0089^{\dagger}$	$-0.0192^{\dagger}$
	(0.0027)	(0.0014)	(0.0025)	(0.0018)	(0.0030)
Child age 0 to 3	-0.0146^{**}	-0.0056	-0.0094	$-0.0242^{\dagger}$	-0.0174^{**}
	(0.0071)	(0.0035)	(0.0065)	(0.0043)	(0.0076)
Child age 4 to 6	$0.0371^{\dagger}$	0.0102^{***}	$0.0266^{\dagger}$	0.0044	-0.0100
	(0.0072)	(0.0035)	(0.0064)	(0.0045)	(0.0067)
Log. equiv. disposable income (in thsd.)	0.0111^{***}	-0.0053^{***}	$0.0172^{\dagger}$	-0.0069^{***}	0.0010
	(0.0038)	(0.0019)	(0.0035)	(0.0024)	(0.0048)
Repayment of debts	$0.0309^{\dagger}$	$0.0092^{\dagger}$	$0.0209^{\dagger}$	$0.0197^{\dagger}$	0.0066
	(0.0045)	(0.0024)	(0.0040)	(0.0033)	(0.0047)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0103^{*}	0.0016	-0.0104^{*}	0.0050	0.0041
	(0.0059)	(0.0029)	(0.0054)	(0.0041)	(0.0057)
Apartment or flat	-0.0092^{*}	0.0064^{***}	$-0.0155^{\dagger}$	$0.0127^{\dagger}$	0.0143^{**}
	(0.0049)	(0.0024)	(0.0045)	(0.0033)	(0.0063)
Wife's characteristics					
Age	$-0.0043^{\dagger}$	$-0.0012^{\dagger}$	$-0.0031^{\dagger}$	$-0.0032^{\dagger}$	-0.0004
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0357^{\dagger}$	-0.0054^{**}	$-0.0307^{\dagger}$	-0.0087^{***}	-0.0010
	(0.0048)	(0.0027)	(0.0041)	(0.0033)	(0.0060)
High skilled	$0.0795^{\dagger}$	0.0026	$0.0732^{\dagger}$	$0.0263^{\dagger}$	$0.0258^{\dagger}$
	(0.0075)	(0.0034)	(0.0068)	(0.0057)	(0.0061)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0411^{\dagger}$
	–	–	–	–	(0.0058)
Blue collar high	–	–	–	–	$0.0542^{\dagger}$
	–	–	–	–	(0.0114)
Blue collar low	–	–	–	–	$-0.0357^{\dagger}$
	–	–	–	–	(0.0076)
Husband's characteristics					
Age	$-0.0029^{\dagger}$	-0.0005^{*}	$-0.0023^{\dagger}$	-0.0003	$-0.0046^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0167^{***}	-0.0036	-0.0143^{***}	-0.0038	-0.0082
	(0.0053)	(0.0027)	(0.0047)	(0.0036)	(0.0061)
High skilled	-0.0141^{**}	0.0009	-0.0145^{***}	-0.0061	-0.0002
	(0.0063)	(0.0034)	(0.0055)	(0.0045)	(0.0059)
Occupation (ref.: white collar high)					
White collar low	0.0011	0.0037	-0.0013	0.0080^{*}	$0.0268^{\dagger}$
	(0.0070)	(0.0035)	(0.0063)	(0.0048)	(0.0071)
Blue collar high	0.0100^{*}	0.0051^{*}	0.0063	0.0089^{**}	-0.0203^{***}
	(0.0060)	(0.0031)	(0.0054)	(0.0040)	(0.0063)
Blue collar low	0.0006	0.0048	-0.0029	0.0119^{***}	0.0124^{*}
	(0.0063)	(0.0031)	(0.0057)	(0.0042)	(0.0074)
Country characteristics					
GDP growth rate	0.0029^{***}	-0.0001	0.0025^{***}	-0.0001	$0.0049^{\dagger}$
	(0.0011)	(0.0006)	(0.0010)	(0.0008)	(0.0013)
Unemployment rate	0.0030^{**}	0.0004	-0.0012	0.0018^{*}	-0.0003
	(0.0014)	(0.0007)	(0.0012)	(0.0009)	(0.0016)
Female LFP rate	$-0.0099^{\dagger}$	$-0.0072^{\dagger}$	-0.0052^{**}	-0.0057^{***}	-0.0038
	(0.0025)	(0.0013)	(0.0022)	(0.0018)	(0.0027)
Added worker dummy	0.0258^{***}	$0.0286^{\dagger}$	-0.0064	$0.0459^{\dagger}$	$0.0627^{\dagger}$
	(0.0093)	(0.0051)	(0.0082)	(0.0071)	(0.0148)
Δ% due to AWE	13.96%	69.01%	–	67.69%	32.18%
Pseudo-R^2	0.1017	0.0984	0.1118	0.0889	0.0952
Observations	87,416	87,416	87,416	76,133	73,891

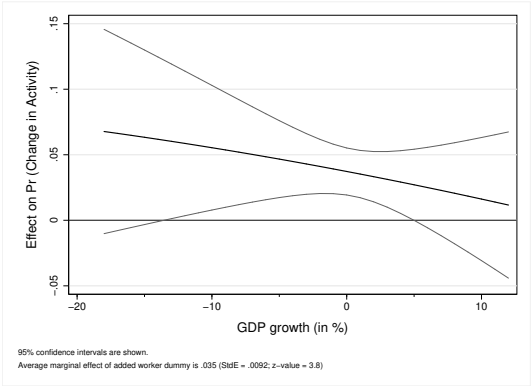
Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Δ% refers to the percentage change in women's probability of adjusting their labor supply due to their husband's unemployment. Percentage changes are shown for significant added worker effects (5% level) only. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.2: Probit Estimations: Added Worker Effect by Country Group

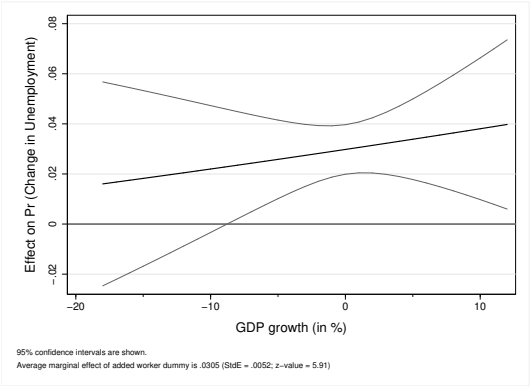
	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$	Δ **JS**	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$
			Scandinavia		
ME	0.0944**	0.0297	0.0622	−0.0071	0.0232
StdE	(0.0454)	(0.0182)	(0.0461)	(0.0261)	(0.0386)
Δ%	27.28%	–	–	–	–
Observations	7,339	7,339	7,339	4,641	11,228
			Continental Europe		
ME	−0.0210	0.0031	−0.0265	0.0136	0.0579***
StdE	(0.0215)	(0.0067)	(0.0209)	(0.0133)	(0.0189)
Δ%	–	–	–	–	62.86%
Observations	21,099	21,099	21,099	17,355	36,482
			Anglo-Saxon Countries		
ME	−0.0616	0.0207	−0.0896**	0.0244	0.0694
StdE	(0.0429)	(0.0178)	(0.0384)	(0.0290)	(0.0444)
Δ%	–	–	-39.37%	–	–
Observations	4,005	4,005	4,005	3,180	5,867
			Mediterranean Countries		
ME	0.0602†	0.0419†	0.0170*	0.0616†	0.1078†
StdE	(0.0122)	(0.0087)	(0.0096)	(0.0108)	(0.0295)
Δ%	43.08%	72.26%	–	81.51%	42.06%
Observations	29,232	29,232	29,232	27,028	11,920
			Central and Eastern Europe		
ME	0.0310**	0.0280***	0.0028	0.0567†	−0.0345
StdE	(0.0143)	(0.0085)	(0.0128)	(0.0132)	(0.0357)
Δ%	16.92%	59.85%	–	91.55%	–
Observations	25,745	25,745	25,745	23,929	8,394

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Δ% refers to the percentage change in women's probability of adjusting their labor supply due to their husband's unemployment. Percentage changes are shown for significant added worker effects (5% level) only. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. Full estimation results are shown in Tables 2.A7 to 2.A11. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

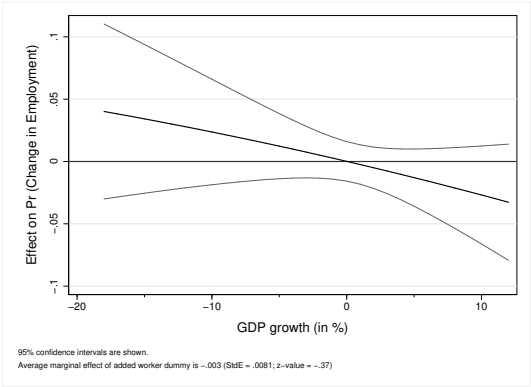
Figures



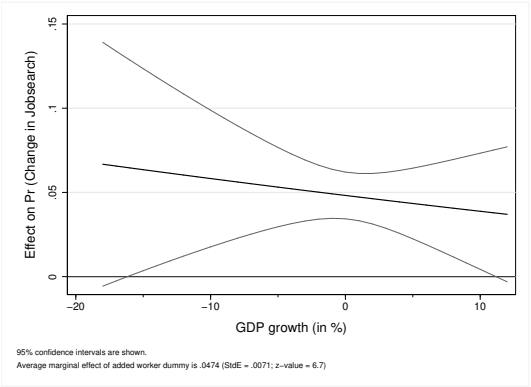
(a) Inactivity → Activity



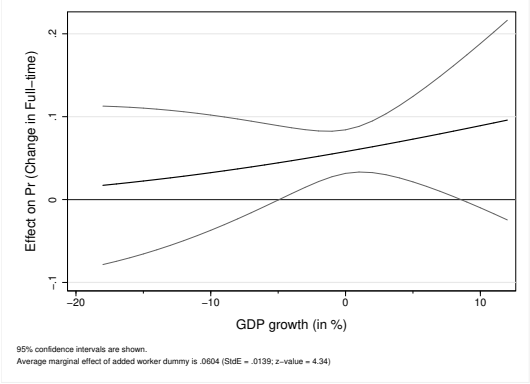
(b) Inactivity → Unemployment



(c) Inactivity → Employment



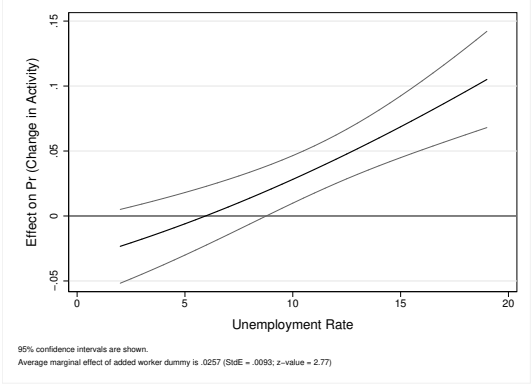
(d) Δ Jobsearch



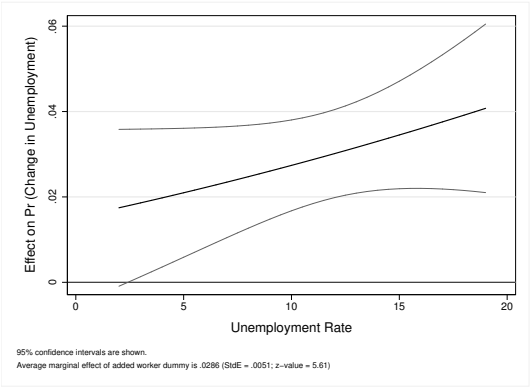
(e) Part-time → Full-time

Figure 2.1: Marginal Effects of Interactions between the Added Worker Dummy and the GDP Growth Rate

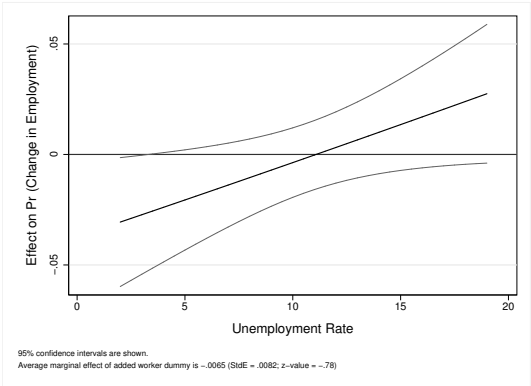
Source: EU-SILC; own calculations. Note: The figure shows the average marginal effects of the added worker dummy including the interaction effects with the GDP growth rate.



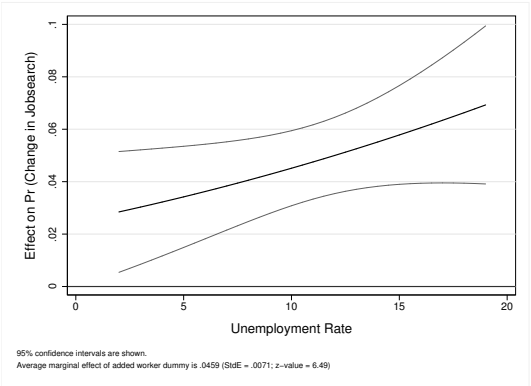
(a) Inactivity → Activity



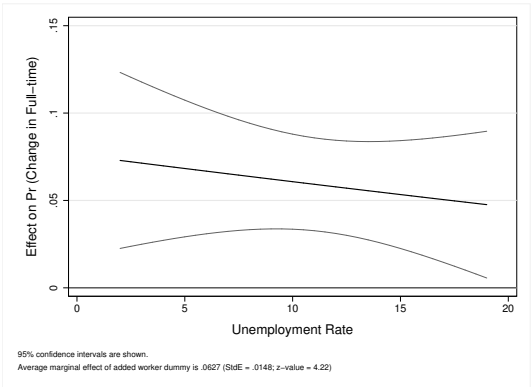
(b) Inactivity → Unemployment



(c) Inactivity → Employment



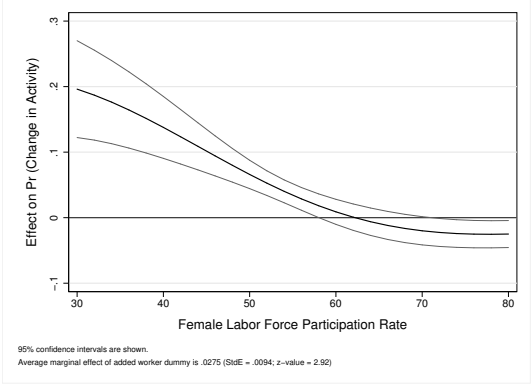
(d) Δ Jobsearch



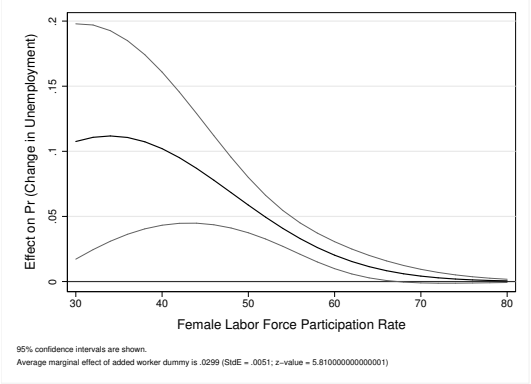
(e) Part-time → Full-time

Figure 2.2: Marginal Effects of Interactions between the Added Worker Dummy and the Unemployment Rate

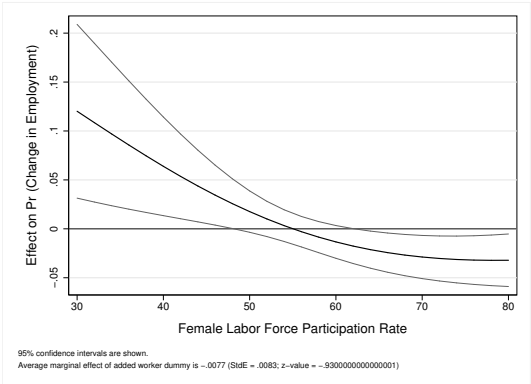
Source: EU-SILC; own calculations. Note: The figure shows the average marginal effects of the added worker dummy including the interaction effects with the unemployment rate.



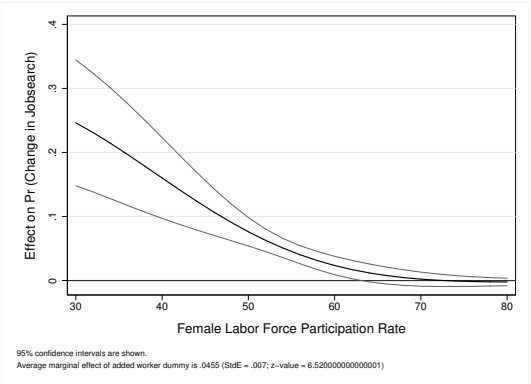
(a) Inactivity → Activity



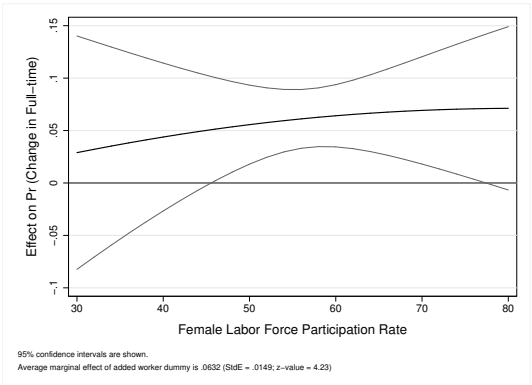
(b) Inactivity → Unemployment



(c) Inactivity → Employment



(d) Δ Jobsearch



(e) Part-time → Full-time

Figure 2.3: Marginal Effects of Interactions between the Added Worker Dummy and the Female Labor Force Participation Rate

Source: EU-SILC; own calculations. Note: The figure shows the average marginal effects of the added worker dummy including the interaction effects with the labor force participation rate.

2.A Appendix

Table 2.A1: Women's Transition Probabilities

Wife's change	**Husband's change**		
	$E_{t-1} \rightarrow E_t$	$E_{t-1} \rightarrow UE_t$	Difference
$\text{IA}_{t-1} \rightarrow \text{A}_t$	0.185	0.216	$0.031^{\dagger}$
	(0.388)	(0.411)	
$\text{IA}_{t-1} \rightarrow \text{UE}_t$	0.041	0.094	$0.053^{\dagger}$
	(0.198)	(0.292)	
$\text{IA}_{t-1} \rightarrow \text{E}_t$	0.144	0.121	$-0.023^{\dagger}$
	(0.351)	(0.327)	
Δ Job search	0.067	0.137	$0.070^{\dagger}$
	(0.250)	(0.344)	
$\text{PT}_{t-1} \rightarrow \text{FT}_t$	0.167	0.277	$0.110^{\dagger}$
	(0.373)	(0.447)	

*Source: EU-SILC, own calculations. Notes: Results present means and standard deviations of the probability of making a labor market transition for women with a husband who stays employed from $t-1$ to t ($E_{t-1} \rightarrow E_t$) and women whose husband becomes unemployed from $t-1$ to t ($E_{t-1} \rightarrow UE_t$). $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inactivity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Table 2.A2: Descriptive Statistics

	(I)		(II)		(III)	
	Mean	StdD	Mean	StdD	Mean	StdD
Household characteristics						
Married	0.843	0.364	0.862	0.345	0.776	0.417
No. of children	1.005	1.094	0.966	1.097	0.955	0.982
Child age 0 to 3	0.161	0.367	0.158	0.365	0.107	0.310
Child age 4 to 6	0.158	0.365	0.143	0.350	0.141	0.348
Equiv. disposable income (in thsd.)	15.038	17.274	14.620	17.225	21.877	17.126
Repayment of debts	0.328	0.469	0.316	0.465	0.405	0.491
Detached house	0.367	0.482	0.366	0.482	0.399	0.490
Semi-detached house	0.260	0.439	0.248	0.432	0.374	0.484
Apartment or flat	0.373	0.484	0.385	0.487	0.228	0.419
Wife's characteristics						
Age	44.265	10.386	44.847	10.392	44.368	8.952
Low skilled	0.374	0.484	0.402	0.490	0.183	0.386
Medium skilled	0.459	0.498	0.455	0.498	0.496	0.500
High skilled	0.168	0.374	0.142	0.349	0.321	0.467
White collar high	–	–	–	–	0.376	0.484
White collar low	–	–	–	–	0.404	0.491
Blue collar high	–	–	–	–	0.065	0.246
Blue collar low	–	–	–	–	0.155	0.362
Husband's characteristics						
Age	46.904	9.901	47.491	9.845	46.025	8.914
Low skilled	0.322	0.467	0.344	0.475	0.184	0.387
Medium skilled	0.462	0.499	0.457	0.498	0.483	0.500
High skilled	0.216	0.411	0.199	0.399	0.333	0.471
White collar high	0.348	0.476	0.331	0.470	0.471	0.499
White collar low	0.127	0.333	0.128	0.334	0.149	0.356
Blue collar high	0.295	0.456	0.303	0.459	0.216	0.412
Blue collar low	0.230	0.421	0.239	0.426	0.164	0.370
Country characteristics						
GDP growth rate	1.005	3.132	0.938	3.160	0.898	2.638
Unemployment rate	9.543	4.063	9.789	4.173	8.405	3.641
Female LFP rate	55.857	7.848	55.153	7.558	60.740	7.532
Added worker dummy	0.051	0.220	0.054	0.226	0.028	0.165
Observations	87,416		76,133		73,891	

Source: EU-SILC, own calculations. Notes: Results present means and standard deviations of the explanatory variables included in the regressions. Column (I) shows the descriptive statistics of the sample used for the analysis of wives' transitions from inactivity to activity, column (II) those for the analysis of wives' changes in job-search behavior, and column (III) those for the analysis of wives' transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. LFP, labor force participation.

Table 2.A3: Probit Estimations: Pooled Regressions Including Country-Time Fixed Effects

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\boldsymbol{\Delta}$ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0324^{\dagger}$	-0.0130^{***}	-0.0212^{***}	$-0.0204^{\dagger}$	$-0.0276^{\dagger}$
	(0.0078)	(0.0043)	(0.0068)	(0.0058)	(0.0068)
No. of children	$-0.0228^{\dagger}$	$-0.0069^{\dagger}$	$-0.0158^{\dagger}$	$-0.0087^{\dagger}$	$-0.0187^{\dagger}$
	(0.0027)	(0.0014)	(0.0025)	(0.0018)	(0.0029)
Child age 0 to 3	-0.0163^{**}	-0.0059^{*}	-0.0110^{*}	$-0.0243^{\dagger}$	-0.0177^{**}
	(0.0071)	(0.0034)	(0.0064)	(0.0043)	(0.0076)
Child age 4 to 6	$0.0360^{\dagger}$	0.0102^{***}	$0.0255^{\dagger}$	0.0041	-0.0102
	(0.0071)	(0.0035)	(0.0064)	(0.0044)	(0.0067)
Log. equiv. disposable income (in thsd.)	0.0130^{***}	-0.0038^{*}	$0.0181^{\dagger}$	-0.0052^{**}	0.0057
	(0.0040)	(0.0019)	(0.0037)	(0.0025)	(0.0050)
Repayment of debts	$0.0294^{\dagger}$	$0.0085^{\dagger}$	$0.0203^{\dagger}$	$0.0189^{\dagger}$	0.0059
	(0.0045)	(0.0024)	(0.0040)	(0.0033)	(0.0047)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0107^{*}	0.0019	-0.0110^{**}	0.0051	0.0047
	(0.0059)	(0.0029)	(0.0054)	(0.0041)	(0.0057)
Apartment or flat	-0.0100^{**}	0.0061^{***}	$-0.0161^{\dagger}$	$0.0127^{\dagger}$	0.0135^{**}
	(0.0049)	(0.0024)	(0.0045)	(0.0033)	(0.0063)
Wife's characteristics					
Age	$-0.0044^{\dagger}$	$-0.0013^{\dagger}$	$-0.0031^{\dagger}$	$-0.0032^{\dagger}$	-0.0005
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0349^{\dagger}$	-0.0052^{*}	$-0.0302^{\dagger}$	-0.0082^{**}	-0.0007
	(0.0048)	(0.0027)	(0.0041)	(0.0033)	(0.0060)
High skilled	$0.0777^{\dagger}$	0.0025	$0.0714^{\dagger}$	$0.0252^{\dagger}$	$0.0252^{\dagger}$
	(0.0074)	(0.0033)	(0.0068)	(0.0056)	(0.0061)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0409^{\dagger}$
	–	–	–	–	(0.0058)
Blue collar high	–	–	–	–	$0.0563^{\dagger}$
	–	–	–	–	(0.0115)
Blue collar low	–	–	–	–	$-0.0351^{\dagger}$
	–	–	–	–	(0.0076)
Husband's characteristics					
Age	$-0.0029^{\dagger}$	-0.0005^{*}	$-0.0023^{\dagger}$	-0.0003	$-0.0046^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0164^{***}	-0.0033	-0.0144^{***}	-0.0033	-0.0084
	(0.0053)	(0.0027)	(0.0047)	(0.0036)	(0.0061)
High skilled	-0.0136^{**}	0.0007	-0.0140^{**}	-0.0064	-0.0006
	(0.0063)	(0.0033)	(0.0055)	(0.0044)	(0.0059)
Occupation (ref.: white collar high)					
White collar low	0.0024	0.0041	-0.0006	0.0083^{*}	$0.0275^{\dagger}$
	(0.0069)	(0.0034)	(0.0062)	(0.0048)	(0.0071)
Blue collar high	0.0103^{*}	0.0054^{*}	0.0062	0.0090^{**}	-0.0186^{***}
	(0.0059)	(0.0030)	(0.0054)	(0.0040)	(0.0063)
Blue collar low	0.0005	0.0053^{*}	-0.0035	0.0122^{***}	0.0128^{*}
	(0.0063)	(0.0030)	(0.0057)	(0.0042)	(0.0074)
Added worker dummy	0.0240^{***}	$0.0279^{\dagger}$	-0.0070	$0.0441^{\dagger}$	$0.0623^{\dagger}$
	(0.0092)	(0.0051)	(0.0082)	(0.0070)	(0.0148)
Pseudo-R^2	0.1109	0.1103	0.1213	0.0996	0.1030
Observations	87,416	87,416	87,416	76,052	73,890

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Country-time fixed effects are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$*;* *** $p < 0.01$*;* ** $p < 0.05$*;* * $p < 0.1$.

Table 2.A4: Probit Estimations: Pooled Regressions Based on Restricted Age Sample (25 to 59 years)

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\mathbf{\Delta\ JS}$ ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0317^{\dagger}$	-0.0146^{***}	-0.0194^{***}	$-0.0243^{\dagger}$	$-0.0265^{\dagger}$
	(0.0083)	(0.0049)	(0.0072)	(0.0066)	(0.0069)
No. of children	$-0.0268^{\dagger}$	$-0.0073^{\dagger}$	$-0.0194^{\dagger}$	$-0.0097^{\dagger}$	$-0.0174^{\dagger}$
	(0.0031)	(0.0016)	(0.0028)	(0.0021)	(0.0031)
Child age 0 to 3	-0.0134^{*}	-0.0057	-0.0085	$-0.0289^{\dagger}$	-0.0183^{**}
	(0.0079)	(0.0039)	(0.0072)	(0.0049)	(0.0079)
Child age 4 to 6	$0.0413^{\dagger}$	0.0119^{***}	$0.0293^{\dagger}$	0.0049	-0.0096
	(0.0078)	(0.0039)	(0.0070)	(0.0051)	(0.0069)
Log. equiv. disposable income (in thsd.)	0.0143^{***}	-0.0043^{**}	$0.0193^{\dagger}$	-0.0049^{*}	0.0033
	(0.0043)	(0.0021)	(0.0040)	(0.0028)	(0.0052)
Repayment of debts	$0.0342^{\dagger}$	$0.0101^{\dagger}$	$0.0231^{\dagger}$	$0.0223^{\dagger}$	0.0064
	(0.0051)	(0.0027)	(0.0046)	(0.0037)	(0.0050)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0105	0.0041	-0.0127^{**}	0.0075	0.0057
	(0.0068)	(0.0033)	(0.0062)	(0.0047)	(0.0061)
Apartment or flat	-0.0108^{*}	0.0085^{***}	$-0.0191^{\dagger}$	$0.0153^{\dagger}$	0.0185^{***}
	(0.0056)	(0.0027)	(0.0051)	(0.0038)	(0.0068)
Wife's characteristics					
Age	$-0.0038^{\dagger}$	-0.0008^{**}	$-0.0029^{\dagger}$	$-0.0028^{\dagger}$	0.0000
	(0.0006)	(0.0003)	(0.0006)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0418^{\dagger}$	-0.0057^{**}	$-0.0368^{\dagger}$	-0.0100^{***}	-0.0031
	(0.0054)	(0.0029)	(0.0047)	(0.0038)	(0.0065)
High skilled	$0.0879^{\dagger}$	0.0039	$0.0802^{\dagger}$	$0.0277^{\dagger}$	$0.0258^{\dagger}$
	(0.0083)	(0.0038)	(0.0077)	(0.0062)	(0.0065)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0394^{\dagger}$
	–	–	–	–	(0.0061)
Blue collar high	–	–	–	–	$0.0615^{\dagger}$
	–	–	–	–	(0.0125)
Blue collar low	–	–	–	–	$-0.0335^{\dagger}$
	–	–	–	–	(0.0082)
Husband's characteristics					
Age	$-0.0032^{\dagger}$	-0.0009^{***}	$-0.0023^{\dagger}$	-0.0009^{**}	$-0.0049^{\dagger}$
	(0.0006)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0186^{***}	-0.0046	-0.0148^{***}	-0.0045	-0.0079
	(0.0060)	(0.0030)	(0.0054)	(0.0041)	(0.0065)
High skilled	-0.0119^{*}	0.0012	-0.0123^{*}	-0.0078	0.0031
	(0.0072)	(0.0039)	(0.0063)	(0.0050)	(0.0063)
Occupation (ref.: white collar high)					
White collar low	0.0041	0.0039	0.0015	0.0092^{*}	$0.0306^{\dagger}$
	(0.0079)	(0.0041)	(0.0071)	(0.0056)	(0.0076)
Blue collar high	0.0145^{**}	0.0053	0.0104^{*}	0.0114^{**}	-0.0194^{***}
	(0.0068)	(0.0035)	(0.0061)	(0.0047)	(0.0067)
Blue collar low	0.0032	0.0041	0.0004	0.0138^{***}	0.0129
	(0.0071)	(0.0035)	(0.0065)	(0.0049)	(0.0079)
Country characteristics					
GDP growth rate	0.0030^{**}	0.0001	0.0024^{**}	0.0001	$0.0052^{\dagger}$
	(0.0012)	(0.0007)	(0.0011)	(0.0009)	(0.0014)
Unemployment rate	0.0030^{*}	0.0003	-0.0015	0.0020^{*}	-0.0008
	(0.0016)	(0.0008)	(0.0014)	(0.0011)	(0.0017)
Female LFP rate	$-0.0111^{\dagger}$	$-0.0080^{\dagger}$	-0.0058^{**}	-0.0067^{***}	-0.0044
	(0.0029)	(0.0015)	(0.0025)	(0.0021)	(0.0029)
Added worker dummy	0.0300^{***}	$0.0300^{\dagger}$	-0.0039	$0.0538^{\dagger}$	$0.0665^{\dagger}$
	(0.0105)	(0.0056)	(0.0095)	(0.0084)	(0.0158)
Pseudo-R^2	0.0872	0.0914	0.1013	0.0716	0.0934
Observations	72,724	72,724	72,724	62,238	66,380

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.A5: Probit Estimations: Pooled Regressions Including Husband's Labor Market Experience and Previous Job Status

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\mathbf{\Delta\ JS}$ ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0390^{\dagger}$	-0.0111^{**}	$-0.0280^{\dagger}$	-0.0209^{***}	$-0.0311^{\dagger}$
	(0.0094)	(0.0055)	(0.0081)	(0.0074)	(0.0084)
No. of children	$-0.0231^{\dagger}$	$-0.0092^{\dagger}$	$-0.0141^{\dagger}$	$-0.0120^{\dagger}$	$-0.0143^{\dagger}$
	(0.0034)	(0.0019)	(0.0030)	(0.0024)	(0.0038)
Child age 0 to 3	-0.0148^{*}	-0.0047	-0.0100	$-0.0201^{\dagger}$	0.0034
	(0.0085)	(0.0047)	(0.0075)	(0.0056)	(0.0101)
Child age 4 to 6	$0.0392^{\dagger}$	0.0097^{**}	$0.0290^{\dagger}$	0.0127^{**}	0.0046
	(0.0087)	(0.0046)	(0.0076)	(0.0059)	(0.0085)
Log. equiv. disposable income (in thsd.)	$0.0203^{\dagger}$	-0.0097^{***}	$0.0314^{\dagger}$	-0.0093^{**}	$0.0243^{\dagger}$
	(0.0056)	(0.0030)	(0.0050)	(0.0037)	(0.0073)
Repayment of debts	$0.0316^{\dagger}$	$0.0132^{\dagger}$	$0.0182^{\dagger}$	$0.0179^{\dagger}$	0.0107^{*}
	(0.0055)	(0.0031)	(0.0048)	(0.0039)	(0.0059)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0106	-0.0003	-0.0092	0.0057	0.0071
	(0.0074)	(0.0039)	(0.0066)	(0.0052)	(0.0074)
Apartment or flat	-0.0061	0.0039	-0.0092^{*}	0.0128^{***}	0.0131^{*}
	(0.0059)	(0.0032)	(0.0053)	(0.0041)	(0.0075)
Wife's characteristics					
Age	$-0.0041^{\dagger}$	-0.0011^{***}	$-0.0029^{\dagger}$	$-0.0032^{\dagger}$	0.0002
	(0.0006)	(0.0003)	(0.0005)	(0.0004)	(0.0007)
Education (ref.: medium skilled)					
Low skilled	$-0.0406^{\dagger}$	-0.0087^{**}	$-0.0323^{\dagger}$	-0.0121^{***}	-0.0121
	(0.0059)	(0.0036)	(0.0049)	(0.0041)	(0.0074)
High skilled	$0.0777^{\dagger}$	0.0042	$0.0687^{\dagger}$	$0.0341^{\dagger}$	0.0230^{***}
	(0.0096)	(0.0048)	(0.0086)	(0.0073)	(0.0079)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0314^{\dagger}$
	–	–	–	–	(0.0074)
Blue collar high	–	–	–	–	$0.0672^{\dagger}$
	–	–	–	–	(0.0151)
Blue collar low	–	–	–	–	$-0.0320^{\dagger}$
	–	–	–	–	(0.0093)
Husband's characteristics					
Age	$-0.0032^{\dagger}$	-0.0008^{**}	$-0.0023^{\dagger}$	-0.0002	$-0.0048^{\dagger}$
	(0.0006)	(0.0004)	(0.0006)	(0.0005)	(0.0008)
Education (ref.: medium skilled)					
Low skilled	-0.0157^{**}	-0.0020	-0.0157^{***}	-0.0014	-0.0105
	(0.0065)	(0.0038)	(0.0056)	(0.0046)	(0.0079)
High skilled	-0.0144^{*}	0.0047	-0.0176^{***}	-0.0100^{*}	-0.0091
	(0.0080)	(0.0048)	(0.0068)	(0.0056)	(0.0074)
Occupation (ref.: white collar high)					
White collar low	0.0024	0.0041	-0.0005	0.0050	0.0219^{***}
	(0.0085)	(0.0047)	(0.0075)	(0.0060)	(0.0083)
Blue collar high	0.0068	0.0069	0.0017	0.0102^{*}	-0.0128
	(0.0078)	(0.0046)	(0.0068)	(0.0055)	(0.0086)
Blue collar low	0.0080	0.0021	0.0082	0.0090	0.0187^{**}
	(0.0079)	(0.0042)	(0.0071)	(0.0055)	(0.0091)
Share of years in employment	-0.0358^{*}	-0.0085	-0.0267	-0.0248^{*}	$-0.1162^{\dagger}$
	(0.0194)	(0.0096)	(0.0174)	(0.0135)	(0.0224)
Temporary job	0.0197^{**}	0.0042	0.0149^{**}	0.0032	0.0270^{***}
	(0.0080)	(0.0038)	(0.0074)	(0.0054)	(0.0102)
Country characteristics					
GDP growth rate	0.0030^{**}	-0.0005	0.0030^{***}	-0.0005	$0.0079^{\dagger}$
	(0.0012)	(0.0007)	(0.0011)	(0.0009)	(0.0017)
Unemployment rate	0.0011	0.0003	-0.0024	0.0024^{**}	-0.0011
	(0.0017)	(0.0009)	(0.0015)	(0.0012)	(0.0020)
Female LFP rate	$-0.0121^{\dagger}$	$-0.0067^{\dagger}$	-0.0071^{***}	-0.0041^{*}	-0.0066^{*}
	(0.0031)	(0.0018)	(0.0027)	(0.0024)	(0.0034)
Added worker dummy	0.0217^{**}	0.0191^{***}	-0.0001	$0.0386^{\dagger}$	0.0398^{**}
	(0.0105)	(0.0059)	(0.0093)	(0.0085)	(0.0159)
Pseudo-R^2	0.1108	0.0939	0.1238	0.0873	0.1013
Observations	56,320	56,320	56,320	50,153	43,296

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.A6: Probit Estimations: Pooled Regressions Conditioning on Three Months of Husband's Unemployment

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\boldsymbol{\Delta}$ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0313^{\dagger}$	-0.0126^{***}	-0.0207^{***}	$-0.0202^{\dagger}$	$-0.0277^{\dagger}$
	(0.0075)	(0.0043)	(0.0065)	(0.0057)	(0.0066)
No. of children	$-0.0235^{\dagger}$	$-0.0071^{\dagger}$	$-0.0164^{\dagger}$	$-0.0089^{\dagger}$	$-0.0192^{\dagger}$
	(0.0027)	(0.0014)	(0.0025)	(0.0018)	(0.0030)
Child age 0 to 3	-0.0146^{**}	-0.0056	-0.0094	$-0.0243^{\dagger}$	-0.0171^{**}
	(0.0071)	(0.0035)	(0.0065)	(0.0043)	(0.0076)
Child age 4 to 6	$0.0370^{\dagger}$	0.0101^{***}	$0.0267^{\dagger}$	0.0042	-0.0100
	(0.0072)	(0.0035)	(0.0064)	(0.0045)	(0.0067)
Log. equiv. disposable income (in thsd.)	0.0112^{***}	-0.0053^{***}	$0.0172^{\dagger}$	-0.0068^{***}	0.0010
	(0.0038)	(0.0019)	(0.0035)	(0.0024)	(0.0048)
Repayment of debts	$0.0309^{\dagger}$	$0.0093^{\dagger}$	$0.0209^{\dagger}$	$0.0198^{\dagger}$	0.0068
	(0.0045)	(0.0024)	(0.0040)	(0.0033)	(0.0047)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0103^{*}	0.0016	-0.0104^{*}	0.0050	0.0042
	(0.0059)	(0.0029)	(0.0054)	(0.0041)	(0.0057)
Apartment or flat	-0.0094^{*}	0.0063^{***}	$-0.0156^{\dagger}$	$0.0126^{\dagger}$	0.0142^{**}
	(0.0049)	(0.0024)	(0.0045)	(0.0033)	(0.0063)
Wife's characteristics					
Age	$-0.0043^{\dagger}$	$-0.0012^{\dagger}$	$-0.0031^{\dagger}$	$-0.0032^{\dagger}$	-0.0004
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0357^{\dagger}$	-0.0054^{**}	$-0.0308^{\dagger}$	-0.0086^{***}	-0.0011
	(0.0048)	(0.0027)	(0.0041)	(0.0033)	(0.0060)
High skilled	$0.0794^{\dagger}$	0.0026	$0.0732^{\dagger}$	$0.0263^{\dagger}$	$0.0258^{\dagger}$
	(0.0075)	(0.0034)	(0.0068)	(0.0057)	(0.0061)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0410^{\dagger}$
	–	–	–	–	(0.0058)
Blue collar high	–	–	–	–	$0.0541^{\dagger}$
	–	–	–	–	(0.0114)
Blue collar low	–	–	–	–	$-0.0356^{\dagger}$
	–	–	–	–	(0.0076)
Husband's characteristics					
Age	$-0.0029^{\dagger}$	-0.0005^{*}	$-0.0023^{\dagger}$	-0.0003	$-0.0046^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0166^{***}	-0.0035	-0.0143^{***}	-0.0037	-0.0082
	(0.0053)	(0.0027)	(0.0047)	(0.0036)	(0.0061)
High skilled	-0.0141^{**}	0.0010	-0.0145^{***}	-0.0059	-0.0002
	(0.0063)	(0.0034)	(0.0055)	(0.0045)	(0.0059)
Occupation (ref.: white collar high)					
White collar low	0.0010	0.0037	-0.0014	0.0081^{*}	$0.0270^{\dagger}$
	(0.0070)	(0.0035)	(0.0063)	(0.0048)	(0.0071)
Blue collar high	0.0101^{*}	0.0052^{*}	0.0062	0.0092^{**}	-0.0202^{***}
	(0.0060)	(0.0031)	(0.0054)	(0.0040)	(0.0063)
Blue collar low	0.0006	0.0049	-0.0031	0.0119^{***}	0.0127^{*}
	(0.0063)	(0.0031)	(0.0057)	(0.0042)	(0.0074)
Country characteristics					
GDP growth rate	0.0030^{***}	-0.0001	0.0025^{***}	-0.0001	$0.0049^{\dagger}$
	(0.0011)	(0.0006)	(0.0010)	(0.0008)	(0.0013)
Unemployment rate	0.0030^{**}	0.0004	-0.0012	0.0018^{*}	-0.0003
	(0.0014)	(0.0007)	(0.0012)	(0.0009)	(0.0016)
Female LFP rate	$-0.0098^{\dagger}$	$-0.0071^{\dagger}$	-0.0052^{**}	-0.0056^{***}	-0.0038
	(0.0025)	(0.0013)	(0.0022)	(0.0018)	(0.0027)
Added worker dummy (3 month)	0.0308^{***}	$0.0312^{\dagger}$	-0.0046	$0.0505^{\dagger}$	$0.0731^{\dagger}$
	(0.0102)	(0.0055)	(0.0091)	(0.0078)	(0.0165)
Pseudo-R^2	0.1017	0.0983	0.1117	0.0890	0.0953
Observations	87,503	87,503	87,503	76,133	73,891

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.A7: PROBIT ESTIMATIONS: SCANDINAVIA

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\boldsymbol{\Delta}$ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	−0.0124	−0.0017	−0.0109	−0.0144	0.0139
	(0.0158)	(0.0070)	(0.0150)	(0.0125)	(0.0120)
No. of children	−0.0242***	−0.0045	−0.0200***	−0.0024	−0.0353†
	(0.0074)	(0.0035)	(0.0070)	(0.0058)	(0.0063)
Child age 0 to 3	−0.0099	0.0109	−0.0209	−0.0229	0.0967†
	(0.0204)	(0.0104)	(0.0193)	(0.0160)	(0.0213)
Child age 4 to 6	0.0473**	0.0053	0.0393*	−0.0019	0.0070
	(0.0229)	(0.0106)	(0.0213)	(0.0181)	(0.0159)
Log. equiv. disposable income (in thsd.)	0.0521***	−0.0288†	0.0795†	−0.0238*	−0.0017
	(0.0192)	(0.0071)	(0.0192)	(0.0133)	(0.0142)
Repayment of debts	0.0158	0.0043	0.0123	−0.0069	0.0124
	(0.0133)	(0.0061)	(0.0126)	(0.0106)	(0.0098)
Dwelling type (ref.: detached house)					
Semi-detached house	−0.0237	0.0029	−0.0261	0.0159	−0.0008
	(0.0186)	(0.0082)	(0.0180)	(0.0163)	(0.0156)
Apartment or flat	−0.0608†	0.0154*	−0.0786†	−0.0003	0.0203
	(0.0176)	(0.0090)	(0.0161)	(0.0129)	(0.0159)
Wife's characteristics					
Age	−0.0021	0.0008	−0.0030*	−0.0015	−0.0018
	(0.0017)	(0.0007)	(0.0017)	(0.0012)	(0.0012)
Education (ref.: medium skilled)					
Low skilled	−0.0683†	0.0107	−0.0801†	−0.0006	0.0158
	(0.0200)	(0.0106)	(0.0186)	(0.0147)	(0.0170)
High skilled	0.0904†	0.0003	0.0882†	0.0217*	0.0302**
	(0.0161)	(0.0066)	(0.0154)	(0.0130)	(0.0138)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	−0.0686†
	–	–	–	–	(0.0131)
Blue collar high	–	–	–	–	0.0743**
	–	–	–	–	(0.0293)
Blue collar low	–	–	–	–	−0.0332
	–	–	–	–	(0.0211)
Husband's characteristics					
Age	−0.0018	−0.0003	−0.0014	−0.0004	−0.0058†
	(0.0017)	(0.0007)	(0.0017)	(0.0012)	(0.0012)
Education (ref.: medium skilled)					
Low skilled	−0.0017	0.0012	−0.0035	0.0193	0.0145
	(0.0207)	(0.0097)	(0.0196)	(0.0176)	(0.0156)
High skilled	0.0070	−0.0097	0.0174	−0.0051	0.0235*
	(0.0179)	(0.0075)	(0.0169)	(0.0136)	(0.0129)
Occupation (ref.: white collar high)					
White collar low	0.0068	0.0005	0.0054	−0.0061	0.0393**
	(0.0239)	(0.0112)	(0.0224)	(0.0185)	(0.0163)
Blue collar high	0.0161	−0.0137	0.0304*	−0.0031	−0.0110
	(0.0196)	(0.0086)	(0.0183)	(0.0153)	(0.0141)
Blue collar low	0.0146	−0.0022	0.0161	0.0045	−0.0283*
	(0.0209)	(0.0097)	(0.0195)	(0.0160)	(0.0160)
Country characteristics					
GDP growth rate	0.0051	−0.0001	0.0049	−0.0083*	0.0038
	(0.0049)	(0.0023)	(0.0047)	(0.0043)	(0.0036)
Unemployment rate	−0.0180	0.0036	−0.0223	0.0343**	−0.0028
	(0.0208)	(0.0098)	(0.0199)	(0.0166)	(0.0159)
Female LFP rate	−0.0130	−0.0064	−0.0038	−0.0007	0.0272**
	(0.0195)	(0.0091)	(0.0187)	(0.0152)	(0.0130)
Added worker dummy	0.0944**	0.0297	0.0622	−0.0071	0.0232
	(0.0454)	(0.0182)	(0.0461)	(0.0261)	(0.0386)
Pseudo-R^2	0.0850	0.0493	0.0911	0.0780	0.0641
Observations	7,339	7,339	7,339	4,641	11,228

*Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Table 2.A8: Probit Estimations: Continental Europe

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\mathbf{\Delta\ JS}$ ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0542^{\dagger}$	-0.0093^{**}	$-0.0439^{\dagger}$	-0.0159^{*}	-0.0194^{***}
	(0.0133)	(0.0046)	(0.0127)	(0.0083)	(0.0064)
No. of children	$-0.0236^{\dagger}$	-0.0028	$-0.0213^{\dagger}$	-0.0089^{***}	$-0.0128^{\dagger}$
	(0.0059)	(0.0019)	(0.0057)	(0.0032)	(0.0035)
Child age 0 to 3	$-0.0560^{\dagger}$	-0.0102^{***}	-0.0442^{***}	-0.0232^{***}	-0.0199^{**}
	(0.0141)	(0.0039)	(0.0137)	(0.0079)	(0.0081)
Child age 4 to 6	0.0454^{***}	0.0181^{***}	0.0276^{*}	0.0232^{**}	0.0103
	(0.0161)	(0.0059)	(0.0152)	(0.0098)	(0.0079)
Log. equiv. disposable income (in thsd.)	-0.0034	-0.0042	0.0008	-0.0021	0.0010
	(0.0111)	(0.0044)	(0.0105)	(0.0061)	(0.0065)
Repayment of debts	0.0307^{***}	0.0063	0.0252^{**}	0.0166^{***}	0.0047
	(0.0105)	(0.0040)	(0.0101)	(0.0064)	(0.0056)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0225^{**}	0.0016	-0.0243^{**}	0.0027	-0.0015
	(0.0112)	(0.0041)	(0.0107)	(0.0072)	(0.0059)
Apartment or flat	-0.0130	-0.0014	-0.0118	0.0027	0.0106
	(0.0135)	(0.0042)	(0.0131)	(0.0075)	(0.0083)
Wife's characteristics					
Age	$-0.0061^{\dagger}$	-0.0008^{**}	$-0.0052^{\dagger}$	$-0.0036^{\dagger}$	-0.0007
	(0.0011)	(0.0004)	(0.0010)	(0.0007)	(0.0007)
Education (ref.: medium skilled)					
Low skilled	$-0.0489^{\dagger}$	-0.0016	$-0.0482^{\dagger}$	-0.0040	-0.0043
	(0.0100)	(0.0043)	(0.0092)	(0.0061)	(0.0070)
High skilled	$0.0782^{\dagger}$	-0.0012	$0.0793^{\dagger}$	0.0224^{***}	0.0185^{***}
	(0.0142)	(0.0039)	(0.0139)	(0.0087)	(0.0065)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0270^{\dagger}$
	–	–	–	–	(0.0064)
Blue collar high	–	–	–	–	0.0481^{***}
	–	–	–	–	(0.0173)
Blue collar low	–	–	–	–	-0.0282^{***}
	–	–	–	–	(0.0086)
Husband's characteristics					
Age	-0.0030^{***}	-0.0003	-0.0028^{***}	0.0000	$-0.0043^{\dagger}$
	(0.0011)	(0.0004)	(0.0010)	(0.0008)	(0.0007)
Education (ref.: medium skilled)					
Low skilled	-0.0223^{*}	0.0002	-0.0233^{**}	-0.0035	-0.0018
	(0.0123)	(0.0050)	(0.0117)	(0.0076)	(0.0076)
High skilled	-0.0067	0.0054	-0.0115	-0.0071	-0.0060
	(0.0121)	(0.0043)	(0.0117)	(0.0070)	(0.0060)
Occupation (ref.: white collar high)					
White collar low	-0.0056	-0.0010	-0.0041	0.0028	0.0175^{**}
	(0.0144)	(0.0046)	(0.0138)	(0.0095)	(0.0077)
Blue collar high	0.0272^{**}	0.0048	0.0234^{*}	-0.0012	-0.0111
	(0.0133)	(0.0054)	(0.0128)	(0.0083)	(0.0072)
Blue collar low	0.0195	0.0018	0.0172	0.0017	0.0039
	(0.0143)	(0.0047)	(0.0140)	(0.0085)	(0.0086)
Country characteristics					
GDP growth rate	$0.0263^{\dagger}$	-0.0055^{**}	$0.0299^{\dagger}$	-0.0049	0.0059
	(0.0067)	(0.0026)	(0.0065)	(0.0043)	(0.0040)
Unemployment rate	0.0031	0.0021	0.0040	0.0081	-0.0078
	(0.0137)	(0.0043)	(0.0135)	(0.0078)	(0.0064)
Female LFP rate	0.0034	0.0039	-0.0003	0.0034	-0.0030
	(0.0070)	(0.0024)	(0.0068)	(0.0045)	(0.0040)
Added worker dummy	-0.0210	0.0031	-0.0265	0.0136	0.0579^{***}
	(0.0215)	(0.0067)	(0.0209)	(0.0133)	(0.0189)
Pseudo-R^2	0.1266	0.0822	0.1252	0.1100	0.0819
Observations	21,099	21,099	21,099	17,355	36,482

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.A9: Probit Estimations: Anglo-Saxon Countries

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	Δ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	0.0038	−0.0209*	0.0205	−0.0335*	−0.0334
	(0.0263)	(0.0118)	(0.0242)	(0.0203)	(0.0208)
No. of children	−0.0314***	−0.0034	−0.0268***	0.0012	−0.0371†
	(0.0106)	(0.0033)	(0.0101)	(0.0061)	(0.0083)
Child age 0 to 3	−0.0266	−0.0161**	−0.0090	−0.0515†	−0.0861†
	(0.0276)	(0.0072)	(0.0271)	(0.0138)	(0.0166)
Child age 4 to 6	−0.0371	−0.0092	−0.0256	−0.0491†	−0.0546***
	(0.0272)	(0.0074)	(0.0264)	(0.0122)	(0.0169)
Log. equiv. disposable income (in thsd.)	0.0065	0.0003	0.0078	−0.0100	0.0059
	(0.0156)	(0.0048)	(0.0150)	(0.0087)	(0.0149)
Repayment of debts	0.0491***	−0.0072	0.0563†	0.0041	0.0032
	(0.0172)	(0.0061)	(0.0165)	(0.0116)	(0.0121)
Dwelling type (ref.: detached house)					
Semi-detached house	−0.0126	0.0087	−0.0204	−0.0213	0.0142
	(0.0208)	(0.0058)	(0.0202)	(0.0152)	(0.0132)
Apartment or flat	−0.0290	0.0265	−0.0663*	0.0054	0.0491
	(0.0389)	(0.0162)	(0.0344)	(0.0269)	(0.0340)
Wife's characteristics					
Age	−0.0057***	−0.0009*	−0.0051**	−0.0026**	−0.0027*
	(0.0021)	(0.0006)	(0.0020)	(0.0012)	(0.0015)
Education (ref.: medium skilled)					
Low skilled	−0.0403	0.0214**	−0.0667***	0.0083	0.0058
	(0.0247)	(0.0099)	(0.0219)	(0.0168)	(0.0217)
High skilled	0.0920†	0.0132**	0.0785†	0.0360**	0.0231
	(0.0233)	(0.0067)	(0.0226)	(0.0168)	(0.0153)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	−0.0513†
	–	–	–	–	(0.0153)
Blue collar high	–	–	–	–	0.1862†
	–	–	–	–	(0.0495)
Blue collar low	–	–	–	–	−0.0563***
	–	–	–	–	(0.0211)
Husband's characteristics					
Age	−0.0038*	0.0005	−0.0039*	−0.0011	−0.0042***
	(0.0021)	(0.0005)	(0.0020)	(0.0013)	(0.0015)
Education (ref.: medium skilled)					
Low skilled	−0.0530**	−0.0043	−0.0508**	−0.0134	−0.0095
	(0.0265)	(0.0065)	(0.0253)	(0.0157)	(0.0202)
High skilled	−0.0349	0.0094	−0.0442**	0.0023	−0.0129
	(0.0225)	(0.0082)	(0.0213)	(0.0155)	(0.0148)
Occupation (ref.: white collar high)					
White collar low	−0.0216	−0.0038	−0.0210	−0.0045	0.0360*
	(0.0308)	(0.0090)	(0.0294)	(0.0192)	(0.0205)
Blue collar high	−0.0166	0.0016	−0.0177	0.0028	−0.0239
	(0.0274)	(0.0090)	(0.0262)	(0.0173)	(0.0177)
Blue collar low	−0.0327	0.0058	−0.0361	−0.0006	0.0176
	(0.0269)	(0.0088)	(0.0257)	(0.0172)	(0.0210)
Country characteristics					
GDP growth rate	0.0027	0.0031	0.0017	0.0068	0.0064
	(0.0207)	(0.0066)	(0.0204)	(0.0130)	(0.0162)
Unemployment rate	−0.0174	0.0020	−0.0194	−0.0468	−0.0124
	(0.0596)	(0.0192)	(0.0584)	(0.0382)	(0.0463)
Female LFP rate	−0.0111	−0.0030	−0.0073	−0.0431	−0.0147
	(0.0457)	(0.0154)	(0.0445)	(0.0295)	(0.0355)
Added worker dummy	−0.0616	0.0207	−0.0896**	0.0244	0.0694
	(0.0429)	(0.0178)	(0.0384)	(0.0290)	(0.0444)
Pseudo-R^2	0.0761	0.1452	0.0846	0.1075	0.0546
Observations	4,005	4,005	4,005	3,180	5,867

*Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Table 2.A10: Probit Estimations: Mediterranean Countries

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\mathbf{\Delta\ JS}$ ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0795^{\dagger}$	-0.0257^{**}	$-0.0493^{\dagger}$	-0.0376^{***}	0.0004
	(0.0167)	(0.0106)	(0.0138)	(0.0129)	(0.0213)
No. of children	$-0.0194^{\dagger}$	$-0.0116^{\dagger}$	-0.0078^{**}	$-0.0109^{\dagger}$	-0.0078
	(0.0039)	(0.0027)	(0.0031)	(0.0032)	(0.0078)
Child age 0 to 3	0.0322^{***}	0.0169^{**}	0.0142^{*}	-0.0062	0.0270
	(0.0112)	(0.0079)	(0.0086)	(0.0077)	(0.0206)
Child age 4 to 6	0.0111	0.0100	0.0012	0.0028	-0.0191
	(0.0095)	(0.0068)	(0.0072)	(0.0073)	(0.0164)
Log. equiv. disposable income (in thsd.)	$0.0233^{\dagger}$	-0.0030	$0.0277^{\dagger}$	-0.0019	0.0142
	(0.0049)	(0.0030)	(0.0041)	(0.0035)	(0.0117)
Repayment of debts	$0.0298^{\dagger}$	$0.0212^{\dagger}$	0.0092^{**}	$0.0319^{\dagger}$	-0.0116
	(0.0060)	(0.0044)	(0.0046)	(0.0052)	(0.0117)
Dwelling type (ref.: detached house)					
Semi-detached house	0.0071	0.0066	0.0012	0.0182^{***}	-0.0217
	(0.0078)	(0.0050)	(0.0065)	(0.0060)	(0.0160)
Apartment or flat	0.0019	0.0130^{***}	-0.0103^{**}	$0.0223^{\dagger}$	-0.0265^{*}
	(0.0065)	(0.0044)	(0.0052)	(0.0051)	(0.0144)
Wife's characteristics					
Age	$-0.0036^{\dagger}$	-0.0016^{***}	$-0.0020^{\dagger}$	$-0.0037^{\dagger}$	0.0042^{***}
	(0.0007)	(0.0005)	(0.0006)	(0.0006)	(0.0014)
Education (ref.: medium skilled)					
Low skilled	$-0.0241^{\dagger}$	-0.0133^{***}	-0.0108^{**}	-0.0123^{**}	0.0112
	(0.0064)	(0.0045)	(0.0048)	(0.0052)	(0.0138)
High skilled	$0.0520^{\dagger}$	0.0015	$0.0472^{\dagger}$	0.0179^{*}	0.0392^{**}
	(0.0117)	(0.0073)	(0.0098)	(0.0098)	(0.0170)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0531^{\dagger}$
	–	–	–	–	(0.0144)
Blue collar high	–	–	–	–	0.0558^{**}
	–	–	–	–	(0.0249)
Blue collar low	–	–	–	–	-0.0302
	–	–	–	–	(0.0190)
Husband's characteristics					
Age	$-0.0033^{\dagger}$	-0.0015^{***}	-0.0017^{***}	-0.0009	$-0.0060^{\dagger}$
	(0.0007)	(0.0005)	(0.0006)	(0.0006)	(0.0014)
Education (ref.: medium skilled)					
Low skilled	-0.0074	-0.0038	-0.0043	-0.0029	-0.0228^{*}
	(0.0067)	(0.0046)	(0.0052)	(0.0053)	(0.0135)
High skilled	-0.0103	-0.0035	-0.0077	-0.0108	0.0168
	(0.0088)	(0.0061)	(0.0068)	(0.0071)	(0.0170)
Occupation (ref.: white collar high)					
White collar low	0.0022	0.0076	-0.0043	0.0137^{**}	0.0253
	(0.0086)	(0.0060)	(0.0066)	(0.0068)	(0.0170)
Blue collar high	0.0080	0.0061	0.0030	0.0165^{***}	-0.0324^{**}
	(0.0078)	(0.0055)	(0.0061)	(0.0061)	(0.0156)
Blue collar low	-0.0018	0.0024	-0.0028	0.0216^{***}	0.0366^{**}
	(0.0082)	(0.0057)	(0.0064)	(0.0066)	(0.0183)
Country characteristics					
GDP growth rate	-0.0001	-0.0017	-0.0005	-0.0019	0.0071
	(0.0024)	(0.0018)	(0.0019)	(0.0019)	(0.0052)
Unemployment rate	-0.0051^{***}	-0.0017	$-0.0055^{\dagger}$	0.0005	-0.0076^{*}
	(0.0019)	(0.0013)	(0.0015)	(0.0015)	(0.0042)
Female LFP rate	$-0.0144^{\dagger}$	$-0.0106^{\dagger}$	-0.0054^{*}	-0.0019	-0.0109
	(0.0042)	(0.0031)	(0.0033)	(0.0035)	(0.0091)
Added worker dummy	$0.0602^{\dagger}$	$0.0419^{\dagger}$	0.0170^{*}	$0.0616^{\dagger}$	$0.1078^{\dagger}$
	(0.0122)	(0.0087)	(0.0096)	(0.0108)	(0.0295)
Pseudo-R^2	0.0874	0.0986	0.0583	0.1030	0.0358
Observations	29,232	29,232	29,232	27,028	11,920

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.A11: Probit Estimations: Central and Eastern Europe

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	Δ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	0.0147	0.0030	0.0110	−0.0033	−0.0907***
	(0.0098)	(0.0054)	(0.0087)	(0.0065)	(0.0298)
No. of children	−0.0228†	−0.0060***	−0.0169†	−0.0100***	−0.0137
	(0.0043)	(0.0021)	(0.0040)	(0.0031)	(0.0096)
Child age 0 to 3	−0.0460†	−0.0280†	−0.0170*	−0.0434†	0.0744**
	(0.0110)	(0.0051)	(0.0103)	(0.0058)	(0.0364)
Child age 4 to 6	0.0865†	0.0068	0.0786†	0.0114	0.0481*
	(0.0116)	(0.0058)	(0.0104)	(0.0071)	(0.0269)
Log. equiv. disposable income (in thsd.)	−0.0037	−0.0026	−0.0014	−0.0114***	0.0243*
	(0.0066)	(0.0039)	(0.0058)	(0.0043)	(0.0130)
Repayment of debts	0.0197***	0.0049	0.0141**	0.0109**	0.0577†
	(0.0072)	(0.0039)	(0.0063)	(0.0050)	(0.0170)
Dwelling type (ref.: detached house)					
Semi-detached house	−0.0112	−0.0049	−0.0078	0.0172*	0.0255
	(0.0130)	(0.0065)	(0.0114)	(0.0095)	(0.0342)
Apartment or flat	−0.0030	−0.0015	−0.0029	0.0171†	0.0116
	(0.0072)	(0.0040)	(0.0063)	(0.0048)	(0.0182)
Wife's characteristics					
Age	−0.0030†	−0.0017†	−0.0013*	−0.0023†	−0.0010
	(0.0008)	(0.0005)	(0.0007)	(0.0005)	(0.0017)
Education (ref.: medium skilled)					
Low skilled	−0.0382†	−0.0015	−0.0374†	−0.0065	−0.0239
	(0.0089)	(0.0050)	(0.0076)	(0.0062)	(0.0224)
High skilled	0.1048†	0.0032	0.0982†	0.0291***	0.0438
	(0.0128)	(0.0064)	(0.0118)	(0.0093)	(0.0271)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	−0.0032
	–	–	–	–	(0.0244)
Blue collar high	–	–	–	–	0.0247
	–	–	–	–	(0.0273)
Blue collar low	–	–	–	–	−0.0426
	–	–	–	–	(0.0263)
Husband's characteristics					
Age	−0.0018**	−0.0001	−0.0017**	−0.0000	−0.0025
	(0.0008)	(0.0004)	(0.0007)	(0.0005)	(0.0017)
Education (ref.: medium skilled)					
Low skilled	−0.0137	−0.0058	−0.0080	−0.0072	0.0041
	(0.0111)	(0.0055)	(0.0100)	(0.0066)	(0.0250)
High skilled	−0.0114	−0.0124**	−0.0004	−0.0169**	0.0458
	(0.0116)	(0.0062)	(0.0102)	(0.0074)	(0.0281)
Occupation (ref.: white collar high)					
White collar low	0.0365**	0.0017	0.0345***	0.0098	0.0765***
	(0.0144)	(0.0074)	(0.0128)	(0.0088)	(0.0284)
Blue collar high	0.0117	0.0042	0.0076	0.0074	0.0025
	(0.0099)	(0.0054)	(0.0089)	(0.0065)	(0.0240)
Blue collar low	0.0056	0.0090	−0.0039	0.0083	0.0321
	(0.0108)	(0.0061)	(0.0095)	(0.0069)	(0.0264)
Country characteristics					
GDP growth rate	0.0008	−0.0005	0.0014	−0.0004	0.0063**
	(0.0013)	(0.0007)	(0.0011)	(0.0008)	(0.0029)
Unemployment rate	0.0067*	0.0062***	−0.0002	0.0032	−0.0242***
	(0.0038)	(0.0021)	(0.0034)	(0.0025)	(0.0076)
Female LFP rate	−0.0027	−0.0011	0.0003	−0.0053	−0.0322***
	(0.0056)	(0.0030)	(0.0051)	(0.0037)	(0.0116)
Added worker dummy	0.0310**	0.0280***	0.0028	0.0567†	−0.0345
	(0.0143)	(0.0085)	(0.0128)	(0.0132)	(0.0357)
Pseudo-R^2	0.1140	0.1113	0.1051	0.0924	0.0560
Observations	25,745	25,745	25,745	23,929	8,394

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ *refers to women's transitions from inactivity to activity;* $IA_{t-1} \rightarrow UE_t$ *refers to women's transitions from inactivity to unemployment;* $IA_{t-1} \rightarrow E_t$ *refers to women's transitions from inacitity to employment;* Δ *JS refers to women's job-search transitions;* $PT_{t-1} \rightarrow FT_t$ *refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from* $t-1$ *to* t *and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' unemployment rate are additionally included in the regressions. LFP, labor force participation. Asterisks denote statistical significance:* † $p < 0.001$*;* *** $p < 0.01$*;* ** $p < 0.05$*;* * $p < 0.1$.

Table 2.A12: Probit Estimations: Added Worker Effect by Country Group – Including Country-Time Fixed Effects

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$	Δ **JS**	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$
			Scandinavia		
ME	0.0916**	0.0362*	0.0462	−0.0032	0.0150
StdE	(0.0417)	(0.0196)	(0.0415)	(0.0273)	(0.0380)
Δ%	26.50%	–	–	–	–
Observations	7,335	7,335	7,335	4,560	11,227
			Continental Europe		
ME	−0.0175	0.0053	−0.0252	0.0138	0.0578***
StdE	(0.0199)	(0.0066)	(0.0192)	(0.0129)	(0.0199)
Δ%	–	–	–	–	62.82%
Observations	21,099	21,099	21,099	17,355	36,482
			Anglo-Saxon Countries		
ME	−0.0634	0.0209	−0.0893**	0.0252	0.0692
StdE	(0.0429)	(0.0184)	(0.0387)	(0.0296)	(0.0445)
Δ%	–	–	-39.22%	–	–
Observations	4,005	4,005	4,005	3,180	5,867
			Mediterranean Countries		
ME	0.0628†	0.0428†	0.0160*	0.0614†	0.0998†
StdE	(0.0120)	(0.0088)	(0.0092)	(0.0107)	(0.0269)
Δ%	44.84%	73.54%	–	81.21%	39.00%
Observations	29,232	29,232	29,232	27,028	11,920
			Central and Eastern Europe		
ME	0.0373**	0.0292†	0.0036	0.0504†	−0.0284
StdE	(0.0146)	(0.0087)	(0.0126)	(0.0121)	(0.0353)
Δ%	20.45%	62.49%	–	81.52%	–
Observations	25,745	25,745	25,745	23,929	8,394

*Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics (as shown in Table 2.1). $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Δ% refers to the percentage change in women's probability of adjusting their labor supply due to their husband's unemployment. Percentage changes are shown for significant added worker effects (5% level) only. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Table 2.A13: Probit Estimations: Added Worker Effect by Country Group – Including Region-Time Fixed Effects

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$	Δ **JS**	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$
			Scandinavia		
ME	0.0852**	0.0342*	0.0402	−0.0007	0.0150
StdE	(0.0423)	(0.0196)	(0.0419)	(0.0283)	(0.0377)
Δ%	24.64%	–	–	–	–
Observations	7,249	7,249	7,249	4,529	11,226
			Continental Europe		
ME	−0.0163	0.0099	−0.0325	0.0218	0.0607***
StdE	(0.0239)	(0.0089)	(0.0224)	(0.0137)	(0.0200)
Δ%	–	–	–	–	65.88%
Observations	17,948	17,948	17,948	16,329	35,289
			Anglo-Saxon Countries		
ME	−0.0143	0.0480	−0.0616	0.0638	0.0706
StdE	(0.0547)	(0.0332)	(0.0487)	(0.0414)	(0.0457)
Δ%	–	–	–	–	–
Observations	3,129	3,129	3,129	2,760	5,596
			Mediterranean Countries		
ME	0.0671†	0.0418†	0.0208**	0.0620†	0.0982†
StdE	(0.0122)	(0.0087)	(0.0095)	(0.0106)	(0.0267)
Δ%	47.68%	70.99%	25.43%	81.58%	38.31%
Observations	28,585	28,585	28,585	26,811	11,885
			Central and Eastern Europe		
ME	0.0387**	0.0313†	0.0047	0.0502†	−0.0397
StdE	(0.0152)	(0.0094)	(0.0130)	(0.0119)	(0.0336)
Δ%	20.01%	57.92%	–	78.08%	–
Observations	23,919	23,919	23,919	23,393	8,336

*Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Δ% refers to the percentage change in women's probability of adjusting their labor supply due to their husband's unemployment. Percentage changes are shown for significant added worker effects (5% level) only. Region-time fixed effects are additionally included in the regressions. There are some countries within the EU that are too small to be subdivided into NUTS-2 regions, these are Cyprus, Estonia, Latvia, Lithuania, Luxembourg, and Malta. For some other countries, information on regional location is missing in the data, these are Germany, the Netherlands, Portugal, and Slovenia. In these cases, the region-time fixed effects are replaced by country-time fixed effects. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Supplementary Appendix

Table 2.B1: Multinomial Logit Estimations: Pooled Regressions

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{IA}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE
Household characteristics			
Married	$0.0307^{\dagger}$	-0.0130^{***}	-0.0177^{***}
	(0.0074)	(0.0044)	(0.0064)
No. of children	$0.0241^{\dagger}$	$-0.0073^{\dagger}$	$-0.0168^{\dagger}$
	(0.0028)	(0.0014)	(0.0026)
Child age 0 to 3	0.0161^{**}	-0.0050	-0.0111^{*}
	(0.0071)	(0.0035)	(0.0065)
Child age 4 to 6	$-0.0343^{\dagger}$	0.0095^{***}	$0.0248^{\dagger}$
	(0.0071)	(0.0035)	(0.0065)
Log. equiv. disposable income (in thsd.)	-0.0124^{***}	-0.0050^{***}	$0.0173^{\dagger}$
	(0.0040)	(0.0017)	(0.0038)
Repayment of debts	$-0.0309^{\dagger}$	$0.0098^{\dagger}$	$0.0211^{\dagger}$
	(0.0046)	(0.0024)	(0.0041)
Dwelling type (ref.: detached house)			
Semi-detached house	0.0096	0.0019	-0.0114^{**}
	(0.0060)	(0.0030)	(0.0055)
Apartment or flat	0.0091^{*}	0.0064^{***}	$-0.0155^{\dagger}$
	(0.0050)	(0.0024)	(0.0046)
Wife's characteristics			
Age	$0.0043^{\dagger}$	$-0.0012^{\dagger}$	$-0.0031^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)
Education (ref.: medium skilled)			
Low skilled	$0.0393^{\dagger}$	-0.0051^{*}	$-0.0342^{\dagger}$
	(0.0048)	(0.0027)	(0.0042)
High skilled	$-0.0741^{\dagger}$	0.0041	$0.0700^{\dagger}$
	(0.0074)	(0.0035)	(0.0068)
Husband's characteristics			
Age	$0.0029^{\dagger}$	-0.0006^{**}	$-0.0023^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)
Education (ref.: medium skilled)			
Low skilled	$0.0194^{\dagger}$	-0.0031	$-0.0164^{\dagger}$
	(0.0054)	(0.0027)	(0.0049)
High skilled	0.0143^{**}	0.0004	-0.0148^{***}
	(0.0063)	(0.0034)	(0.0056)
Occupation (ref.: white collar high)			
White collar low	-0.0019	0.0036	-0.0016
	(0.0071)	(0.0035)	(0.0064)
Blue collar high	-0.0115^{*}	0.0048	0.0067
	(0.0061)	(0.0031)	(0.0056)
Blue collar low	-0.0021	0.0044	-0.0023
	(0.0065)	(0.0031)	(0.0059)
Country characteristics			
GDP growth rate	-0.0023^{**}	-0.0004	0.0026^{***}
	(0.0011)	(0.0006)	(0.0010)
Unemployment rate	0.0003	-0.0001	-0.0002
	(0.0014)	(0.0007)	(0.0013)
Female LFP rate	$0.0121^{\dagger}$	$-0.0077^{\dagger}$	-0.0045^{**}
	(0.0025)	(0.0014)	(0.0022)
Added worker dummy	-0.0221^{**}	$0.0278^{\dagger}$	-0.0057
	(0.0094)	(0.0050)	(0.0086)
Pseudo-R^2		0.1120	
Observations		87,503	

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from multinomial logit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow IA_t$ refers to women remaining in inactivity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects are additionally included in the regression. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$*;* *** $p < 0.01$*;* ** $p < 0.05$*;* * $p < 0.1$.

Table 2.B2: Probit Estimations: Pooled Regressions Based on Sample Including Husband's Labor Market Experience and Previous Job Status

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\mathbf{\Delta\ JS}$ ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0403^{\dagger}$	-0.0113^{**}	$-0.0290^{\dagger}$	-0.0210^{***}	$-0.0321^{\dagger}$
	(0.0095)	(0.0055)	(0.0082)	(0.0074)	(0.0085)
No. of children	$-0.0231^{\dagger}$	$-0.0092^{\dagger}$	$-0.0141^{\dagger}$	$-0.0119^{\dagger}$	$-0.0148^{\dagger}$
	(0.0034)	(0.0019)	(0.0030)	(0.0024)	(0.0039)
Child age 0 to 3	-0.0147^{*}	-0.0046	-0.0101	$-0.0200^{\dagger}$	0.0023
	(0.0085)	(0.0047)	(0.0075)	(0.0056)	(0.0101)
Child age 4 to 6	$0.0390^{\dagger}$	0.0097^{**}	$0.0288^{\dagger}$	0.0127^{**}	0.0026
	(0.0087)	(0.0046)	(0.0077)	(0.0059)	(0.0085)
Log. equiv. disposable income (in thsd.)	0.0178^{***}	$-0.0103^{\dagger}$	$0.0297^{\dagger}$	-0.0104^{***}	0.0172^{**}
	(0.0055)	(0.0030)	(0.0050)	(0.0037)	(0.0073)
Repayment of debts	$0.0313^{\dagger}$	$0.0131^{\dagger}$	$0.0180^{\dagger}$	$0.0177^{\dagger}$	0.0101^{*}
	(0.0055)	(0.0031)	(0.0048)	(0.0039)	(0.0059)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0102	-0.0002	-0.0089	0.0060	0.0075
	(0.0074)	(0.0039)	(0.0066)	(0.0052)	(0.0074)
Apartment or flat	-0.0054	0.0040	-0.0087	0.0131^{***}	0.0155^{**}
	(0.0060)	(0.0032)	(0.0053)	(0.0041)	(0.0075)
Wife's characteristics					
Age	$-0.0042^{\dagger}$	$-0.0012^{\dagger}$	$-0.0030^{\dagger}$	$-0.0033^{\dagger}$	0.0003
	(0.0006)	(0.0003)	(0.0005)	(0.0004)	(0.0007)
Education (ref.: medium skilled)					
Low skilled	$-0.0399^{\dagger}$	-0.0086^{**}	$-0.0319^{\dagger}$	-0.0118^{***}	-0.0117
	(0.0059)	(0.0035)	(0.0049)	(0.0041)	(0.0073)
High skilled	$0.0789^{\dagger}$	0.0044	$0.0696^{\dagger}$	$0.0345^{\dagger}$	0.0235^{***}
	(0.0096)	(0.0048)	(0.0086)	(0.0073)	(0.0080)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0328^{\dagger}$
	–	–	–	–	(0.0075)
Blue collar high	–	–	–	–	$0.0700^{\dagger}$
	–	–	–	–	(0.0152)
Blue collar low	–	–	–	–	$-0.0315^{\dagger}$
	–	–	–	–	(0.0093)
Husband's characteristics					
Age	$-0.0034^{\dagger}$	-0.0009^{**}	$-0.0025^{\dagger}$	-0.0003	$-0.0057^{\dagger}$
	(0.0006)	(0.0004)	(0.0005)	(0.0004)	(0.0007)
Education (ref.: medium skilled)					
Low skilled	-0.0147^{**}	-0.0018	-0.0149^{***}	-0.0011	-0.0093
	(0.0065)	(0.0038)	(0.0056)	(0.0046)	(0.0079)
High skilled	-0.0133^{*}	0.0050	-0.0168^{**}	-0.0095^{*}	-0.0052
	(0.0080)	(0.0048)	(0.0068)	(0.0056)	(0.0075)
Occupation (ref.: white collar high)					
White collar low	0.0022	0.0040	-0.0005	0.0051	0.0233^{***}
	(0.0085)	(0.0047)	(0.0075)	(0.0060)	(0.0084)
Blue collar high	0.0073	0.0070	0.0021	0.0102^{*}	-0.0142^{*}
	(0.0078)	(0.0045)	(0.0068)	(0.0055)	(0.0086)
Blue collar low	0.0088	0.0023	0.0087	0.0094^{*}	0.0210^{**}
	(0.0079)	(0.0042)	(0.0071)	(0.0055)	(0.0091)
Share of years in employment	–	–	–	–	–
	–	–	–	–	–
Country characteristics					
GDP growth rate	0.0030^{**}	-0.0005	0.0030^{***}	-0.0005	$0.0076^{\dagger}$
	(0.0012)	(0.0007)	(0.0011)	(0.0009)	(0.0017)
Unemployment rate	0.0011	0.0003	-0.0024	0.0024^{**}	-0.0011
	(0.0017)	(0.0009)	(0.0015)	(0.0012)	(0.0020)
Female LFP rate	$-0.0122^{\dagger}$	$-0.0067^{\dagger}$	-0.0071^{***}	-0.0042^{*}	-0.0062^{*}
	(0.0031)	(0.0018)	(0.0027)	(0.0024)	(0.0034)
Added worker dummy	0.0287^{***}	$0.0210^{\dagger}$	0.0049	$0.0414^{\dagger}$	$0.0589^{\dagger}$
	(0.0104)	(0.0059)	(0.0093)	(0.0086)	(0.0164)
Pseudo-R^2	0.1103	0.0937	0.1234	0.0869	0.0985
Observations	56,320	56,320	56,320	50,153	43,296

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects are additionally included in the regressions. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.B3: Probit Estimations: Pooled Regressions Including Interaction with the GDP Growth Rate

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\boldsymbol{\Delta}$ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0311^{\dagger}$	-0.0124^{***}	-0.0207^{***}	$-0.0201^{\dagger}$	$-0.0278^{\dagger}$
	(0.0075)	(0.0043)	(0.0065)	(0.0056)	(0.0066)
No. of children	$-0.0236^{\dagger}$	$-0.0071^{\dagger}$	$-0.0164^{\dagger}$	$-0.0089^{\dagger}$	$-0.0192^{\dagger}$
	(0.0027)	(0.0014)	(0.0025)	(0.0018)	(0.0030)
Child age 0 to 3	-0.0142^{**}	-0.0054	-0.0093	$-0.0241^{\dagger}$	-0.0174^{**}
	(0.0072)	(0.0035)	(0.0065)	(0.0043)	(0.0076)
Child age 4 to 6	$0.0373^{\dagger}$	0.0102^{***}	$0.0267^{\dagger}$	0.0044	-0.0100
	(0.0072)	(0.0035)	(0.0064)	(0.0045)	(0.0067)
Log. equiv. disposable income (in thsd.)	0.0113^{***}	-0.0053^{***}	$0.0173^{\dagger}$	-0.0068^{***}	0.0010
	(0.0038)	(0.0019)	(0.0035)	(0.0024)	(0.0048)
Repayment of debts	$0.0308^{\dagger}$	$0.0092^{\dagger}$	$0.0209^{\dagger}$	$0.0197^{\dagger}$	0.0066
	(0.0045)	(0.0024)	(0.0040)	(0.0033)	(0.0047)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0103^{*}	0.0016	-0.0104^{*}	0.0051	0.0041
	(0.0059)	(0.0029)	(0.0054)	(0.0041)	(0.0057)
Apartment or flat	-0.0096^{*}	0.0063^{***}	$-0.0156^{\dagger}$	$0.0126^{\dagger}$	0.0143^{**}
	(0.0049)	(0.0024)	(0.0045)	(0.0033)	(0.0063)
Wife's characteristics					
Age	$-0.0043^{\dagger}$	$-0.0012^{\dagger}$	$-0.0031^{\dagger}$	$-0.0032^{\dagger}$	-0.0004
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0358^{\dagger}$	-0.0055^{**}	$-0.0307^{\dagger}$	-0.0087^{***}	-0.0009
	(0.0048)	(0.0027)	(0.0041)	(0.0033)	(0.0060)
High skilled	$0.0793^{\dagger}$	0.0025	$0.0730^{\dagger}$	$0.0262^{\dagger}$	$0.0258^{\dagger}$
	(0.0075)	(0.0034)	(0.0068)	(0.0057)	(0.0061)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0411^{\dagger}$
	–	–	–	–	(0.0058)
Blue collar high	–	–	–	–	$0.0541^{\dagger}$
	–	–	–	–	(0.0114)
Blue collar low	–	–	–	–	$-0.0357^{\dagger}$
	–	–	–	–	(0.0076)
Husband's characteristics					
Age	$-0.0029^{\dagger}$	-0.0005^{*}	$-0.0023^{\dagger}$	-0.0003	$-0.0046^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0164^{***}	-0.0035	-0.0142^{***}	-0.0038	-0.0082
	(0.0053)	(0.0027)	(0.0047)	(0.0036)	(0.0061)
High skilled	-0.0141^{**}	0.0009	-0.0145^{***}	-0.0061	-0.0002
	(0.0063)	(0.0034)	(0.0055)	(0.0045)	(0.0059)
Occupation (ref.: white collar high)					
White collar low	0.0006	0.0036	-0.0015	0.0078	$0.0269^{\dagger}$
	(0.0070)	(0.0035)	(0.0063)	(0.0048)	(0.0071)
Blue collar high	0.0101^{*}	0.0051^{*}	0.0063	0.0089^{**}	-0.0204^{***}
	(0.0060)	(0.0031)	(0.0054)	(0.0040)	(0.0063)
Blue collar low	0.0005	0.0048	-0.0030	0.0118^{***}	0.0124^{*}
	(0.0063)	(0.0031)	(0.0057)	(0.0042)	(0.0074)
Country characteristics					
GDP growth rate	0.0030^{***}	-0.0001	0.0026^{***}	-0.0001	$0.0049^{\dagger}$
	(0.0011)	(0.0006)	(0.0010)	(0.0008)	(0.0013)
Unemployment rate	0.0036^{***}	0.0004	-0.0009	0.0019^{**}	-0.0003
	(0.0014)	(0.0007)	(0.0012)	(0.0009)	(0.0016)
Female LFP rate	$-0.0095^{\dagger}$	$-0.0071^{\dagger}$	-0.0050^{**}	-0.0056^{***}	-0.0039
	(0.0025)	(0.0013)	(0.0022)	(0.0018)	(0.0027)
Added worker dummy	$0.0350^{\dagger}$	$0.0305^{\dagger}$	-0.0030	$0.0474^{\dagger}$	$0.0604^{\dagger}$
	(0.0092)	(0.0052)	(0.0081)	(0.0071)	(0.0139)
Pseudo-R^2	0.1013	0.0982	0.1116	0.0888	0.0952
Observations	87,503	87,503	87,503	76,133	73,891

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' GDP growth rate are additionally included in the regressions. The interaction effects are shown in Figure 2.1. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.B4: Probit Estimations: Pooled Regressions Including Interaction with the Female LFP Rate

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$ ME/StdE	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$ ME/StdE	$\boldsymbol{\Delta}$ **JS** ME/StdE	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$ ME/StdE
Household characteristics					
Married	$-0.0312^{\dagger}$	-0.0125^{***}	-0.0207^{***}	$-0.0201^{\dagger}$	$-0.0277^{\dagger}$
	(0.0075)	(0.0043)	(0.0065)	(0.0056)	(0.0066)
No. of children	$-0.0235^{\dagger}$	$-0.0071^{\dagger}$	$-0.0164^{\dagger}$	$-0.0089^{\dagger}$	$-0.0192^{\dagger}$
	(0.0027)	(0.0014)	(0.0025)	(0.0018)	(0.0030)
Child age 0 to 3	-0.0144^{**}	-0.0054	-0.0094	$-0.0242^{\dagger}$	-0.0174^{**}
	(0.0071)	(0.0035)	(0.0065)	(0.0043)	(0.0076)
Child age 4 to 6	$0.0372^{\dagger}$	0.0102^{***}	$0.0267^{\dagger}$	0.0043	-0.0101
	(0.0072)	(0.0035)	(0.0064)	(0.0045)	(0.0067)
Log. equiv. disposable income (in thsd.)	0.0116^{***}	-0.0052^{***}	$0.0174^{\dagger}$	-0.0066^{***}	0.0009
	(0.0038)	(0.0019)	(0.0035)	(0.0024)	(0.0048)
Repayment of debts	$0.0306^{\dagger}$	$0.0092^{\dagger}$	$0.0207^{\dagger}$	$0.0196^{\dagger}$	0.0066
	(0.0045)	(0.0024)	(0.0040)	(0.0033)	(0.0047)
Dwelling type (ref.: detached house)					
Semi-detached house	-0.0098^{*}	0.0016	-0.0101^{*}	0.0054	0.0041
	(0.0059)	(0.0029)	(0.0054)	(0.0041)	(0.0057)
Apartment or flat	-0.0089^{*}	0.0064^{***}	$-0.0152^{\dagger}$	$0.0130^{\dagger}$	0.0142^{**}
	(0.0049)	(0.0024)	(0.0045)	(0.0033)	(0.0063)
Wife's characteristics					
Age	$-0.0043^{\dagger}$	$-0.0012^{\dagger}$	$-0.0031^{\dagger}$	$-0.0032^{\dagger}$	-0.0004
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	$-0.0361^{\dagger}$	-0.0055^{**}	$-0.0309^{\dagger}$	-0.0088^{***}	-0.0010
	(0.0048)	(0.0027)	(0.0041)	(0.0033)	(0.0060)
High skilled	$0.0790^{\dagger}$	0.0025	$0.0730^{\dagger}$	$0.0260^{\dagger}$	$0.0258^{\dagger}$
	(0.0075)	(0.0034)	(0.0068)	(0.0057)	(0.0061)
Occupation (ref.: white collar high)					
White collar low	–	–	–	–	$-0.0411^{\dagger}$
	–	–	–	–	(0.0058)
Blue collar high	–	–	–	–	$0.0541^{\dagger}$
	–	–	–	–	(0.0114)
Blue collar low	–	–	–	–	$-0.0356^{\dagger}$
	–	–	–	–	(0.0076)
Husband's characteristics					
Age	$-0.0029^{\dagger}$	-0.0005^{*}	$-0.0023^{\dagger}$	-0.0003	$-0.0046^{\dagger}$
	(0.0005)	(0.0003)	(0.0005)	(0.0004)	(0.0006)
Education (ref.: medium skilled)					
Low skilled	-0.0168^{***}	-0.0035	-0.0144^{***}	-0.0040	-0.0081
	(0.0053)	(0.0027)	(0.0047)	(0.0036)	(0.0061)
High skilled	-0.0145^{**}	0.0009	-0.0147^{***}	-0.0063	-0.0002
	(0.0063)	(0.0034)	(0.0055)	(0.0045)	(0.0059)
Occupation (ref.: white collar high)					
White collar low	0.0011	0.0036	-0.0012	0.0082^{*}	$0.0268^{\dagger}$
	(0.0070)	(0.0035)	(0.0063)	(0.0048)	(0.0071)
Blue collar high	0.0102^{*}	0.0051^{*}	0.0063	0.0090^{**}	-0.0204^{***}
	(0.0060)	(0.0031)	(0.0054)	(0.0040)	(0.0063)
Blue collar low	0.0008	0.0048	-0.0029	0.0120^{***}	0.0124^{*}
	(0.0063)	(0.0031)	(0.0057)	(0.0042)	(0.0074)
Country characteristics					
GDP growth rate	0.0030^{***}	-0.0001	0.0025^{***}	-0.0001	$0.0049^{\dagger}$
	(0.0011)	(0.0006)	(0.0010)	(0.0008)	(0.0013)
Unemployment rate	0.0035^{***}	0.0004	-0.0010	0.0019^{**}	-0.0003
	(0.0014)	(0.0007)	(0.0012)	(0.0009)	(0.0016)
Female LFP rate	$-0.0096^{\dagger}$	$-0.0071^{\dagger}$	-0.0051^{**}	-0.0056^{***}	-0.0038
	(0.0025)	(0.0013)	(0.0022)	(0.0018)	(0.0027)
Added worker dummy	0.0275^{***}	$0.0299^{\dagger}$	-0.0077	$0.0455^{\dagger}$	$0.0632^{\dagger}$
	(0.0094)	(0.0051)	(0.0083)	(0.0070)	(0.0149)
Pseudo-R^2	0.1017	0.0982	0.1118	0.0893	0.0952
Observations	87,503	87,503	87,503	76,133	73,891

Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Both country and year fixed effects as well as an interaction of the added worker dummy with the countries' female labor force participation rate are additionally included in the regressions. The interaction effects are shown in Figure 2.3. LFP, labor force participation. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 2.B5: Probit Estimations: Added Worker Effect by Country Group Based on Sample Including Region-Time Fixed Effects

	$\mathbf{IA}_{t-1} \rightarrow \mathbf{A}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{UE}_t$	$\mathbf{IA}_{t-1} \rightarrow \mathbf{E}_t$	Δ **JS**	$\mathbf{PT}_{t-1} \rightarrow \mathbf{FT}_t$
			Scandinavia		
ME	0.0895*	0.0304*	0.0562	−0.0057	0.0232
StdE	(0.0457)	(0.0185)	(0.0465)	(0.0275)	(0.0386)
Δ%	–	–	–	–	–
Observations	7,249	7,249	7,249	4,529	11,226
			Continental Europe		
ME	−0.0308	0.0046	−0.0422	0.0148	0.0626***
StdE	(0.0272)	(0.0093)	(0.0260)	(0.0146)	(0.0194)
Δ%	–	–	–	–	68.03%
Observations	17,948	17,948	17,948	16,329	35,289
			Anglo-Saxon Countries		
ME	−0.0154	0.0427	−0.0640	0.0498	0.0729
StdE	(0.0558)	(0.0280)	(0.0483)	(0.0409)	(0.0462)
Δ%	–	–	–	–	–
Observations	3,129	3,129	3,129	2,760	5,596
			Mediterranean Countries		
ME	0.0605†	0.0424†	0.0168*	0.0617†	0.1076†
StdE	(0.0123)	(0.0088)	(0.0097)	(0.0109)	(0.0295)
Δ%	43.02%	72.16%	–	81.25%	41.94%
Observations	28,585	28,585	28,585	26,811	11,885
			Central and Eastern Europe		
ME	0.0384**	0.0313***	0.0071	0.0585†	−0.0347
StdE	(0.0153)	(0.0097)	(0.0134)	(0.0136)	(0.0360)
Δ%	19.88%	58.11%	–	90.95%	–
Observations	23,919	23,919	23,919	23,393	8,336

*Source: EU-SILC, own calculations. Notes: Results present average marginal effects, calculated as average effects over all individuals in the respective sample, and robust standard errors (clustered at household level) obtained from probit estimations of women's labor market transitions on a set of individual, household, and country characteristics. $IA_{t-1} \rightarrow A_t$ refers to women's transitions from inactivity to activity; $IA_{t-1} \rightarrow UE_t$ refers to women's transitions from inactivity to unemployment; $IA_{t-1} \rightarrow E_t$ refers to women's transitions from inacitity to employment; Δ JS refers to women's job-search transitions; $PT_{t-1} \rightarrow FT_t$ refers to women's transitions from part-time to full-time employment. The added worker dummy takes value 1 if the husband becomes unemployed from $t-1$ to t and 0 if he stays employed. Δ% refers to the percentage change in women's probability of adjusting their labor supply due to their husband's unemployment. Percentage changes are shown for significant added worker effects (5% level) only. Region-time fixed effects are additionally included in the regressions. Asterisks denote statistical significance: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

Chapter 3

Berlin Calling – Internal Migration in Germany*

3.1 Introduction

Demographic change is one of the main social, political, and economic challenges for many developed countries in the coming decades. Also in Germany, the population is both declining and aging rapidly. The challenges of this development for the social security systems, in particular the health and pension system, have been analyzed comprehensively.[1] One aspect that has largely been ignored in the ongoing discussion so far is the regional heterogeneity of this demographic process. As shown in Figure 3.1, regional age heterogeneity is prevalent in Germany with a clear tendency of younger people clustering in urban areas (panel (a)), middle-aged individuals in urban and suburban areas (panel (b)), and individuals older than 50 years in East Germany as well as in some rural parts of West Germany (panels (c) and (d)).

The age structure of a region has implications on economic factors like the human capital base (brain drain / brain gain) and the innovation potential of the affected regions, which in turn affect the economic performance of these regions (Gregory and Patuelli, 2015). Since fertility and mortality rates appear to be stable in the short-run (Destatis, 2016; Dudel and Klüsener, 2016), migration flows constitute one of the most important determinants of changes in the regional age structure. In this paper, we will focus on internal migration flows in Germany.[2] As internal migration, if heterogeneous across

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[1] See, e.g., Börsch-Supan et al. (2016).

[2] We will ignore international migration to Germany, since international migration flows and their age composition are already widely analyzed. See Greenwood (1997) for an overview of the literature.

age groups, influences both the source region's as well as the host region's age structure, we argue that it is important to gain insights into the different migration patterns of interregional migrants of different age groups. Our analysis builds conceptually on previous studies by Hunt (2006), Mitze and Reinkowski (2011), and Sander (2014), who conclude that economic factors provide the most explanatory power concerning internal migration flows in Germany.

We contribute to this literature by using highly disaggregated data compared to previous works, as well as by using age group-specific wages in order to measure earning perspectives for each group more precisely. Furthermore, for the first time, we add a price index based on housing prices to our model, which enables us to take regional differences in living costs into account. Based on various data sources on the county level[3], we estimate an extended gravity model in order to investigate the locational decisions of internal migrants of different age groups.

In a first step, we provide a detailed descriptive overview of the internal migration flows of different age groups in Germany. Our focus is to document heterogeneities across age groups concerning the frequency of migration and the location choice of the migrants. Compared to the previous literature, our analysis is based on the county level, which enables us to analyze the determinants of migration more precisely. We show that migration behavior differs significantly between age groups, with the youngest group in our analysis (18 to 29 years old) being by far the largest (43% of all migrants), as well as the one with the highest urbanization tendencies. In a second step, we pinpoint the exact drivers of the heterogeneous migration behaviors of different age groups in order to shed light on possible heterogeneous magnitudes of push and pull factors across age groups.

In line with the majority of existing empirical studies, we find that labor market factors are the most powerful determinants of internal migration patterns. Our results further indicate that age group-specific wages are indeed a more precise measure for earnings perspectives explaining regional migration and affect predominantly younger age groups.

The paper proceeds as follows. The next Section provides an overview of the framework of migration theory and the relevant empirical literature. The Section further briefly presents historical internal migration patterns in Germany, since internal migration in Germany differs significantly from that in other countries. Section 3.3 outlines the empirical strategy and describes our data. The results of our descriptive and multivariate analysis are presented in Sections 3.4 and 3.5, respectively. Section 3.6 concludes.

[3]In this paper, the term 'county' refers to German *Landkreise*.

3.2 Theoretical Framework and Literature

The theoretical framework for the analysis of migration is based on the human capital theory developed by Sjaastad (1962) and Becker (1964). This model treats the migration decision as an investment decision, i.e., the returns to migration should exceed the cost of migration. Therefore, labor market conditions are at the core of the theoretical notion of migration theory. This idea has been further formalized by Todaro (1969) and Harris and Todaro (1970) who relax the assumption of complete information about wages and employment opportunities in all potential host destinations. Instead, they set up a model in which an individual compares the expected income from staying in the source region with the expected income from moving to another region less the cost of the move. In this model, income is a function of the wage rate and the probability of being employed in the respective region, which in turn is a function of the region's unemployment rate.

At the aggregate level the individual's migration decision can be modeled by a gravity model, which is based on the early work of Ravenstein (1885, 1889) and was first introduced by Zipf (1946). Zipf (1946) uses the physical concept of gravity and explains the volume of migration to be proportional to the product of the origin and destination population, and inversely proportional to the distance of the two regions. Combining the neoclassical idea of migration with the basic gravity model leads to an extended gravity model, which includes variables capturing the push and pull factors proposed by the neoclassical theory. This extended model can be written as:

$$M_{ij} = f(C_{ij}, P_i, P_j, Y_i, Y_j, U_i, U_j), \tag{3.1}$$

where the number of migrants from region i to region j is a function of migration costs C_{ij}, the source (host) region's population P_i (P_j), a measure for the source (host) region's wage rate Y_i (Y_j), and the source (host) region's unemployment rate U_i (U_j). The model is usually extended by measures for local amenities and by variables reflecting regional living costs. In the simple model shown in Equation (3.1), the number of migrants between any two regions i and j is expected to decrease with increasing cost. The population of the origin, as well as the destination region is expected to positively contribute to the number of migrants. Ceteris paribus, the number of migrants is expected to be positively (negatively) associated with the wage rate and negatively (positively) with unemployment rate in the host (source) region.[4]

The implications of this model are empirically well documented, although mixed results concerning the influence of some particular push and pull factors are found. Furthermore,

[4]For a detailed description and the development of the migration theory, see, among others, Greenwood (1997) and Bodvarsson et al. (2015).

these factors appear to be of different importance for the migration decision of individuals at different stages of their life cycle, with individuals in their working age reacting more sensitive towards regional differences in labor market conditions. Empirical studies generally confirm these predictions of the neoclassical model: younger individuals react more sensitive towards regional differences of labor market characteristics compared to older groups (see, among others, Bell and Muhidin (2009); De Groot et al. (2011); Etzo (2011); Goss and Schoening (1984); Gregg et al. (2004); Piras (2017); Plane et al. (2005)).

In general, these insights are true for Germany as well. The German history of internal migration, however, is rather particular. In the first years after World War II, migration patterns in Germany were dominated by forced migrants from the former eastern territories of the German Reich.[5] In the 1950s and 1960s, when the economy was booming, West Germany, as most of Western Europe, was characterized by urbanization trends (Fielding, 1989; Kontuly et al., 1986). This pattern changed during the 1970s and 1980s, where counterurbanization and suburbanization were the most prevalent trends. According to Kontuly (1991), these trends were especially strong in former industrial areas. The main destination for internal migrants further changed from the West to the South and the overall prevalence of internal migration in Germany declined from the 1960s until the 1990s (see, e.g., Bucher and Heins (2001)). The migration patterns of the following decade were largely shaped by the German reunification and the subsequent period of East-West labor migration, which partly balanced wage differentials in Germany (Decressin (1994), Hunt (2000), Burda and Hunt (2001), Parikh et al. (2003), Heiland (2004), and, in part, Hunt (2006) and Alecke et al. (2010)). Especially forced migration after 1945 and East-West migration after the collapse of the iron curtain in 1989 are a particular German phenomena, making internal migration in Germany a relatively unique case and possibly distorting analyses on the influence of labor market factors on internal migration covering these periods.

Previous empirical analyses predominantly focus on German interstate migration, which limits the implications of the results concerning migration between smaller regional units. They further lack geographical information, such as the distance between regions, which prohibits estimating gravity models. Nonetheless, they find significant effects of labor market disparities on internal migration flows. One noticeable finding of Hunt (2000) and Burda and Hunt (2001) is that labor market factors have higher explanatory power as a pull factor, and variables like the unemployment rate are insignificant in the source regions. Hunt (2006) finds that wages have especially high explanatory power in the host region, while unemployment seems to be less important overall. This implies the effects of economic factors as push and pull factors to be asymmetric.

[5] See Bauer et al. (2013) for a detailed discussion of post-war forced migration into Germany.

Different to Hunt (2000, 2006) and Burda and Hunt (2001), Mitze and Reinkowski (2011) and Sander (2014) do not explicitly deal with post-reunification movements and base their analysis on somewhat later time frames, 1996 to 2006 and 1995 to 2010, respectively. Furthermore, Mitze and Reinkowski (2011) use 97 Spatial Planning Regions and Sander (2014) 132 analytical regions calculated on the basis of county data for their analysis. In contrast to Mitze and Reinkowski (2011), who use extended gravity models to analyze the drivers of migration, Sander (2014) estimates a gravity model only including the distance and population as explanatory variables.

Sander (2014) underlines that migration patterns in Germany are heterogeneous across age groups. 18 to 24 year olds move predominantly out of non-urban areas. In comparison, driven by more heterogeneous reasons to migrate, the group of 25 to 29 year olds has, in addition to moving to urban centers, a higher tendency to move to areas in commuting distance to urban areas. The group of 30 to 49 year olds shows a pattern that contrasts the anecdotal notion of middle-aged families in suburban areas. It seems that over time, middle-aged families tend to contradict this stereotype to an extent by staying in urban centers instead of moving to suburban areas. Overall, Sander (2014) finds that migration to urban centers is increasing, while out-migration from urban centers is decreasing, especially for the younger age groups. These results seem to reinforce the hypothesis that internal migration intensifies existing demographic trends.

Mitze and Reinkowski (2011) document a high explanatory power for most of the economic factors. They find that income, measured as GDP per capita, is an important driver of locational choices. In particular the income in the destination region seems to be a strong pull factor for migration. Additionally, employment prospects appear to affect internal migration substantially. The discrepancy to previous papers, in which only little effects of unemployment on migration are found, might stem from the different aggregation level of their data, since earlier studies predominantly used federal states as observation unit. Mitze and Reinkowski (2011) further investigate the age-specific heterogeneity of migration determinants. The results suggest that labor market factors affect only the migration decision of individuals below age 50, i.e., those with a strong labor market attachment. Younger age groups are also found to be more sensitive to income prospects by Burda and Hunt (2001) and Hunt (2006). These findings seem to underline the heterogeneous effects of economic factors across age groups, at least in magnitude, and in some cases even in direction.

3.3 Empirical Strategy and Data

3.3.1 Empirical Strategy

To analyze the determinants of internal migration in Germany, we estimate an extended gravity model (Greenwood, 1997) of the form:

$$M_{ijt} = \alpha d_{ij} + X_{it}^{'}\beta + X_{jt}^{'}\gamma + \phi_i + \kappa_j + \theta_t + \varepsilon_{ijt}. \tag{3.2}$$

The dependent variable M_{ijt} is the number of internal migrants between source county i and host county j in year t. The variable d_{ij} captures the distance in kilometers between the centroids of a county pair. Distance is included to proxy for migration costs, including the actual monetary cost of moving from county i to j, information and search costs, as well as the psychic costs of changing residency (Greenwood, 1997; Greenwood and Hunt, 2003). The vectors X_{it} and X_{jt} control for time-variant source and host county characteristics, respectively.[6] The vector X_{it} (X_{jt}) controls for the population of the source (host) county. In our baseline specification X_{it} (X_{jt}) further includes the source (host) county's unemployment rate, GDP per capita, (age group-specific) average wage, and a rental price index. The unemployment rate has been added to the model in order to reflect the employment prospects, whereas the GDP per capita proxies macroeconomic business cycle effects in the respective region (Bodvarsson et al., 2015). The wage captures the income perspectives of each group in the respective region, and the rental price index reflects the living costs in a region. ϕ_i denotes fixed effects for the counties of origin and κ_j for the counties of destination, while θ_t refers to year fixed effects.

In a first step, we estimate this extended gravity model for our overall sample. Subsequently, we estimate Equation (3.2) separately for the four age groups (i) 18 to 29 years, (ii) 30 to 49 years, (iii) 50 to 64 years, and (iv) individuals aged 65 years and older. In these age group-specific estimations, except for the oldest group, we include the respective age group-specific wage instead of the average wage. By controlling for regional age-specific wages, we are able to proxy for group-specific regional income perspectives more precisely than most related empirical studies. Concerning the estimation of Equation (3.2) for the age group of people over 65 years, we exclude wage as the majority of this group has already left the labor market. By estimating these sub-sample regressions, we take into account that push and pull factors of migration might differ across age groups. For example, young individuals may particularly be attracted by urban areas with relatively promising job opportunities, e.g., a low unemployment rate, while individuals in the middle

[6] All variables in the model, apart form the dependent variable, are included in logarithmic form. This enables us to interpret them as elasticities. For the sake of readability, we refer to them only by their variable names in the rest of this paper.

of their life cycle may put more emphasis on other factors, such as earnings and lower living costs. Individuals at the end of their working life might be affected by even different factors.

We estimate Equation (3.2) using the Poisson Pseudo-Maximum-Likelihood (PPML) estimator suggested by Santos Silva and Tenreyro (2006), which uses the absolute number of migrants between any pair of counties as dependent variable. This solves two fundamental problems of estimating gravity models using OLS. First, the log-linearization of the dependent variable truncates the sample due to the county pairs with zero observed migration, which are possibly not random, and thus may bias our estimates. Second, in a gravity model, heteroskedasticity does not only affect the efficiency, but also the consistency of a linear estimator. This problem is also solved by PPML (Santos Silva and Tenreyro, 2006).

3.3.2 Data

Our analysis makes use of various data sources in order to obtain a comprehensive set of explanatory factors. Specifically, we employ data on county to county migration including the migration status and the age group of the migrants. Since migration behavior of international migrants might be systematically different to the behavior of natives, e.g., due to network effects, we restrict our analysis to individuals with German nationality (Bodvarsson et al., 2015). Information on the number of inter-regional migrants for each age group is drawn from changes in the place of residence as captured by the German population registers. These registers record every change of permanent residence across all counties (NUTS-3 level) within a year, including multiple and return moves. The data is disaggregated by age groups and by whether the person is a German citizen. The data needs to be corrected due to a peculiarity concerning the settlement of ethnic German migrants from Eastern European countries. All ethnic Germans are required to enter the country through a single 'border transit center' (*Grenzdurchgangslager*) located in the county *Göttingen* in Lower-Saxony. After being registered and accepted as an ethnic German immigrant, they are allocated to the German federal states following the *Königssteiner Schlüssel*, a German allocation rule based on the regional tax base and population.[7] Because of this transit center, *Göttingen* appears to have extraordinary high migration flows. Additionally, after naturalization they appear as German migrants in our

[7]The allocation of these migrants varies between different federal states. For example, in the case of Baden-Wuerttemberg, they are transferred directly to particular counties and towns, whereas in Bavaria they are allowed to freely choose their region of settlement within the state. Further information on the distribution system for ethnic Germans can be found in Haug and Sauer (2007).

data.[8] Therefore we exclude *Göttingen* from our analysis entirely.

The information on the regional age-specific wages are provided by the IAB. They are calculated based on the full sample of the Establishment History Panel (BHP). Data on the unemployment rates, GDP per capita, and the population at the county-level is drawn from the *Regionaldatenbank*, a database of regional statistics published by the German Federal Statistical Office.[9] We differentiate between urban and rural areas based on population size and density. Urban areas are defined as either counties or district-free cities with a population density above 150 inhabitants per square kilometer. This calculation follows the definition of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

The centroids for the calculation of distances are based on shape files provided by the German Federal Agency for Cartography and Geodesy (BKG), which uses the territorial boundaries of the counties by the end of each year.[10] Information on regional age-specific gross daily wages is provided by the Institute for Employment Research (IAB) and calculated exclusively for this project using the full sample of employees subject to social security contributions.[11]

Finally, we use a rental price index derived from the RWI-GEO-REDX data set, which is provided by the FDZ Ruhr at the RWI. Based on data from *Immobilenscout24*, the leading online platform for housing in Germany, the price index is created using hedonic price regressions, which control for the quality of the facility as well as regional characteristics and is provided as deviations of housing costs from the national mean.[12] Note that housing costs constitute the biggest single share of living costs in Germany, reaching a share of almost 20% in the consumer price index (Destatis, 2019).

3.4 Descriptive Analysis

For the descriptive analysis, we use the full sample of internal migrants, restricted to German natives only, for the years 2008 to 2014. Depending on the year, we observe 401 to 412 counties with a total of 15,878,335 individuals changing residency across county borders in Germany in our observation period.

Concerning the intensity of internal migration, we find the same patterns as in other

[8]The distribution of the naturalized Germans and the underlying legal process is discussed in more detail in Sander (2014).

[9]https://www.regionalstatistik.de/genesis/online

[10]http://www.geodatenzentrum.de/geodaten/gdz_rahmen.gdz_div?gdz_spr=deu&gdz_akt_zeile=5&gdz_anz_zeile=1&gdz_unt_zeile=0&gdz_user_id=0

[11]For detailed information on the data and the underlying calculations, see Schmucker et al. (2016).

[12]See Klick and Schaffner (2019) for a detailed explanation of the data set and the corresponding price index.

industrialized countries. Migration intensity in Germany differs according to the life cycle, which is illustrated by Figure 3.2, showing the skewed distribution of internal migrants across age groups. Compared to the group between 0 and 18 years, we observe a threefold increase in migration intensity for the group between 18 and 29 years, and a sharp decline for the older groups. The age group between 18 and 29 years constitutes 14% of the total population, but accounts for 43% (6.9 million) of all native internal migrants in Germany. This is the largest group of internal migrants, followed by the age group between 30 and 49 years being the largest population group (28%) but accounting only for 29% (4.6 million) of internal migrants. With shares of 8% and 6%, respectively, the other two age groups (50 to 64 years and older than 64 years), both representing around 21% of the total population, are of minor importance for the internal migration flows in Germany.[13] These numbers are relatively stable throughout the years of our observation period, which is illustrated in Figure 3.A1 in the Appendix.

Additional to migration intensity, destination choices of internal migrants also differ across age groups. Table 3.1 shows the number of migrants by source and host counties differentiated by rural and urban areas. A large majority of internal migrants (12 million or 76%), originate from counties classified as urban and 24% from counties classified as rural. 3.6 million (23%) individuals migrate into rural counties, while 12.3 million (77%) migrate into urban counties, resulting in a migration gap of roughly 250,000 individuals less living in rural counties. If age groups are examined separately, the disparity of regional choices appears to be even more pronounced. From the 6.9 million migrants in the age group between 18 to 29 years, 1.7 million (25%) originate from rural counties and 5.1 million (75%) originate from urban counties. Only 1.3 million (19%) of them migrate into rural destinations, while the remaining majority of 5.6 million chooses to migrate into urban areas. This leads to a migration gap of almost 460,000 individuals in their age group for the rural counties. For the remaining age groups, this picture is reversed. Compared to younger groups, more individuals move to rural instead of urban destinations, resulting in a rural migration surplus of 83,561 individuals for the age group 30 to 49 years, around 46,000 for the age group 50 to 64, and around 20,000 for the age group older than 65.

These results indicate that both, the intensity as well as the location choice of internal migrants differ largely across age groups with the youngest age group differing distinctively from the others. Their migration behavior leads to an increase in the share of the younger population in urban counties and to a decline of the same share in rural counties. Vice versa, the migration patterns of the other age groups leads to an increase in the population share of the older age groups in rural counties, and to a decrease in urban counties. Hence,

[13]The remaining 2 million (13%) internal migrants are formed by the group of individuals under 18 year old. Since the largest part of this group can be assumed to move with their parents, they are not part of the analyses.

these trends reinforce regional age heterogeneity. These migration patterns are displayed geographically in Figure 3.3. It highlights counties with positive net migration for all age groups (panel (a)), as well as differentiated for the four age groups (panel (b) to panel (d)). Again, this figure highlights the pronounced disparities between the youngest and the other age groups.

The individual effect of internal migration on the size of the population can be large for many counties. For one, the county of *Bautzen* has lost 12,292 people of the initial 328,990 inhabitants in 2008 due to internal migration. 10,924 or 89% of these migrants were in the age group 18 to 29, while the initial population of this age group was only 46,420 individuals. Hence, since 2008 almost a quarter of the 18 to 29 year old left *Bautzen*. Comparable figures can be observed for several other counties in East Germany and for some rural areas of West Germany. Figure 3.4 shows this development geographically. These maps display the total amount of net migration of the respective county between 2008 and 2014 as a share of the initial population of the respective age group in the year 2008, illustrating the effect of internal migration on age polarization. Panel (a), shows that the biggest relative loss of population occurred in eastern and some western rural counties, whereas the highest migration gains can be observed in metropolitan and suburban areas no matter whether in the East or the West. Panel (b) once more highlights the extreme clustering of younger individuals in urban areas and a loss of up to 33% in some rural counties. Panels (c) to (e) show that the migration behavior of the older groups is rather similar, reflecting the findings from Figure 3.3.

The impression that people in one age group migrate predominantly into regions with a high share of people in the same age group, is supported by a PPML regression of the number of migrants on the age group-specific age shares of the respective source and the host counties, and the distance. The results can be found in Table 3.2. As expected, the estimated coefficient for the distance is negative and significantly different from zero, indicating that migration predominantly takes place between close counties. The estimated coefficients for the source county's age-specific population share are positive and significant for all age groups. The estimated elasticities are close to one for all groups except for the 50 to 64 year olds. This effect, however, is not surprising. If the share of an age group in a certain region is large, the sending potential of this region is higher as well. Therefore, this can be interpreted as a mechanical effect. The estimated effects for the host county, however, are more interesting. The effect is positive for all age groups except for the one aged 30 to 49 years, for which it is negative. This indicates, even though not being a causal effect, that the number of in-migrants is higher in regions in which already a large share of the respective age group resides. For the age group 30 to 49 years, however, the opposite is true. They predominantly migrate into regions in which the share of people

in their age group is small. Overall, these results underline the results obtained before. The youngest and oldest age groups are attracted by regions in which the share of people belonging to the same age group is relatively high.

In general, we find strong urbanization tendencies regarding internal migration in Germany, which are driven to a large extent by the youngest age group in our analysis, which accounts for 43% of all internal migrants. The older age groups have an opposite migration pattern. Since the migration intensity of these older groups is substantially lower, (younger) migrants cluster in metropolitan areas and a large share of them does not seem to leave the cities at later points in the life cycle.

3.5 Multivariate Analysis

For the multivariate analysis, we exclude counties with non-constant boundaries during our sample period, and observations with missing values in our variables of interest. In doing so, we end up with 1,089,884 observations and 15,290,701 adult German internal migrants in the years from 2008 to 2014.[14] Since we use the borders of the counties from 2014, we observe, depending on the year, 377 to 401 counties.

The estimation results for our basic model (Equation (3.2)) are shown in Table 3.3.[15] Column (i) shows the results for the group containing all ages, column (ii) for the age group 18 to 29 years, column (iii) for the age group 30 to 49 years, column (iv) for the age group 50 to 64 years, and column (v) those for the age group 65 years and older. In columns (ii), (iii), and (iv) we use age group-specific rather than average wages as in the overall estimation.[16] In column (v), we exclude wages altogether, because the group of 65 years and older have a high propensity of already having left the labor market.

The estimation results for the overall sample shown in column (i) are mostly in line with economic theory. We find a negative effect for the distance variable, which means that a larger distance decreases the number of migrants with an estimated elasticity of around -1.78. In absolute terms, the coefficient of the distance variable is large compared to the other estimated coefficients. Concerning the influence of population size, we find that source counties with larger population experience higher numbers of out-migrants, while the host county's population size does not affect the number of in-migrants significantly. While the effect for the source county is as expected and likely to be a mechanical effect

[14] Sample means are displayed in Table 3.A1 in the Appendix.

[15] We have also estimated the model using OLS. The results are shown in Table 3.A2 in the Appendix. The results obtained by OLS are comparable to those obtained by PPML.

[16] We estimated the sub-samples using the overall average wages without finding significant differences in the directions of the effects. The change in the wage variable mainly affects the coefficients concerning the age group 18 to 29 years. The results are shown in Table 3.A3 in the Appendix.

reflecting the higher migration potential of larger regions, the insignificant host county effect is counterintuitive.

Columns (ii)-(iv) of Table 3.3 highlight the heterogeneity of the population effect across age groups. Concerning the host counties, the effects of population size is positive for the age group 18 to 29 years, and negative for the other age groups. Compared to the host counties, the source county's population size effect appears to be positive for all age groups, even though only statistically significant for those younger than 50 years. The estimated effects concerning population size confirm the findings from the descriptive analysis: the majority of internal migrants originates from larger counties or district free cities. This is attributable to the fact that large counties have a larger migration potential as sending regions. The youngest age group predominantly migrates into more populated counties, while the older age groups seem to prefer more rural counties with smaller populations.

The source county's unemployment rate predominantly serves as a push factor. As for the population effect, the effect of the unemployment rate on migration appears to decrease with age, i.e., individuals in the age group 18 to 29 years react strongest to an increase in the unemployment rate of the source county, while the oldest age group appears not to be affected by the unemployment rate in a significant way, possibly because the latter choose to migrate not primarily due to labor market considerations. This pattern is in line with the findings of Mitze and Reinkowski (2011), who find unemployment effects exclusively for workforce relevant age groups as well. The unemployment rate in the host county is negatively associated with the number of in-migrants. Note, however, that this effect appears to be driven only by the age group 30 to 49 years.

Columns (ii)-(iv) of Table 3.3 further indicate that the GDP per capita is only negatively associated with the number of out-migrants for the two younger age-groups, while a higher GDP per capita fosters the out-migration of individuals older than 49. A higher GDP per capita in the host county increases in-migration for all age-groups but the youngest. Compared to GDP per capita, the effects of (age group-specific) wages appears to be more consistent, being negatively related to out-migration and positively related to in-migration. Again, younger age-groups tend to react most sensitive to wages. Housing costs in the source and host county have a significant but rather small effect on internal migration flows, indicating that the influence of regional prices is relatively small in magnitude. While higher rental prices reduce in-migration for all groups to a similar extent, rental prices in the source county only fosters the out-migration of those in the age group 30 to 49, whereas in the other age groups out-migrations is affected negatively. Overall, rental prices appear to play only a minor role for the decision to migrate and – at least if compared to other factors – for the decision where to migrate.

Our results confirm the findings of the previous literature in several ways. First,

the results indicate that economic factors have a strong influence on internal migration decisions in Germany. The effects of these factors are significant in the predicted ways for almost all age groups. We further observe heterogeneities across age groups, which possibly stem from life cycle effects. The effect of the wage as a pull factor seems to influence the youngest age group in particular. This is in line with the literature arguing that younger workers have on average higher returns to migration compared to other groups (Lehmer and Ludsteck, 2011). However, it is important to keep in mind that the reported results constitute correlations rather than causal effects, since the explanatory variables cannot be considered as exogenous in many cases. It is possible that migration itself can have an effect on the explanatory variables. Therefore the results are likely to suffer from reverse causality. This could especially be the case for wages and the rental price index, a connection that has been established, e.g., by Fendel (2016) for Germany.

3.6 Conclusion

In this paper, we have analyzed internal migration behavior in Germany. We identified differences in locational choices and the importance of push and pull factors of migration across age groups and revealed that urbanization tendencies are predominantly driven by younger migrants.

Our analysis is based on small scale administrative data, containing every migration movement across county borders between 2008 and 2014 disaggregated for different age groups. This data is further merged with regional information on unemployment, GDP, (age group-specific) wages, and housing costs. The empirical strategy we use is based on the gravity migration model and estimated using the PPML technique as suggested by Santos Silva and Tenreyro (2006). This strategy implies a positive connection between population and migration and a negative one between distance and migration. Furthermore, if migration is viewed as an investment decision, locational choices should be driven by interregional disparities in income perspectives. Previous studies tried to measure income perspectives using GDP and unemployment rates in the respective regions. We argue that wages, especially age group-specific wages, are more suitable for explaining income perspectives. Furthermore, we are able to use a hedonic price index for rents, based on *Immobilienscout24* data, to take disparities in living costs between regions into account, which have been largely neglected in previous studies. This enables us to provide a more precise picture of the role of living costs concerning migration decisions.

The descriptive analysis shows that the largest share of internal migrants is comprised by the age group between 18 and 29 years, which accounts for more than 40% of the migrants. The major part of internal migration is directed to urban areas, which is

especially true for the youngest group intensifying the age polarization between rural and urban areas. These findings are reinforced by regression results indicating that especially the youngest and oldest groups choose locations with higher population shares of their own age groups.

The general estimation results concerning the standard labor market indicators like the unemployment rate and GDP per capita generally confirm the implications of the neoclassical migration model. In addition, we find that wages have high explanatory power for internal migration in Germany and that these estimates are robust across several specifications. Higher wages in a region leads to lower migration outflows and higher migration inflows. Living costs do not seem to have a strong effect on out-migration, higher costs only reduces the amount of in-migrants. However, these effects are comparably small in magnitude.

To demonstrate the heterogeneous effects of labor market variables on migration behavior over the life course, we disaggregated our sample into four age groups. Indeed, the labor market indicators have different effects across age groups. Unemployment is a push factor for all groups in working age, but it is only connected to in-migration for the age group between 30 and 49. Housing prices in the source county influences the age group between 30 and 49 positively implying that rising living costs increase out-migration of this age group from the respective region, while higher housing prices in the host-county appear to decrease in-migration. Wages influence different age groups heterogeneously as well: higher wages in the source- (host-) county increase (decrease) in- (out-) migration for individuals younger than age 50, while the migration decision of older age groups does not seem to be affected by wages.

Tables

Table 3.1: Number of Internal Migrants by Age Group and County Type

	All	18-29	30-49	50-64	65+
	Source County				
Rural	3,800,017	1,736,074	975,527	315,205	266,278
	24.14%	25.50%	21.22%	24.48%	26.99%
Urban	11,941,342	5,073,034	3,622,410	972,376	720,398
	75.86%	74.50%	78.78%	75.52%	73.01%
	Host County				
Rural	3,550,055	1,280,311	1,057,797	360,755	286,398
	22.55%	18.80%	23.01%	28.02%	29.03%
Urban	12,191,304	5,528,797	3,540,140	926,826	700,278
	77.45%	81.20%	76.99%	71.98%	70.97%
Total	15,741,359	6,809,108	4,597,937	1,287,581	986,676

Source: Destatis. Note: The table shows the total number and the share of internal migrants by source and host differentiated by rural and urban areas.

Table 3.2: Gravity Model of Internal Migration including Regional Age Group-Shares

	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.6973^{***}	-1.8121^{***}	-1.9100^{***}	-1.8795^{***}
	(0.0074)	(0.0087)	(0.0074)	(0.0077)
Source county characteristics				
Age-specific population share	1.0221^{***}	1.1015^{***}	0.4157^{***}	1.0567^{***}
	(0.0236)	(0.0877)	(0.0657)	(0.1324)
Host county characteristics				
Age-specific population share	0.4977^{***}	-0.7125^{***}	0.8363^{***}	0.3554^{**}
	(0.0269)	(0.0793)	(0.0707)	(0.1301)
R^2	0.7904	0.8033	0.8114	0.7902
Observations	1,089,884	1,089,884	1,089,884	1,089,884

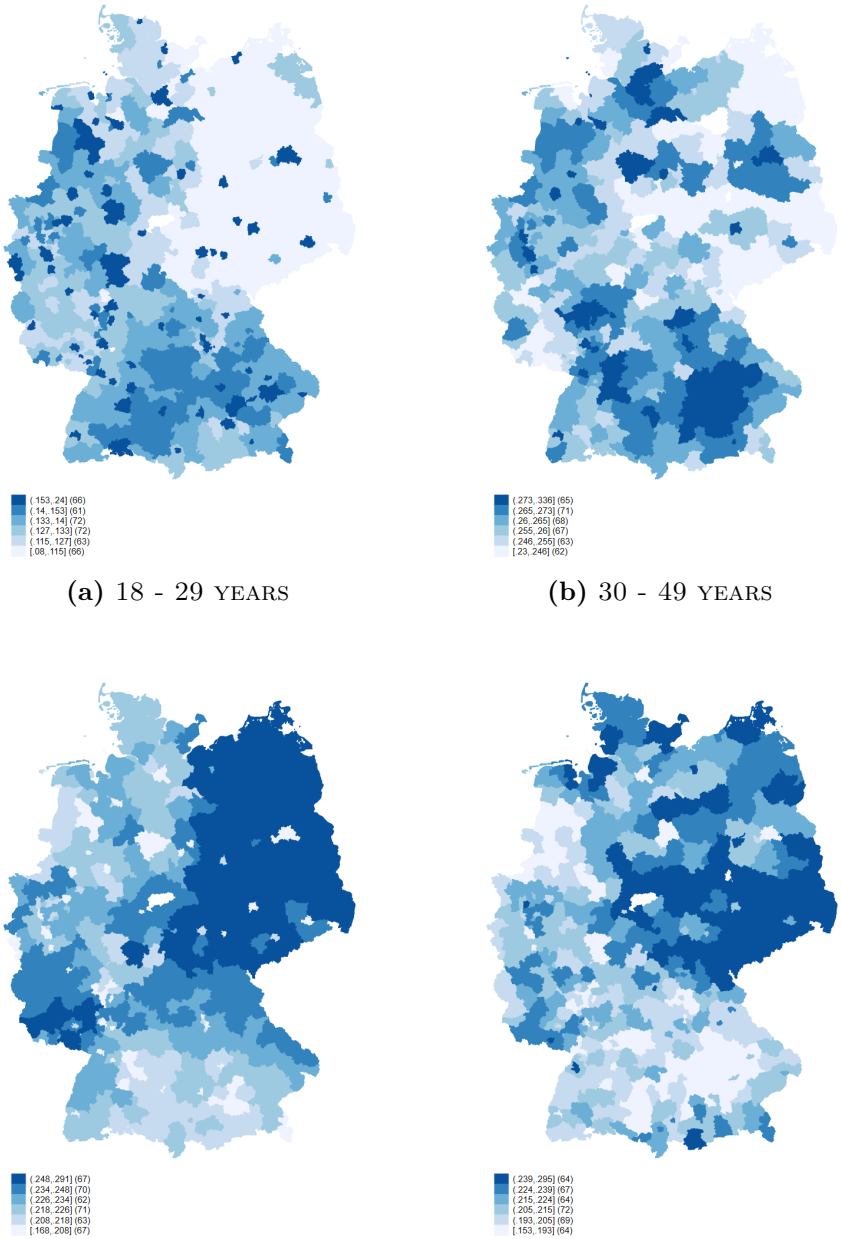
*Source: Destatis, IAB, Immobilienscout24; authors' calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 3.3: Gravity Model of Internal Migration

	(All) β/StdE	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.7771^{***}	-1.6974^{***}	-1.8121^{***}	-1.9099^{***}	-1.8795^{***}
	(0.0075)	(0.0074)	(0.0087)	(0.0074)	(0.0077)
Source county characteristics					
Population	0.9025^{***}	1.5560^{***}	0.8581^{***}	0.1255	-0.1507
	(0.0698)	(0.0784)	(0.0810)	(0.1191)	(0.1486)
Unemployment rate	0.1362^{***}	0.2676^{***}	0.0559^{***}	0.0815^{***}	-0.0111
	(0.0115)	(0.0135)	(0.0162)	(0.0221)	(0.0280)
GDP per capita	-0.0652^{**}	-0.2184^{***}	-0.0802^{*}	0.1094^{**}	0.2677^{***}
	(0.0222)	(0.0247)	(0.0318)	(0.0385)	(0.0469)
Age-specific average wage	-0.6130^{***}	-0.2293^{***}	-0.2689^{***}	-0.1085	–
	(0.0598)	(0.0687)	(0.0727)	(0.0713)	–
Rental price index	0.0003	-0.0008^{*}	0.0016^{***}	-0.0016^{***}	-0.0002
	(0.0003)	(0.0003)	(0.0004)	(0.0005)	(0.0006)
Host county characteristics					
Population	-0.0487	0.5894^{***}	-0.5280^{***}	-0.6374^{***}	-0.1665
	(0.0702)	(0.0859)	(0.0823)	(0.1127)	(0.1365)
Unemployment rate	-0.0758^{***}	0.0119	-0.1527^{***}	-0.0166	0.0327
	(0.0111)	(0.0131)	(0.0149)	(0.0229)	(0.0273)
GDP per capita	0.0090	-0.1319^{***}	0.1490^{***}	0.1019^{**}	0.0150
	(0.0232)	(0.0275)	(0.0294)	(0.0394)	(0.0478)
Age-specific average wage	0.2459^{***}	0.4161^{***}	0.3696^{***}	0.0278	–
	(0.0662)	(0.0667)	(0.0789)	(0.0743)	–
Rental price index	-0.0030^{***}	-0.0024^{***}	-0.0031^{***}	-0.0049^{***}	-0.0023^{***}
	(0.0003)	(0.0004)	(0.0003)	(0.0005)	(0.0005)
R^2	0.7994	0.7890	0.8035	0.8110	0.7904
Observations	1,089,884	1,089,884	1,089,884	1,089,884	1,089,884

*Source: Destatis, IAB, Immobilienscout24; authors' calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Figures



(a) 18 - 29 YEARS **(b)** 30 - 49 YEARS

(c) 50 - 64 YEARS **(d)** 65+ YEARS

Figure 3.1: REGIONAL AGE SHARES, QUANTILES (2014)

Source: Destatis, authors' calculations. Note: The figure shows the share of the respective age group relative to the overall population for every county in the year 2014. The first two values in the legend indicate the interval for the respective age share. The value in the last parenthesis indicates the number of counties for the respective interval.

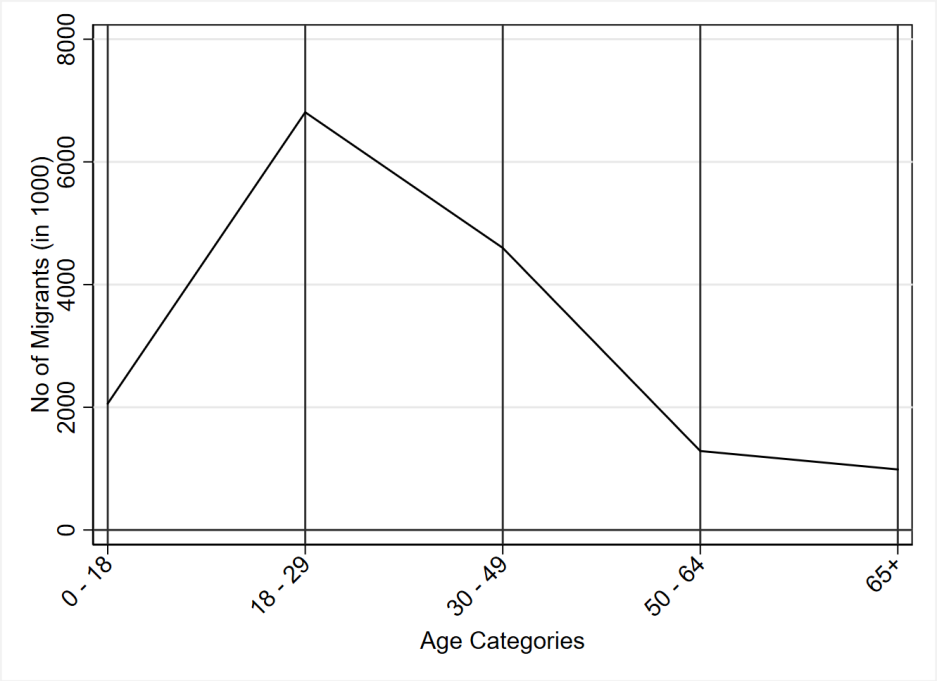
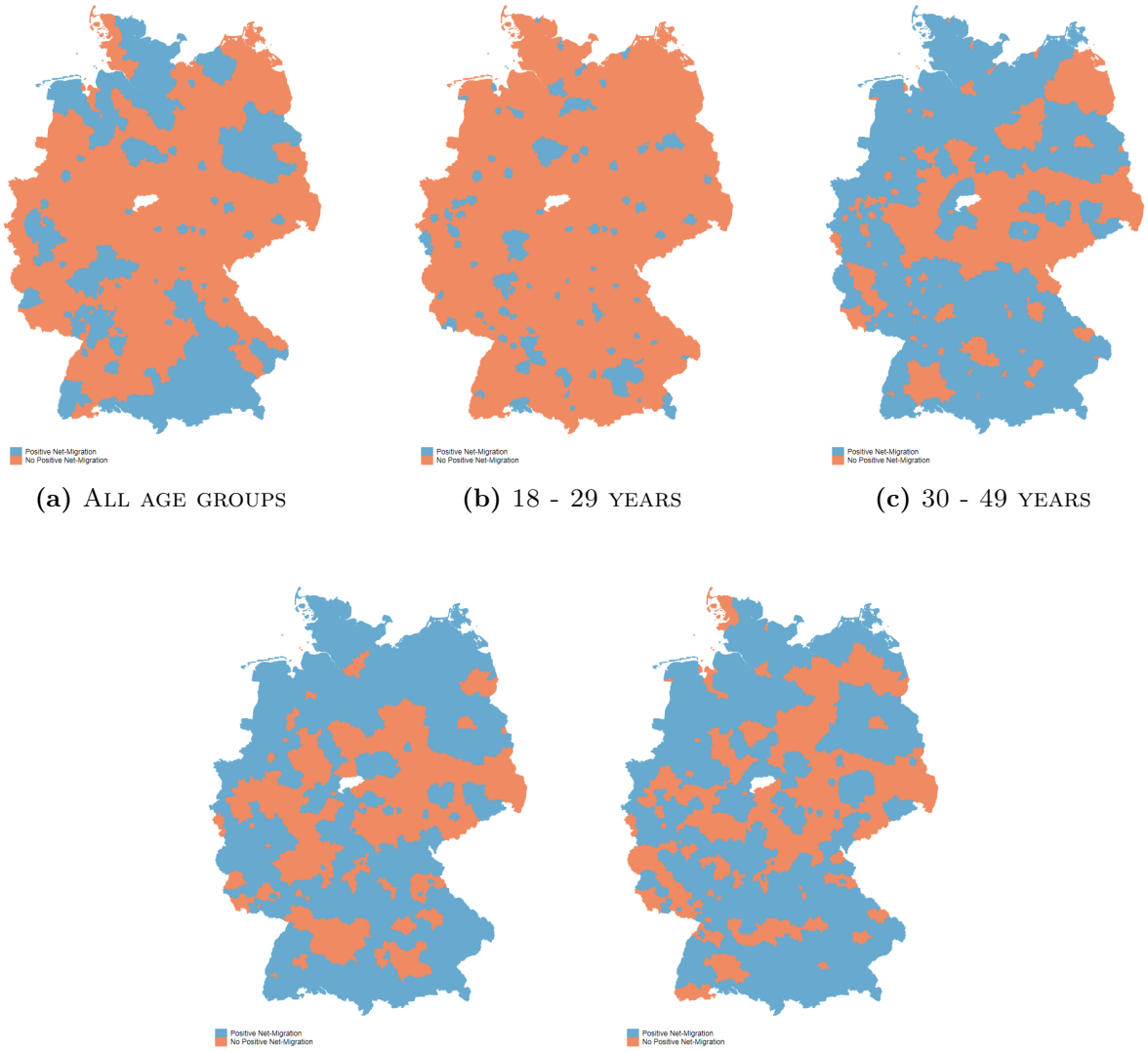


Figure 3.2: Relationship Between Age Group and Migration Intensity

Source: Destatis; authors' calculations. Note: The figure shows the average number of internal migrants over the period 2008 to 2014 for the five age groups.

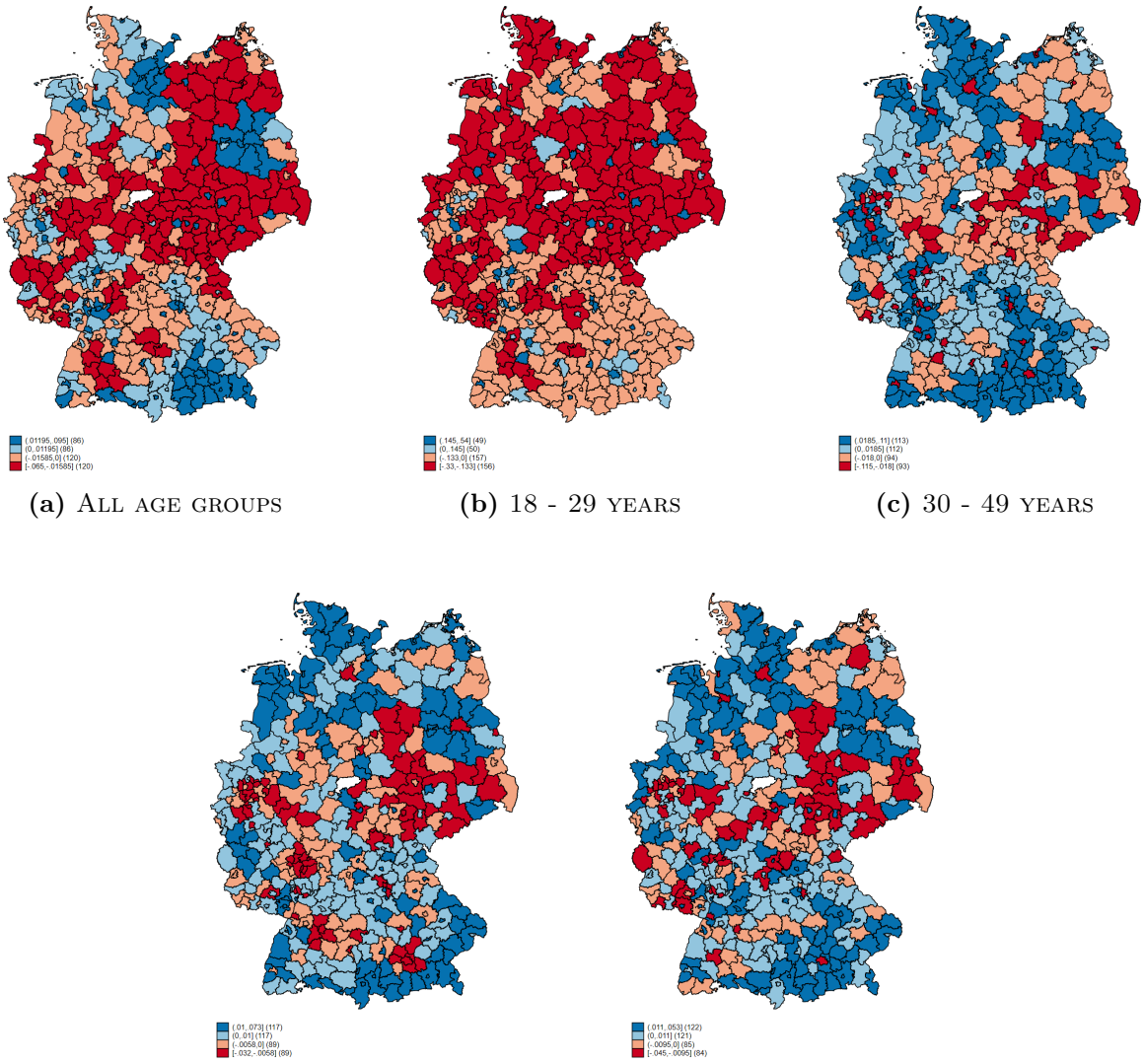


(a) All age groups **(b)** 18 - 29 years **(c)** 30 - 49 years

(d) 50 - 64 years **(e)** 65+ years

Figure 3.3: Positive Net Migration

Source: Destatis, authors' calculations. Note: Counties with a positive net migration of the respective age group are displayed as blue, while counties with no positive net migration are displayed as orange.



(a) All age groups **(b)** 18 - 29 years **(c)** 30 - 49 years

(d) 50 - 64 years **(e)** 65+ years

Figure 3.4: Cumulative Net Migration (2008 – 2014) Relative to Initial Population of each Age Group (2008)

Source: Destatis, authors' calculations. Note: The figure shows the total net migrants between 2008 and 2014 per age group as a share of the initial population of the age group in the respective county. The first two values in the legend indicate the interval for the respective migration share. The value in the last parenthesis indicates the number of counties for the respective interval.

3.A Appendix

Table 3.A1: Sample Means

	Mean	Std. Dev.	Min.	Max.
No. of migrants (total)	16.4378	108.3000	0.00	10028.00
No. of migrants (18–29)	6.9759	41.5993	0.00	2912.00
No. of migrants (30–49)	5.0828	38.1157	0.00	4439.00
No. of migrants (60–64)	1.3308	9.7237	0.00	847.00
No. of migrants (65+)	0.9291	6.8359	0.00	690.00
Distance (in km)	302.2312	150.8851	0.95	824.48
Population	201,254.9419	231,486.7010	33,944.00	3,469,849.00
Unemployment rate	7.5752	3.5481	1.40	21.20
GDP per capita	31,304.6157	13,596.3733	12,712.00	136,224.00
Rental price index	13.6313	6.2809	3.95	45.23
Wage (total)	99.9901	14.7924	67.84	160.91
Wage (18–29)	77.3063	8.8136	55.91	111.90
Wage (30–49)	108.1422	16.9521	72.26	176.73
Wage (60–64)	114.5220	19.6997	72.61	204.23
Observations	1,089,884			

Source: Destatis, IAB, Immobilienscout24; authors' calculations. Note: The table shows descriptive statistics of the sample used for the main analysis.

Table 3.A2: Gravity Model of Internal Migration – Estimated using OLS

	(All) β/StdE	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.4101^{***}	-1.2779^{***}	-1.1377^{***}	-0.8451^{***}	-0.7734^{***}
	(0.0036)	(0.0038)	(0.0044)	(0.0055)	(0.0058)
Source county characteristics					
Population	1.3854^{***}	1.7503^{***}	0.6957^{***}	0.5332^{***}	0.1775^{*}
	(0.0538)	(0.0543)	(0.0575)	(0.0794)	(0.0824)
Unemployment rate	0.1598^{***}	0.2193^{***}	0.0650^{***}	0.0572^{***}	0.0083
	(0.0117)	(0.0115)	(0.0127)	(0.0167)	(0.0182)
GDP per capita	-0.0274	-0.1697^{***}	0.0064	-0.0073	0.0776^{*}
	(0.0204)	(0.0202)	(0.0224)	(0.0299)	(0.0325)
Age-specific average wage	-0.7515^{***}	-0.3815^{***}	-0.2502^{***}	-0.1623^{**}	–
	(0.0537)	(0.0434)	(0.0557)	(0.0526)	–
Rental price index	0.0012^{***}	0.0006^{*}	0.0017^{***}	0.0006	0.0007
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Host county characteristics					
Population	0.1066^{*}	0.6406^{***}	-0.2821^{***}	-0.1489	-0.0195
	(0.0535)	(0.0539)	(0.0581)	(0.0800)	(0.0843)
Unemployment rate	-0.1116^{***}	-0.0489^{***}	-0.1087^{***}	-0.0012	0.0144
	(0.0117)	(0.0116)	(0.0128)	(0.0167)	(0.0180)
GDP per capita	0.0134	-0.0464^{*}	0.0461^{*}	0.0083	-0.0323
	(0.0203)	(0.0201)	(0.0226)	(0.0295)	(0.0318)
Age-specific average wage	0.0076	0.1332^{**}	0.1905^{***}	-0.1182^{*}	–
	(0.0541)	(0.0438)	(0.0567)	(0.0529)	–
Rental price index	-0.0005	0.0004	-0.0008^{**}	-0.0013^{***}	-0.0010^{*}
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
R^2	0.7068	0.7138	0.6435	0.5312	0.5015
Observations	830,432	649,041	572,378	301,475	243,150

*Source: Destatis, IAB, Immobilienscout24; authors' calculations. Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 3.A3: Gravity Model of Internal Migration (Average Wage)

	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE
Distance	-1.6973^{***}	-1.8121^{***}	-1.9100^{***}
	(0.0074)	(0.0087)	(0.0074)
Source county characteristics			
Population	1.2271^{***}	0.8837^{***}	0.1635
	(0.0804)	(0.0821)	(0.1166)
Unemployment rate	0.2076^{***}	0.0580^{***}	0.0867^{***}
	(0.0134)	(0.0160)	(0.0225)
GDP per capita	-0.1241^{***}	-0.0838^{**}	0.1042^{**}
	(0.0252)	(0.0307)	(0.0395)
Average wage	-1.3046^{***}	-0.2449^{**}	-0.0528
	(0.0803)	(0.0747)	(0.1126)
Rental price index	-0.0006	0.0015^{***}	-0.0017^{***}
	(0.0003)	(0.0004)	(0.0005)
Host county characteristics			
Population	0.4436^{***}	-0.4718^{***}	-0.5800^{***}
	(0.0903)	(0.0815)	(0.1119)
Unemployment rate	-0.0351^{**}	-0.1406^{***}	-0.0043
	(0.0132)	(0.0148)	(0.0235)
GDP per capita	-0.0893^{**}	0.1343^{***}	0.0826^{*}
	(0.0284)	(0.0289)	(0.0398)
Average wage	-0.1345	0.5663^{***}	0.2474^{*}
	(0.0785)	(0.0778)	(0.1133)
Rental price index	-0.0020^{***}	-0.0032^{***}	-0.0049^{***}
	(0.0004)	(0.0003)	(0.0005)
R^2	0.7887	0.8035	0.8111
Observations	1,089,884	1,089,884	1,089,884

*Source: Destatis, IAB, Immobilienscout24; authors' calculations. Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

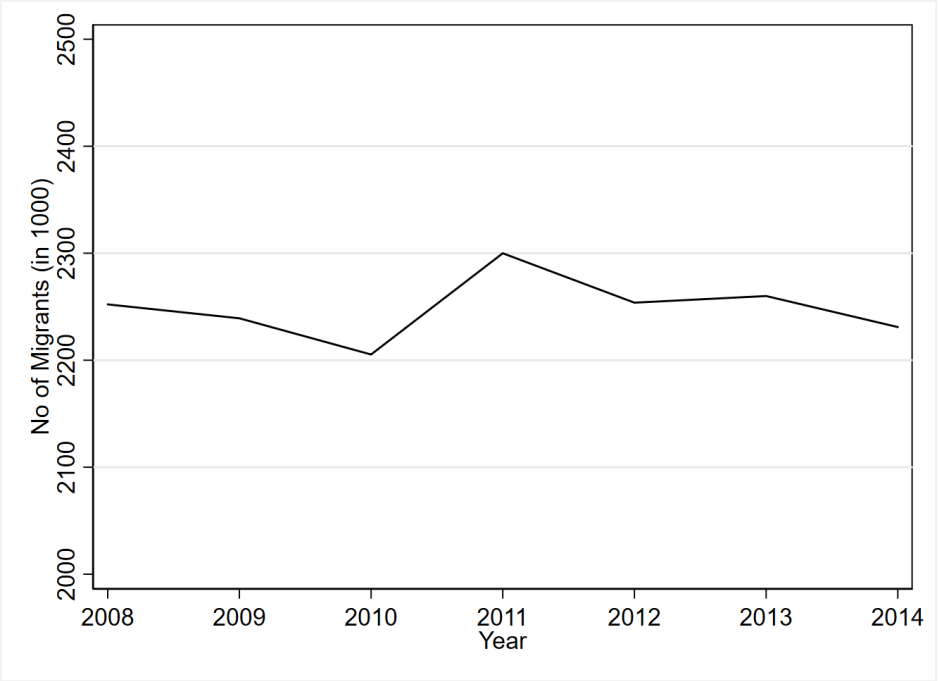


Figure 3.A1: Number of Migrants per Year

Source: Destatis; authors' calculations. Note: The figure shows the average number of internal migrants for each year of observation.

Chapter 4

Rental Housing and Property Taxation

4.1 Introduction

German municipalities generate a considerable part of their revenue through property taxes. In 2017, they received approximately EUR 13.5 billion from the property tax, which corresponds to 13% of their total revenues (Destatis, 2018). In Germany, property taxes are relevant for almost all citizens, since they are paid by the owner of the (developed) property, but can be passed on to the tenants. The property tax in its current form was declared unconstitutional by the German Federal Constitutional Court in 2018 and has to be reformed by the end of 2019. As a result, the topic is discussed extensively in the media and politics. A reform proposal by the SPD concerning the property tax is to declare passing the property tax on to tenants as illegal. This is based on the widespread concern about increases in rents, especially in urban municipalities (Frankfurter Allgemeine Zeitung, 2019b; Spiegel Online, 2019).

From an economic perspective it is unclear whether the statutory incidence, i.e., who literally pays the tax, coincides with its economic incidence, i.e., who actually bears the burden of the tax, and is a long-standing question in economic research (England, 2016). This paper analyses the question who bears the additional burden of an increased property tax for the West German housing market. Theoretically, it is possible that either the property owner or the tenant bears the burden of the property tax. A simple model of housing demand and supply provides the theoretical foundation for analyzing the degree of tax shifting. Holding the supply curve constant, the part of the tax being shifted towards the tenant decreases with an increasing demand elasticity. Vice versa, holding the demand curve constant, the part of the tax being shifted increases with an increasing supply elasticity (Orr, 1968). Therefore, the tax incidence depends on the elasticity of

supply and demand. The 'traditional' view, the 'benefit' view, and the 'capital tax' view have been used to provide a theoretical foundation for analyzing property tax shifting as well.[1] While much of the debate around the property tax is of theoretical nature and deals with the question whether the property tax should be considered as a capital or a benefit tax, both views allow forward shifting of the tax (Zodrow, 2001). Therefore, distinguishing between the two views is challenging from an empirical perspective and is not the focus of this paper. Mieszkowski (1972), Zodrow (2001), and Oates and Fischel (2016) provide reviews of the different 'views'.

The previous empirical literature on property taxes mainly stems from the United States and has produced a variety of results. In the United States, the only way for landlords to shift the tax on to tenants is to increase rents (Carroll and Yinger, 1994). Thus, for the United States' rental market, no shifting implies no effect and shifting implies a positive effect on rents (Heinberg and Oates, 1970). Research on property tax and housing prices dates back to Orr (1968, 1970, 1972), who analyzed the incidence of local property taxes for urban housing in the Boston metropolitan area. His results indicate that no shifting of the tax can be observed, i.e., there is no positive correlation between local property taxes and median rents for the Boston metropolitan area. Therefore, Orr (1968) concludes that most of the burden of the property tax is borne by the owner. This finding is criticized by Heinberg and Oates (1970) due to the definition of certain variables, the use of inappropriate observations, and the likely presence of reverse causality. In contrast, Hyman and Pasour (1973), Dusansky et al. (1981), Carroll and Yinger (1994), and Tsoodle and Turner (2008) observe that higher property taxes are at least partly shifted on to tenants.[2] In Germany, where property taxes can legally be shifted on to tenants as a part of the operating costs[3], the empirical implications for rental outcomes induced by property tax changes are different. Full shifting of the property tax implies no reaction of the net rent, but an increase of the operating costs. For Germany, so far only Löffler and Siegloch (2018) analyze the effect of property taxes on rental prices. They find an empirical weak negative effect of property taxes on net rents in the short run, which reverts to the pre-reform level three years after a tax increase. They conclude that in the short run, a part of the tax burden rests on the landlord.

In this paper, I examine to what extent property tax changes affect rents in Germany. I exploit the specific institutional setting of the German property tax to identify this effect.

[1] It can be shown that the 'traditional' view is a special case of the 'capital tax' view.

[2] Beginning with the study by Tiebout (1956), a large part of the literature also deals with the question of whether property taxes capitalize into prices. The literature usually finds that property taxes are capitalized into house prices, i.e., that prices are lower in higher tax areas. See, e.g., Oates (1969, 1973); Palmon and Smith (1998); Yinger (1982).

[3] The gross rent in Germany usually consists of two separate parts, the net rent and the operating costs. This is explained in more detail in Chapter 4.2.

The property tax rate in Germany is set at the municipal level, while the legal framework for the tax base is set at the federal level. There is a considerable amount of variation in the local property tax over time and across municipalities. For the period considered in this paper, more than 80% of the municipalities have changed their tax multiplier. I contribute to the empirical literature of property tax shifting by analyzing a rich data set for Germany for the period 2008 to 2015. In particular, the degree to which property tax increases in West Germany are passed on to the tenants of apartments is analyzed. This question is of particular interest for Germany, since only 51.4% of all households in Germany lived in their own property in 2017 (Eurostat, 2019). The analysis is based on data provided by *ImmobilienScout24*, the leading online broker for real estate in Germany. This data contains comprehensive information on advertised apartments, including information on the rent and on an extensive range of apartment level characteristics. Extending this data with information on the municipality level allows estimating a hedonic price model including both, information on the apartment and the municipality level.

The results indicate that in the short run, most of the tax burden due to an increase in the property tax is borne by the landlord. However, the results differ between rural and urban municipalities. While landlords are able to shift an additional burden of an increase in the property tax on to tenants in urban municipalities, they are not fully able to do so in rural municipalities. This indicates that the elasticity of demand plays a crucial role when evaluating the landlord's ability to shift the taxes on to tenants. It can be argued that the demand for urban apartments is relatively more inelastic. Hence, the results are in line with the theoretical prediction that tax shifting is more common for apartments with a lower demand elasticity. Furthermore, changes in property tax should not be assumed as being exogenous, since the results indicate that time varying unobserved effects influence both, rents and taxes.

The rest of the paper is organized as follows: Section 4.2 provides an overview of the institutional background for the German property tax. The data and empirical framework are discussed in Section 4.3, while the results are presented in Section 4.4. Section 4.5 summarizes the findings and concludes.

4.2 Institutional Background

The legal basis for the property tax is the federal land tax law (*Grundsteuergesetz*) from August 1973. It applies on the federal level although the tax itself is a municipal tax. Municipalities in Germany can choose to 'leverage' the federal tax. Furthermore, they collect and appropriate all of its revenues. The administration of the tax is divided between the state and the municipality. The state assesses the rateable value of the property tax

and determines the tax rate, while the municipality can set and apply a tax multiplier, which is determined by the municipal council, and collects the tax revenues. Property taxes are one of the three types of taxes that are under the jurisdiction of municipalities in Germany.[4] In 2017, revenues from taxes for all municipalities amounted to EUR 103.5 billion, while the revenue generated from property taxes amounted to EUR 13.5 billion (Destatis, 2018).

Property taxes directly or indirectly affect almost the entire population. They have to be paid by the owner of every developed property; however, they can legally be shifted on to the tenants of rental properties as part of the operating costs. In Germany, the gross rent *(Bruttomiete)* usually consists of two components; the net rent *(Nettokaltmiete)* and the operating costs *(Betriebskosten)*. While the net rent is paid exclusively for the provision of the apartment, the operating costs are the running costs that regularly arise due to the ownership of a property. The proportionate property tax is part of the operating costs. They can be paid either as a lump sum or as an advanced payment. In case of an advanced payment this needs to be of an adequate amount (§556 BGB). In practice, this implies that the advanced payment is adjusted to the actual costs after the end of the calendar year. An increase in the property tax in period t should therefore result in an increase in the operating costs in period $t + 1$.

All legal regulations of the German property tax, i.e., the definition of the tax base, as well as legal norms regarding property assessment are set at the federal level. The property tax liability is calculated as follows:

$$\text{tax} = \text{rateable property value} \times \text{tax rate} \times \text{multiplier}. \tag{4.1}$$

The rateable property value *(Einheitswert)* is set by the federal financial offices once a property is built and usually remains fixed over time. They are only reassessed if substantial changes are made or, e.g., the property is split into separate properties. This value does not equal the market value of a property. It is calculated as if the property was built in 1964 for West Germany and in 1935 for East Germany.

The tax rate *(Grundsteuermesszahl)* is set at the federal level and is a share of the assessed value. It differs for East- and West Germany.[5] As shown in Table 4.1, single-family homes in West Germany are taxed with a tax rate of 0.26% for the first EUR 38,346.89 of their rateable value. Any value above this threshold is taxed at a rate of 0.35%. Two-family houses are taxed with a rate of 0.31%; all other houses as well as vacant lots are taxed with a rate of 0.35%. The tax multiplier *(Hebesatz)* is decided by the municipal councils on

[4]The two most important taxes under the jurisdiction of municipalities are the local business tax and the property tax. A third category are 'other municipality taxes', which are of minor importance.

[5]This paper focuses on West Germany only. Therefore, the values for East Germany are not presented.

a yearly basis and usually becomes effective on January 1, each year. For a given housing stock and thus a fixed federal rate, local property taxes only vary due to changes in the regional tax multipliers.

Figure 4.1 panel (a) shows the local tax multipliers for 2005 and panel (b) those for 2017.[6] It shows that there is a substantial variation in the tax multiplier across municipalities and time. While more than 3,500 municipalities had a tax multiplier between 45 and 310 in 2005, only 1,299 were in the same category 12 years later. In general, the tax multiplier increased in most of the municipalities.

Figure 4.1 panel (c) shows the absolute change in the tax multiplier for each municipality. The tax multiplier has decreased in 94 municipalities and has remained constant in 1,173 municipalities. The remaining 7,000 municipalities have increased the tax multiplier between 2005 and 2017. Panel (d) of Figure 4.1 shows the number of tax multiplier changes in the period from 2005 to 2017. Over this period, 1,146 (around 14%) municipalities did not change their tax multiplier, whereas the remaining 7,121 municipalities have changed their multiplier at least once.

4.3 Data and Empirical Framework

4.3.1 Data and Sample

The data used in this study is drawn from the commercial internet platform *Immobilien-Scout24*, Germany's leading online real estate platform.[7] While this data offers information on advertised houses and apartments for sale and rent, this study focuses on apartments for rent only, as I am interested in the effect of property taxes on rents and not on selling prices. In addition, the reason for focusing on apartments for rent only is the minor importance of the rental market for houses in Germany.[8]

The sample is restricted to apartments offered on *ImmobilienScout24* in West German municipalities (excluding Berlin) between 2008 and 2015.[9] I restrict the sample to West German municipalities for two reasons. First, the East German housing market is subject to a substantial excess supply. Since the fall of the Berlin Wall, East German municipalities on average lost around 15% of their population (Rösel, 2019). Second, there has been a

[6]The figure uses information on the first and last period of the tax multiplier which is used for the event study. Therefore, the period is different from the information contained in the *ImmobilienScout24* data.

[7]For a detailed description of the data, see Bauer et al. (2013).

[8]Only around 10% of the offered rental objects are houses. Since the analysis is limited to apartments only, all objects included in the analysis are subject to a tax rate of 0.35%.

[9]Including Berlin does not alter the results, since there has been no change in the tax multiplier in Berlin between 2008 and 2015.

substantial number of mergers at the municipality level, i.e., different municipalities have been merged into one municipality, which complicates any longitudinal study (Löffler and Siegloch, 2018). Therefore, the sample is restricted to municipalities that did not have any mergers in the time period analyzed. The number of West German municipalities that were not part of any mergers and have information on all explanatory variables are 8,267. After excluding municipality-year observations with less than 15 observations, the analysis is based on 3,455,110 object-year observations in 3,004 municipalities, i.e., 36% of the 8,267 municipalities are covered. Figure 4.2 shows a map of the municipalities included in the analysis after these restrictions. Only rural municipalities are not included in the analysis. Therefore, the results have to be interpreted with caution. In terms of the population living in the municipalities, a much higher share is covered. Figure 4.3 shows the number of apartments and municipalities included in the analysis, as well as the share of population living in these municipalities, over the years. As shown in panel (a) of Figure 4.3, the number of apartments included in the analysis is around 300,000 in 2008 and increases to around 410,000 apartments until 2010. Afterwards the number of apartments included in the sample remains relatively stable until 2012 before it increases to almost 600,000 in 2014. In 2015, around 500,000 apartments are included in the sample. The number of municipalities included in the sample and the share of population covered by the sample follows a similar trend. The number of municipalities included varies between 1,600 and 2,400 per year, while the population share covered by these municipalities varies between 73% and 82%. In total, there are 3,004 different municipalities included in the sample at least once.

Summary statistics for the final sample are reported in Table 4.A1. The average gross rent is around EUR 645, the net rent averages EUR 510, and the operating costs are EUR 135. The average apartment is about 75 square meters in size, has 2.75 rooms, and was built 38 years ago. On average, an advertisement receives 913 clicks and is online for 32 days.[10] The mean tax multiplier is about 429 percent, the mean population is 252,423, the GDP averages EUR 18,593 (measured in thousands), and the unemployment rate is around 4%.[11] On average, the share of net immigration is 1%, while the average combined size of living apartments in square meters per municipality is around 9,886 (measured in thousands). The average number of apartments is 132,988, while the median number of apartments is 28,176.

[10]It is assumed that the apartment is rented out after the advertisement is withdrawn from the platform.

[11]The local unemployment rate is calculated as the number of unemployed as a share of the total population in a municipality.

4.3.2 Empirical Framework

To analyze the effect of the property tax multiplier on the rental outcomes, I estimate the following regression equation:

$$\ln y_{it} = \alpha P_{mt} + X_{it}^{'}\beta + K_{mt}^{'}\delta + \gamma_m + \lambda_t + \epsilon_{it}. \tag{4.2}$$

As noted in Section 4.2, the gross rent in Germany consists of two parts. Therefore, in a first regression, I estimate Equation 4.2 using the logarithmic gross rent as dependent variable. Afterwards, the result for the logarithmic gross rent is decomposed and the model is separately estimated for logarithmic net rent and for logarithmic operating costs. The control variables are identical for all three dependent variables.

γ_m and λ_t refer to municipality and year fixed effects, respectively. Therefore, identification is achieved within municipalities over time. In an alternative specification, I estimate the model using commuting zone $\times$ year fixed effects controlling for time varying regional shocks. P_{mt} refers to the logarithm of the property tax multiplier. Hence, α is the coefficient of interest. To account for the fact that the rental outcomes react with a time lag to the tax changes, I additionally estimate the model including the tax multiplier with a one and a two year lag. If the additional burden of the property tax is fully shifted on to tenants, the estimated coefficient of the tax multiplier for the net rent is expected to be zero, and positive for the operating costs. In this case, the gross rent should increase. If, however, the additional tax burden is partly borne by the landlord, the coefficient for the net rent is expected to be negative.

The vector X_{it} includes a set of object specific control variables such as the age and the size of the apartment, while the vector K_{mt} includes a set of time varying municipality and county specific characteristics such as the unemployment rate and the population. ϵ_{it} denotes the error term.

To account for the fact that the rent of an apartment increases with its size, the logarithm of the apartment's size in square meters is included in the object specific control variables. Furthermore, I control for the apartment's age and its square, and the number of rooms. I further include the number of clicks of the advertisement and its square. The idea is to control for heterogeneities within municipalities. All else equal, an apartment receiving more clicks can be assumed to have a better value for money or to be situated in a better residential area. Moreover, the number of days an advertisement is online and its square is added to the model. This accounts for the possibility that in order to yield a higher price, an apartment needs to be advertised longer and therefore increases the probability of generating a better tenant/apartment match.

At the municipality level, I control for the population, the total available living area in apartments measured in square meters, and the number of available apartments in the municipality on a logarithmic scale. The population variable controls for the fact that prices are higher in large and growing cities, i.e. it controls for demand side effects. The living area and the number of apartments control for supply effects. Further controls are the unemployment rate and the share of net immigration. Ideally, the model would be extended by information on the municipalities' fiscal situation. However, for the period analyzed in this paper, hardly any information on fiscal variables at the municipality level is available. At the county level, I control for GDP.

In Equation 4.2, identification is achieved within municipalities over time. One crucial condition needed to identify causal effects in this model is common trends pre-treatment, i.e., no significant responses of the dependent variable prior the tax reform (Fuest et al., 2018). This can be tested using an event study design, which replaces the logarithm of the tax multiplier from Equation 4.2 with dummy variables indicating that an event takes place in j periods. In this analysis, the event study is only used as a test to identify if the common trends assumption holds. The final results will instead be derived from the fixed effects framework as described above. In the event study it is not possible to measure changes in the tax multiplier on a logarithmic scale.[12] Therefore, the interpretation is with respect to changes in the tax multiplier and not with respect to changes in the tax burden. Since the rateable property value for the calculation of the tax burden is unknown, it is not clear how a change in the tax multiplier affects the tax burden. In contrast, in the fixed effects model, the interpretation for the logarithmic property tax multiplier can be interpreted as an elasticity for the tax burden, given that the rateable value and the tax rate are fixed.

In event studies, the variable of interest is substituted for an event matrix, which formally reads $\sum_{j=\underline{j}}^{\overline{j}} d_{mt}^{j}$, where $\underline{j}$ is the number of leads, and $\overline{j}$ the number of lags used for the analysis (Schmidheiny and Siegloch, 2019). This specification makes the set of regressors perfectly collinear. Therefore, I follow the convention of dropping the pre-reform regressor d_{mt}^{-1}. Hence, all event study coefficients have to be interpreted with respect to the pre-reform year. As the events used in this study are derived from a policy change between two periods, the treatment status for the upper end of the observation period ($t = 2015 = \bar{t}$) needs to be observed for $\bar{t} + |\underline{j}| - 1$ periods. For the lower end of the observation period ($t = 2008 = \underline{t}$), I need to observe the event window for $\underline{t} - \overline{j} + 1$. The dependent variable is observed for the period 2008 to 2015, while the latest available information on the tax multiplier is available until 2017. This implies a maximum of three leads prior to the event if information on the dependent variable is used entirely.

[12] If there is no change in the tax multiplier, the observation would drop out of the sample.

Working with more leads would reduce the upper limit of the data. The number of lags used are four years. For a detailed description of the construction of event studies see, e.g., Schmidheiny and Siegloch (2019).

The analysis of changes in the property tax does not fit the standard event study approach. Compared to traditional difference-in-differences settings, multiple treatments may occur at different points in time. Therefore, the standard design is adjusted to this setting as described in Sandler and Sandler (2014) and Schmidheiny and Siegloch (2019). The usual event dummies are interacted with the total change in the tax multiplier and the event window is adjusted to take into account tax changes that are outside of the event window. The estimated coefficients on future tax changes can be directly used to check for endogeneity problems in the spirit of a Granger test. As already mentioned before, identification requires flat pre-trends, i.e., statistically insignificant coefficients for the variables preceding the tax reform.

Figure 4.4 plots the results for the event study coefficients.[13] While panel (a) shows the results for the gross rent, panel (b) presents the results for the net rent, and panel (c) the results for the operating costs. Each panel displays two different plots. The blue line presents the estimated event coefficients from the regression with all controls described above, while the red line presents the coefficients from the model in which the year fixed effects λ_t are substituted by commuting zone $\times$ year fixed effects to account for time varying regional shocks. To receive a causal estimate of the effect of the property tax on rental outcomes, it has to be assumed that there are no unobserved time variant characteristics that are correlated with both the rental outcome and the tax multiplier. A possible confounder for this could be the presence of regional shocks. Ideally, municipality $\times$ year fixed effects should be included to control for this possibility. However, this leads to perfect collinearity with the variable of interest. Therefore, I include regional time varying dummies at the next highest regional level, the commuting zone. Including commuting zone $\times$ year fixed effects still enables me to identify α, while at the same time being able to control for regional shocks.[14]

The event study reveals that if only time and municipality fixed effects are included, the gross and net rent exhibit significant pre-trends (blue line). The gross and the net rent decrease prior to tax increases and significantly decrease after the tax increase. If commuting zone $\times$ year fixed effects are added to the model, the pre-trends flatten (red line). However, the pre-trend remains statistically significant for the net rent. The estimated coefficients for the effects after the tax increase also turn insignificant for the gross rent, while the effects for the net rent remain significant. Due to the large changes

[13]The full estimation tables are shown in the Appendix in Table 4.A2.

[14]For a description of the commuting zones, see Kosfeld and Werner (2012).

in both, the pre-trends and the estimated effects of changes in the tax multiplier on the gross and the net rent, the effects appear to be driven by regional time variant shocks. If these are not taken into account, the negative effects seem to be overestimated. As described above, it is not possible to include municipality × year fixed effects. This is why the results should be considered as upper bounds (in absolute terms). Panel (c) of Figure 4.4 indicates that there are no significant pre-trends for the operating costs. They start to increase with a lag of one year and steadily increase in the subsequent years. The results change only slightly with the inclusion of commuting zone × year fixed effects. Due to the importance of the regional shocks, all following models will be estimated including the commuting zone × year fixed effects.

4.4 Results

4.4.1 Baseline Results

The results of the basic model (Equation 4.2) for the variables of interest are shown in Table 4.2. The full estimation results are shown in Table 4.A3 in the Appendix. Columns (i) and (ii) show the results for the gross rent, columns (iii) and (iv) for the net rent, and columns (v) and (vi) for the operating costs. The first column for each of the three dependent variables contains the results for the model as shown in Equation 4.2, while the second column shows the results for the model extended by the logarithm of the lagged tax multiplier.[15] Overall, the results with respect to the control variables are as expected (see Appendix Table 4.A3).

For the gross rent, a negative and statistically significant coefficient for the tax multiplier can be observed. The estimation gains efficiency if the lagged tax multiplier is added to the model. The estimated coefficient for the logarithmic tax multiplier also decreases slightly (in absolute terms). A similar picture can be observed for the model using the net rent as dependent variable, the estimated coefficient for the logarithmic tax multiplier is negative and significantly different from zero. Adding the lagged version of the tax multiplier decreases the coefficient in absolute terms for the current period. As for the gross rent, the net rent is only affected by changes in the tax multiplier in the current period (i.e., a change between period $t-1$ and t). For the operating costs, the estimated coefficient of the tax multiplier is statistically significant and has the expected sign. The operating costs rise due to an increase in the property tax multiplier. In contrast to the

[15]The results for the model excluding commuting zone × year fixed effects are shown in the Appendix in Table 4.A4. As suggested by the results obtained in the event study, the estimated coefficients of the effect of the tax multiplier on the gross and net rent are higher in absolute terms. This supports the hypothesis that the results are biased due to regional time variant shocks.

other dependent variables, this seems to happen with a lag of one period. This result is in line with expectations, as the operating costs are an advanced payment on the 'real' operating costs. After the end of a calendar year, the cost account is settled and the operating costs are adjusted to the real costs.

The estimated coefficients for the logarithmic tax multipliers can be interpreted as elasticities with respect to the tax burden. The results imply an estimated elasticity of -0.019 for the gross rent, of -0.03 for the net rent, and of 0.043 for the operating costs. To give an approximation of the magnitude, the elasticities are evaluated at the mean of the respective dependent variable. Thus, for the gross rent, the estimated elasticity implies a decrease of EUR 0.12, for the net rent a decrease of EUR 0.15, and for the operating costs an increase of EUR 0.06 if the tax burden increases by 1%. The average property tax paid per square meter every month is around EUR 0.19 for the years 2008 and 2015 in West Germany (Deutscher Mieterbund, 2019). Therefore, the property tax paid for an average apartment in the sample is roughly EUR 14 per month. An increase in the tax multiplier by 1% is therefore associated with a higher monthly tax burden of around EUR 0.14. This increased burden of EUR 0.14 corresponds to a share of around 0.10% of the monthly operating costs ($\frac{0.14}{134.53} = 0.001$). Therefore, an increase in the operating costs that is approximately proportionate to the increased burden of the property tax increase would require an estimated elasticity of around 0.10. The discrepancy between the required (0.10) and the estimated (0.043) elasticity can be explained by two factors. First, as it is shown by the inclusion of the lagged tax multiplier, the operating costs react with a lag. Even though the estimated coefficient for the period t is not significantly different from zero, based on the results including the tax multiplier for period t, $t-1$, and $t-2$, the hypothesis that the three estimated coefficients are jointly equal to zero can be rejected.[16] This indicates that the operating costs are slightly adjusted over time instead of adjusting it at one time. Second, in some cases the advanced payment for the operating costs may already be higher than the actual operating costs for the apartment. As outlined before, the operating costs are only an advanced payment for the arising actual costs. Since the property tax only accounts for a small share of the operating costs, a change in the property tax may simply be too small to lead to an increase of the operating costs if the advanced payment was already too high. As can be seen in Figure 4.5, landlords have a tendency to advertise the apartments with round sums for the operating costs. This indicates that landlords might not be too accurate when calculating the operating costs. Therefore, a small change could be simply ignored by the landlord.

Although the increase in property tax does not lead to a proportional increase in

[16]The corresponding F-statistic reveals a value of 2.88, which is above the critical value of 2.61 from the F(3,3003) distribution for the 95% level of significance. The results for the regression including the logarithmic tax multiplier and the multiplier lagged by one and two periods are shown in Table 4.A5.

operating costs, this does not mean that the increase is not borne by the tenant. After the end of the period, the account is balanced and the property tax is passed on to the tenant. Therefore, the negative elasticity for the net rent indicates that, at least in the short run, the increase of the property tax is mostly borne by the landlord. The estimated elasticity of -0.03 is roughly equal to the fraction of the average property tax increase ($-\frac{0.03}{100} \times \text{EUR } 510.28 = -\text{EUR } 0.15$) indicating that the additional burden of the property tax is borne by the landlord. However, as discussed in Section 4.3.2, the result is likely to be biased in a way that the negative effect of the property tax on the net and the gross rent is overestimated. Since it is not possible to control for regional shocks at the municipality level, the results should be considered as an upper bound (in absolute terms).

4.4.2 Heterogeneity and Limitations

In what follows, I test whether the results obtained above are homogeneous across different types of municipalities. In detail, I test whether the results are different for urban and rural areas in Germany. As argued by Orr (1968), Hyman and Pasour (1973) as well as Löffler and Siegloch (2018), the degree of property tax shifting largely depends on the demand and supply elasticities of housing and land. If the demand for housing is relatively elastic, the degree of shifting will be relatively low, while the degree of shifting increases with a decreasing elasticity of demand. Vice versa, the degree of shifting will be higher if the housing supply is relatively elastic, while the degree of shifting decreases with a decreasing elasticity of supply. Hyman and Pasour (1973) argue that the supply of capital to housing is relatively elastic in North Carolina, compared to the Boston Metropolitan area, which can explain that property tax shifting can be observed in North Carolina, while no shifting can be observed in the Boston area. Löffler and Siegloch (2018) also argue that the supply of housing and land is rather inelastic in urban municipalities, which should lead to a lower degree of shifting in urban municipalities, compared to rural municipalities. However, as argued before, the demand for rental housing is also rather inelastic in urban municipalities. Especially young people in Germany move from rural to urban municipalities driven by local amenities and better job and earnings perspectives (Bauer et al., 2019). An inelastic demand, however, implies that the property tax can be shifted to a larger degree. Therefore, it is not a priori clear if the property tax can be shifted to a higher or lower degree in urban compared to rural municipalities.

The estimated coefficients for the variables of interest for the heterogeneous effects with respect to urban and rural municipalities are displayed in Table 4.3. Full estimation results are displayed in the Appendix in Table 4.A6. The structure of the table is the same as in Table 4.2 with the only difference that the logarithm of the tax multiplier and

the lagged version of this variable are interacted with a dummy variable that is equal to one for urban and equal to zero for rural municipalities.[17] Table 4.3 reveals that the negative effect of the property tax on the gross and the net rent is driven by apartments in rural municipalities. For urban municipalities, no effect of the property tax can be observed. For the operating costs, the positive effect from Table 4.2 is also driven by apartments from rural municipalities. However, as argued before, this does not mean that the additional burden of the property tax is not borne by the tenant. It simply indicates that the operating costs are not adjusted accordingly. The results therefore suggest that it is possible to fully shift the increased burden of the property tax in urban municipalities. In rural municipalities, however, this is not the case. The net rent decreases and partly offsets the increased burden for the tenants.

Therefore, the results from Table 4.3 indicate that the results from the basic model as shown in Table 4.2 are likely to be biased. The sample is selected in a way that only observations from small rural municipalities are not considered in the sample. As shown in Table 4.3, the estimated effect of changes in the tax multiplier differs for urban and rural municipalities. Given that unobserved time variant shocks bias the results in the opposite direction, it is not clear which effect is stronger. Therefore it is not obvious whether the average negative effect found for the net rent would be larger or smaller in the absence of unobserved effects and sample selection.

However, the described sample selection only affects rural municipalities. Therefore, the effect for urban municipalities is only affected by the time variant shocks, which seem to bias the results downwards. Overall, this indicates that property taxes can be fully shifted (or even over shifted) in urban municipalities. For rural municipalities, the effects found for the sample used in this study suggest that an increased burden of the property tax can not be fully shifted on to tenants.

4.5 Conclusion

In this paper, the economic incidence of increases in the property tax on the rental prices of apartments is analyzed. While previous empirical literature mainly concentrates on the United States, I provide results for Germany. For the analysis I use data based on advertisements in *ImmobilienScout24*, Germany's leading online real estate platform combined with regional information at the municipality level. This data enables me to observe rental housing prices divided by the net rent and the operating costs, which is important for analyzing the property tax incidence in Germany, as this tax can legally be

[17] The rural/urban definition is based on the definition of the BBSR for the year 2015 and is assumed to be constant over time. Urban municipalities have at least 50,000 inhabitants.

shifted on to tenants as part of the operating costs.

In doing so, I follow an approach used by Simon (2016) and Fuest et al. (2018), who apply an event study design to test for the exogeneity of the tax hike. The event study indicates that property tax increases can not be considered as exogenous events. Instead, it is more likely that regional unobserved time variant shocks have a negative effect on the net and gross rent, and a positive effect on the height of the property tax. The bias is reduced by including commuting zone × year fixed effects.

The results obtained by the fixed effects estimation indicate that in the short run, increases in the property tax in Germany are mostly borne by the landlords of rental housing despite the possibility of legally shifting it on to the tenant. This result is illustrated by separately analyzing the effects of changes in the property tax on the gross and net rent, as well as the operating costs of 3,455,110 object-year observations in 3,004 municipalities from 2008 to 2015 in West Germany. Specifically, the results suggest that the net rent decreases as a response to an increase in the property tax, whereas the operating costs are not reacting as expected. Contrary to the a priori assumption that the operating costs respond proportionally (with a lag) to an increase in the property tax, this study reveals that they only react by around one third of what is expected. Two possible explanations for this are given. First, it is shown that the operating costs are adjusted slightly over time. Second, the increases of the property taxes are usually small and the fraction of the operating costs that is paid for the property tax is small as well. Therefore, these minor changes could be ignored by landlords. The results further reveal that the degree of shifting largely differs between urban and rural municipalities. While the results indicate that in urban municipalities landlords can fully shift an increased property tax burden, in rural municipalities they are not able to shift the increase in tax completely.

Especially against the background of the planned tax reform and the considerations about declaring the passing of the property tax to tenants as illegal, the results obtained are highly relevant. Indeed, at the current level of the property value, there does not seem to be any major impact on the level of rents due to an increase in property tax. Although the results show that especially in urban areas the additional property tax is mainly borne by the tenants, the amount is rather low. If, however, there is an adjustment of the property values – which is discussed in the course of the planned reform of the property tax – and these are adjusted to the market value of the real estate, this can actually lead to a considerable additional burden, especially in urban areas. This implies a further deterioration of the situation on the rental market and a further rise in prices, especially in urban areas characterized by immigration.

Another finding of the paper is that changes in the property taxes are not exogenous. Tax increases are more likely to happen in regions with relatively low rental costs. If

regional shocks (at the commuting zone level) are not considered, the results are driven by an omitted variable bias, spuriously indicating a (stronger) negative relationship between (gross) rental prices and tax increases. Due to the reason that the results may still be biased, it is possible that, for the German case, increases in the property tax are fully borne by the tenant.

Tables

Table 4.1: Tax Rates in West Germany

Building type	Tax rate (in %)
One-family houses	
First EUR 38,346.89	0.26
Additional value	0.35
Two-family houses	0.31
Other houses/vacant lots	0.35

Source: §15 GrStG. Note: The table shows the property tax rates for different types of housing in West Germany.

Table 4.2: The Effect of the Property Tax Multiplier on Rental Outcomes (Baseline Specification)

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Municipality characteristics						
Log tax multiplier	-0.0211^{*}	-0.0191^{**}	-0.0388^{***}	-0.0297^{***}	0.0392^{*}	0.0170
	(0.0093)	(0.0074)	(0.0102)	(0.0084)	(0.0176)	(0.0162)
Log lagged tax multiplier	–	−0.0038	–	−0.0176	–	0.0426^{**}
	–	(0.0090)	–	(0.0102)	–	(0.0162)
Municipality dummies	yes	yes	yes	yes	yes	yes
CZ-year dummies	yes	yes	yes	yes	yes	yes
R^2	0.8549	0.8549	0.8568	0.8568	0.3794	0.3794
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

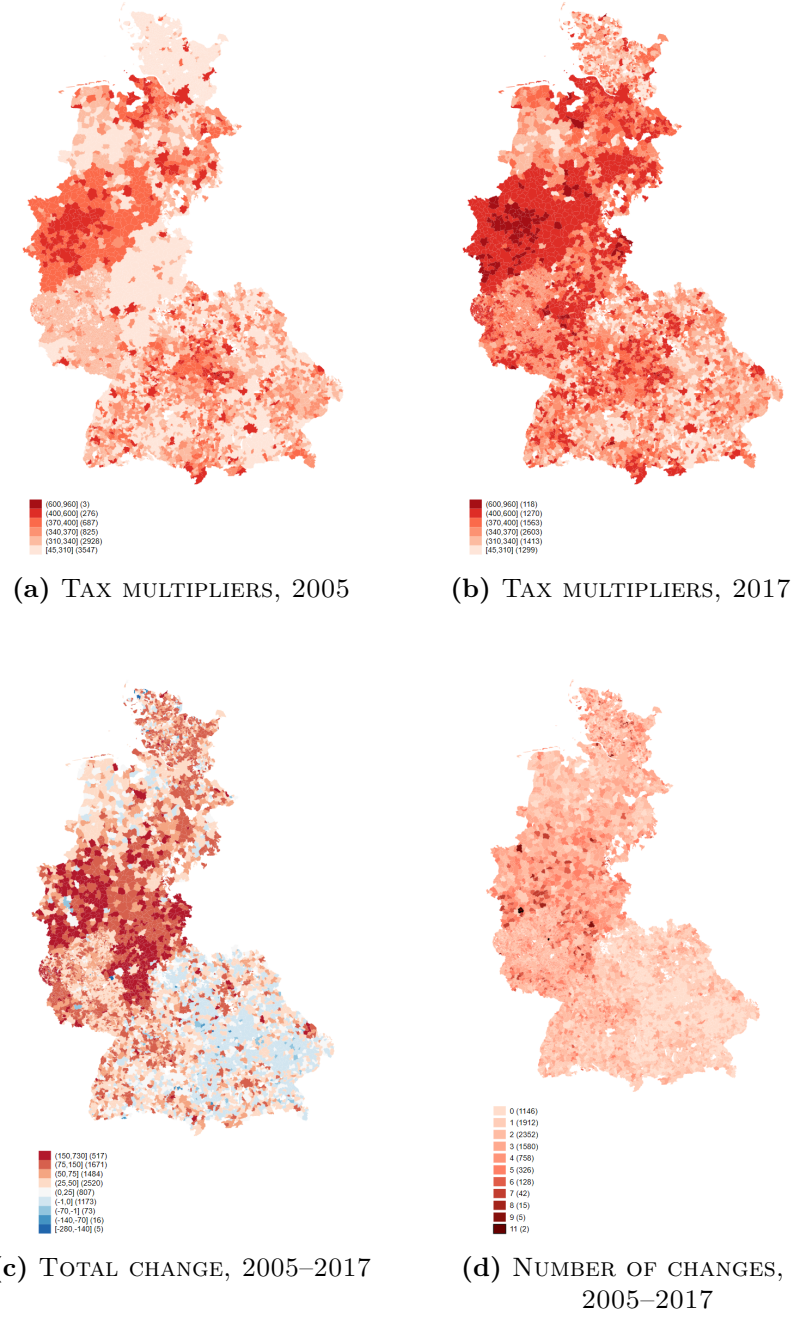
*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The table only displays the variables of interest. Full estimation results are shown in Table 4.A3 in the Appendix. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 4.3: The Effect of the Property Tax Multiplier on Rental Outcomes in Rural and Urban Municipalities

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Municipality characteristics						
Log tax multiplier*Rural	-0.0413^{***}	-0.0270^{**}	-0.0643^{***}	-0.0397^{***}	0.0467^{**}	0.0227
	(0.0092)	(0.0083)	(0.0097)	(0.0088)	(0.0180)	(0.0174)
Log tax multiplier*Urban	0.0139	0.0001	0.0054	−0.0053	0.0262	0.0056
	(0.0143)	(0.0108)	(0.0156)	(0.0122)	(0.0271)	(0.0262)
Log lagged tax multiplier*Rural	–	-0.0236^{*}	–	-0.0428^{***}	–	0.0465^{**}
	–	(0.0093)	–	(0.0101)	–	(0.0177)
Log lagged tax multiplier*Urban	–	0.0204	–	0.0133	–	0.0388
	–	(0.0164)	–	(0.0192)	–	(0.0271)
Municipality dummies	yes	yes	yes	yes	yes	yes
CZ-year dummies	yes	yes	yes	yes	yes	yes
R^2	0.8549	0.8549	0.8568	0.8568	0.3794	0.3794
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The table only displays the variables of interest. Full estimation results are shown in Table 4.A6 in the Appendix. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Figures



(a) Tax multipliers, 2005

(b) Tax multipliers, 2017

(c) Total change, 2005–2017

(d) Number of changes, 2005–2017

Figure 4.1: Changes in Tax Multiplier, 2005 – 2017

Source: Destatis; own calculations. Notes: The figure shows (a) the property tax multiplier for 2005 and (b) 2017, as well as (c) the total change and (d) the number of changes in the property tax multiplier between 2005 and 2017. In the legends of panels (a), (b), and (c) the first two values indicate the interval of the tax multiplier. In the legend of panel (d) the first value indicates the absolute number of tax changes. The value in the last parenthesis indicates the number of municipalities for the respective value.

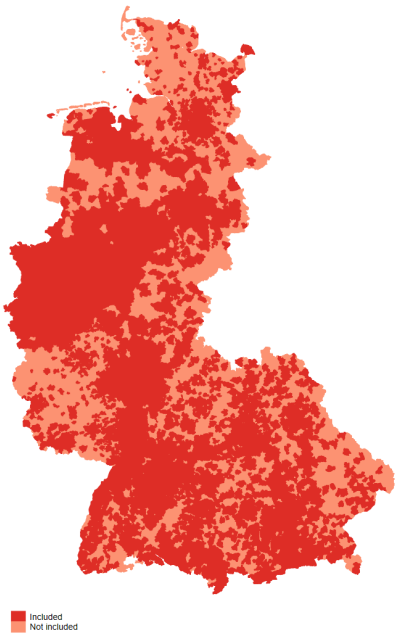
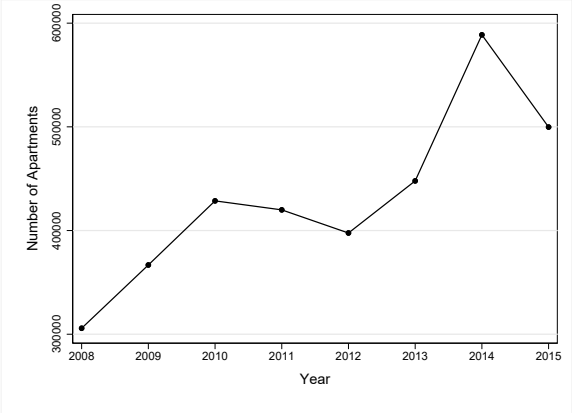
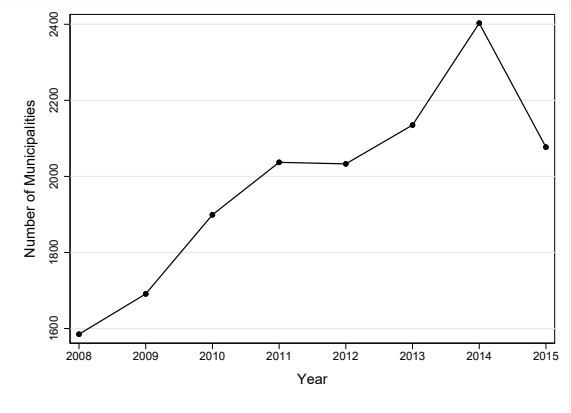


Figure 4.2: Municipalities Included in the Sample

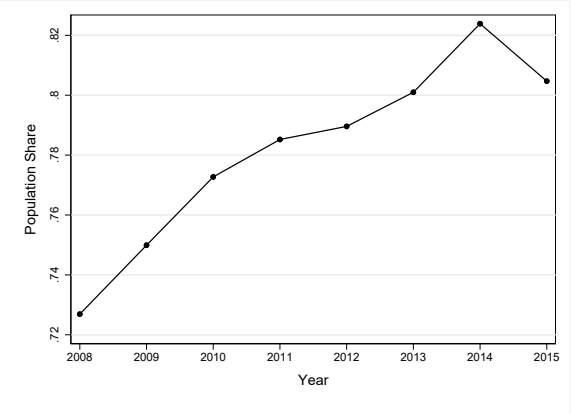
Source: ImmobilienScout24; own calculations. Notes: The figure shows which West-German municipalities are included in the analysis at least once. Dark red municipalities are included, while light red municipalities are not included.



(a) Number of apartments



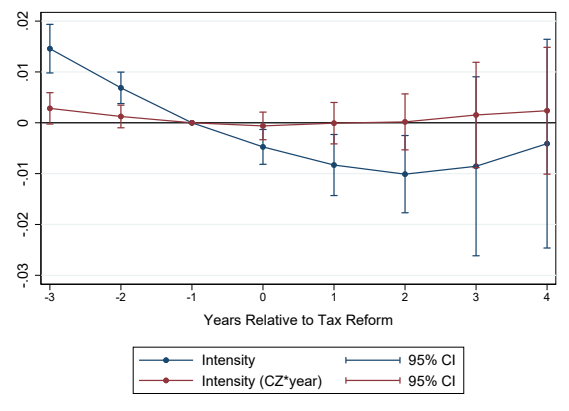
(b) Number of municipalities



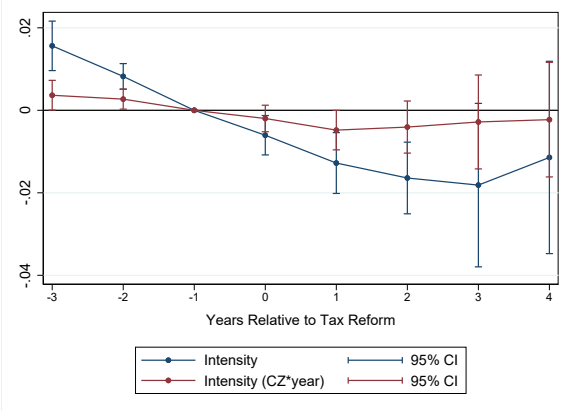
(c) Share of population

Figure 4.3: Number of Apartments, Number of Municipalities, and Share of Population in the Sample, 2008–2015

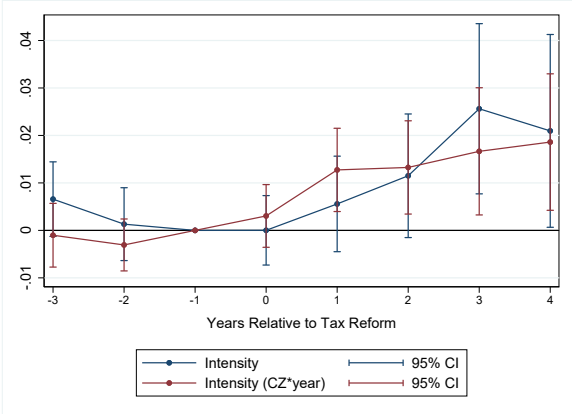
Source: ImmobilienScout24; own calculations. Note: The figure shows the (a) number of apartments, (b) number of municipalities, and (c) the share of the population included in the analysis for each year.



(a) Gross rent



(b) Net rent



(c) Operating costs

Figure 4.4: The Effect of the Property Tax Multiplier on Rental Outcomes (Event Study)

Source: ImmobilienScout24, Destatis; own calculations. Notes: The figure shows the effects of property taxes on the (a) gross rent, (b) the net rent, and (c) the operating costs using an event study as described in Section 4.3.2. The blue line shows the results including all control variables and time and year fixed effects. The red line shows the results controlling for commuting zone × year fixed effects instead of year fixed effects. Full estimation results are shown in Table 4.A2. The vertical bars indicate 95% confidence intervals.

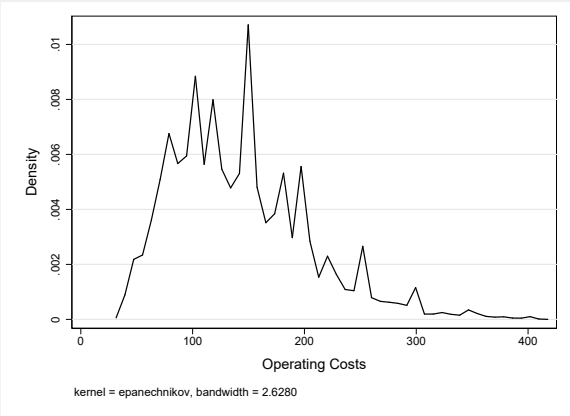


Figure 4.5: Density of Operating Costs

Source: ImmobilienScout24; own calculations. Note: The figure shows a kernel density plot of the operating costs.

4.A Appendix

Table 4.A1: Descriptive Statistics for the Full Sample

	Mean	Std. Dev.	Median	Min.	Max.
Municipality characteristics					
Log tax multiplier	6.03	0.23	6.04	4.38	6.87
Tax multiplier	428.53	96.24	420.00	80.00	960.00
Log population	11.22	1.62	10.94	5.85	14.41
Population	252,422.64	419,873.71	56,436.00	346.00	1,804,729.00
Log GDP	16.19	0.98	16.09	13.86	18.50
GDP (in thsd.)	18,593.36	23,927.46	9,692.83	1,046.82	108,124.92
Unemployment rate	0.04	0.01	0.03	0.00	0.08
Net migration	0.01	0.01	0.01	−0.10	0.17
Log living area in apartments	8.06	1.55	7.81	2.65	11.15
Living area in apartments	9,886.05	15,888.90	2,469.30	14.10	69,230.20
Log number of apartments	10.52	1.67	10.25	4.97	13.74
Number of apartments	132,987.94	221,801.73	28,176.00	144.00	931,236.00
Object characteristics					
Log net rent	6.13	0.44	6.11	5.18	7.64
Net rent	510.28	254.22	450.00	176.90	2,084.18
Log operating cost	4.81	0.43	4.85	3.54	5.96
Operating cost	134.53	57.01	127.33	34.58	388.84
Log gross rent	6.39	0.40	6.36	5.36	7.81
Gross rent	644.80	288.94	578.11	212.34	2,461.10
Log square meter	4.26	0.34	4.28	3.18	5.19
Square meter	75.07	25.40	72.00	24.14	180.00
Number of rooms	2.75	0.92	3.00	0.50	10.00
Number of rooms					
less than 2	0.37	0.48	0.00	0.00	1.00
2 to 3	0.42	0.49	0.00	0.00	1.00
3 to 4	0.17	0.38	0.00	0.00	1.00
4 to 5	0.03	0.18	0.00	0.00	1.00
5 to 7	0.01	0.08	0.00	0.00	1.00
more than 7	0.00	0.01	0.00	0.00	1.00
Age	38.34	28.75	36.00	0.00	215.00
Clicks	913.19	1,262.96	565.00	0.00	403,855.00
Days online	31.59	49.06	17.00	1.00	3,252.00
Observations			3,455,110		

Source: ImmobilienScout24, Destatis, own calculations. Note: The table shows descriptive statistics of the sample used for the main analysis.

Table 4.A2: Full Estimation Results from the Event Study

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Event dummies (ref.: lead 1)						
T-3	0.0146***	0.0028	0.0156***	0.0036*	0.0066	−0.0010
	(0.0024)	(0.0016)	(0.0031)	(0.0018)	(0.0040)	(0.0034)
T-2	0.0069***	0.0012	0.0082***	0.0027*	0.0013	−0.0031
	(0.0016)	(0.0011)	(0.0016)	(0.0012)	(0.0039)	(0.0028)
T0	−0.0047**	−0.0006	−0.0060*	−0.0020	0.0000	0.0030
	(0.0017)	(0.0014)	(0.0024)	(0.0016)	(0.0037)	(0.0034)
T1	−0.0083**	−0.0001	−0.0128***	−0.0048*	0.0056	0.0127**
	(0.0031)	(0.0021)	(0.0038)	(0.0024)	(0.0051)	(0.0045)
T2	−0.0101**	0.0002	−0.0164***	−0.0041	0.0115	0.0133**
	(0.0039)	(0.0028)	(0.0044)	(0.0032)	(0.0066)	(0.0050)
T3	−0.0086	0.0015	−0.0181	−0.0028	0.0256**	0.0167*
	(0.0090)	(0.0053)	(0.0101)	(0.0058)	(0.0091)	(0.0068)
T4	−0.0041	0.0024	−0.0114	−0.0023	0.0210*	0.0186*
	(0.0105)	(0.0064)	(0.0119)	(0.0071)	(0.0104)	(0.0073)
Municipality characteristics						
Log population	0.4448***	0.2728***	0.5351***	0.3625***	0.0291	−0.0648
	(0.0804)	(0.0487)	(0.0882)	(0.0538)	(0.0717)	(0.0701)
Log GDP	0.0519	−0.0323	0.0685	−0.0185	−0.0161	−0.0845*
	(0.0317)	(0.0183)	(0.0352)	(0.0194)	(0.0400)	(0.0400)
Unemployment rate	−0.5935	0.1551	−0.0020	0.4877	−1.9740*	−0.8462
	(0.4524)	(0.2934)	(0.4352)	(0.3453)	(0.9103)	(0.6261)
Net migration	−0.4582***	−0.3648***	−0.5201***	−0.3842***	−0.0694	−0.1976
	(0.1124)	(0.0618)	(0.1257)	(0.0773)	(0.1409)	(0.1241)
Log living area in apartments	−0.3164***	−0.2954***	−0.4319***	−0.3913***	0.0285	0.0736
	(0.0760)	(0.0515)	(0.0835)	(0.0569)	(0.1022)	(0.0880)
Log number of apartments	0.3443***	0.2802***	0.4170***	0.3238***	0.1070	0.0774
	(0.0765)	(0.0520)	(0.0842)	(0.0559)	(0.1017)	(0.0881)
Object characteristics						
Log. square meter	0.8290***	0.8278***	0.8863***	0.8850***	0.6089***	0.6082***
	(0.0094)	(0.0093)	(0.0091)	(0.0090)	(0.0119)	(0.0119)
Age/10	−0.0573***	−0.0571***	−0.0671***	−0.0668***	−0.0240***	−0.0240***
	(0.0015)	(0.0014)	(0.0017)	(0.0016)	(0.0017)	(0.0017)
$(\text{Age}/10)^2$	0.0036***	0.0036***	0.0046***	0.0045***	−0.0000	−0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Number of rooms (ref.: less than 2)						
2 to 3	−0.0004	0.0002	−0.0120***	−0.0114***	0.0403***	0.0408***
	(0.0027)	(0.0027)	(0.0032)	(0.0031)	(0.0030)	(0.0030)
3 to 4	0.0164***	0.0172***	0.0001	0.0007	0.0687***	0.0698***
	(0.0035)	(0.0035)	(0.0041)	(0.0041)	(0.0044)	(0.0044)
4 to 5	0.0239***	0.0247***	0.0091	0.0097	0.0585***	0.0596***
	(0.0048)	(0.0048)	(0.0052)	(0.0051)	(0.0074)	(0.0075)
5 to 7	0.0158*	0.0167**	0.0009	0.0015	0.0416***	0.0430***
	(0.0064)	(0.0064)	(0.0068)	(0.0068)	(0.0110)	(0.0111)
above 7	0.0221	0.0208	−0.0004	−0.0015	0.0628	0.0610
	(0.0211)	(0.0206)	(0.0270)	(0.0264)	(0.0378)	(0.0372)
Clicks/1000	−0.0169***	−0.0180***	−0.0179***	−0.0189***	−0.0118***	−0.0127***
	(0.0023)	(0.0022)	(0.0028)	(0.0027)	(0.0017)	(0.0017)
$(\text{Clicks}/1000)^2$	0.0001***	0.0001***	0.0001***	0.0001***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Days online	0.0004***	0.0004***	0.0004***	0.0004***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
Days online^2	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	−3.9550***	−0.0367	−5.5626***	−1.4195*	0.8718	3.0258**
	(1.0314)	(0.5951)	(1.0805)	(0.6760)	(1.1437)	(1.0278)
Municipality dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	no	yes	no	yes	no
CZ-year dummies	no	yes	no	yes	no	yes
R^2	0.8531	0.8549	0.8550	0.8567	0.3751	0.3794
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) using an event study as described in Section 4.3.2. $T-3$ refers to the event indicator × the change in the property tax multiplier for tax changes that will occur in three years, i.e. this is the third lead. $T-2$ refers to the second lead, $T0$ to the period in which the tax change happens. All other T values (positive) refer to tax changes in the past (lags). The pre-reform period is omitted. All event study variables are interpreted relative to the pre-reform year. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 4.A3: Full Estimation Results: The Effect of the Property Tax Multiplier on Rental Outcomes

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Municipality characteristics						
Log tax multiplier	−0.0211*	−0.0191**	−0.0388***	−0.0297***	0.0392*	0.0170
	(0.0093)	(0.0074)	(0.0102)	(0.0084)	(0.0176)	(0.0162)
Log lagged tax multiplier	–	−0.0038	–	−0.0176	–	0.0426**
	–	(0.0090)	–	(0.0102)	–	(0.0162)
Log population	0.2758***	0.2761***	0.3630***	0.3643***	−0.0553	−0.0586
	(0.0490)	(0.0490)	(0.0537)	(0.0535)	(0.0711)	(0.0710)
Log GDP	−0.0316	−0.0317	−0.0178	−0.0179	−0.0850*	−0.0845*
	(0.0183)	(0.0184)	(0.0194)	(0.0194)	(0.0399)	(0.0399)
Unemployment rate	0.1764	0.1765	0.5027	0.5030	−0.7922	−0.7929
	(0.3089)	(0.3090)	(0.3587)	(0.3597)	(0.6288)	(0.6293)
Net migration	−0.3593***	−0.3597***	−0.3756***	−0.3777***	−0.2017	−0.1967
	(0.0613)	(0.0612)	(0.0766)	(0.0762)	(0.1251)	(0.1240)
Log living area in apartments	−0.2923***	−0.2923***	−0.3840***	−0.3837***	0.0629	0.0621
	(0.0512)	(0.0512)	(0.0565)	(0.0565)	(0.0882)	(0.0883)
Log number of apartments	0.2764***	0.2762***	0.3179***	0.3170***	0.0805	0.0829
	(0.0517)	(0.0518)	(0.0555)	(0.0556)	(0.0885)	(0.0885)
Object characteristics						
Log square meter	0.8278***	0.8278***	0.8849***	0.8849***	0.6082***	0.6082***
	(0.0093)	(0.0093)	(0.0090)	(0.0090)	(0.0118)	(0.0118)
Age/10	−0.0571***	−0.0571***	−0.0668***	−0.0668***	−0.0240***	−0.0240***
	(0.0014)	(0.0014)	(0.0016)	(0.0016)	(0.0017)	(0.0017)
$(\text{Age}/10)^2$	0.0036***	0.0036***	0.0045***	0.0045***	−0.0000	−0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Number of rooms (ref.: less than 2)						
2 to 3	0.0002	0.0002	−0.0114***	−0.0114***	0.0408***	0.0408***
	(0.0027)	(0.0027)	(0.0031)	(0.0031)	(0.0030)	(0.0030)
3 to 4	0.0172***	0.0172***	0.0007	0.0007	0.0698***	0.0698***
	(0.0035)	(0.0035)	(0.0041)	(0.0041)	(0.0044)	(0.0044)
4 to 5	0.0247***	0.0247***	0.0097	0.0097	0.0596***	0.0596***
	(0.0048)	(0.0048)	(0.0051)	(0.0051)	(0.0075)	(0.0075)
5 to 7	0.0167**	0.0167**	0.0016	0.0016	0.0430***	0.0430***
	(0.0064)	(0.0064)	(0.0068)	(0.0068)	(0.0111)	(0.0111)
above 7	0.0207	0.0206	−0.0015	−0.0016	0.0608	0.0611
	(0.0206)	(0.0206)	(0.0264)	(0.0264)	(0.0371)	(0.0371)
Clicks/1000	−0.0180***	−0.0180***	−0.0189***	−0.0189***	−0.0127***	−0.0127***
	(0.0022)	(0.0022)	(0.0027)	(0.0027)	(0.0017)	(0.0017)
$(\text{Clicks}/1000)^2$	0.0001***	0.0001***	0.0001***	0.0001***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Days online	0.0004***	0.0004***	0.0004***	0.0004***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
Days online^2	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.0636	0.0735	−1.1995	−1.1534	2.7485**	2.6365*
	(0.6111)	(0.6173)	(0.6926)	(0.6991)	(1.0407)	(1.0472)
Municipality dummies	yes	yes	yes	yes	yes	yes
CZ-year dummies	yes	yes	yes	yes	yes	yes
R^2	0.8549	0.8549	0.8568	0.8568	0.3794	0.3794
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 4.A4: Full Estimation Results: The Effect of the Property Tax Multiplier on Rental Outcomes without Commuting Zone x Year Fixed Effects

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Municipality characteristics						
Log tax multiplier	-0.0800^{***}	-0.0690^{***}	-0.1025^{***}	-0.0799^{***}	0.0108	−0.0166
	(0.0147)	(0.0123)	(0.0171)	(0.0134)	(0.0156)	(0.0167)
Log lagged tax multiplier	–	−0.0197	–	-0.0407^{**}	–	0.0494^{*}
	–	(0.0142)	–	(0.0151)	–	(0.0201)
Log population	0.4835^{***}	0.4845^{***}	0.5753^{***}	0.5774^{***}	0.0499	0.0474
	(0.0858)	(0.0860)	(0.0924)	(0.0930)	(0.0725)	(0.0719)
Log GDP	0.0688^{*}	0.0690^{*}	0.0872^{*}	0.0876^{*}	−0.0106	−0.0111
	(0.0321)	(0.0321)	(0.0355)	(0.0353)	(0.0413)	(0.0408)
Unemployment rate	−0.6918	−0.6978	−0.1239	−0.1362	-1.9625^{*}	-1.9475^{*}
	(0.4757)	(0.4749)	(0.4599)	(0.4584)	(0.9129)	(0.9148)
Net migration	-0.4652^{***}	-0.4668^{***}	-0.5289^{***}	-0.5323^{***}	−0.0662	−0.0620
	(0.1111)	(0.1103)	(0.1263)	(0.1246)	(0.1424)	(0.1405)
Log living area in apartments	-0.3463^{***}	-0.3470^{***}	-0.4588^{***}	-0.4604^{***}	−0.0004	0.0015
	(0.0779)	(0.0782)	(0.0845)	(0.0851)	(0.1050)	(0.1046)
Log number of apartments	0.3748^{***}	0.3740^{***}	0.4494^{***}	0.4477^{***}	0.1216	0.1237
	(0.0788)	(0.0791)	(0.0870)	(0.0874)	(0.1026)	(0.1025)
Object characteristics						
Log square meter	0.8291^{***}	0.8291^{***}	0.8863^{***}	0.8863^{***}	0.6089^{***}	0.6089^{***}
	(0.0094)	(0.0094)	(0.0091)	(0.0091)	(0.0119)	(0.0119)
Age/10	-0.0574^{***}	-0.0574^{***}	-0.0671^{***}	-0.0671^{***}	-0.0240^{***}	-0.0240^{***}
	(0.0015)	(0.0015)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
$(\text{Age}/10)^2$	0.0036^{***}	0.0036^{***}	0.0046^{***}	0.0046^{***}	−0.0000	−0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Number of rooms (ref.: less than 2)						
2 to 3	−0.0004	−0.0004	-0.0120^{***}	-0.0120^{***}	0.0403^{***}	0.0403^{***}
	(0.0027)	(0.0027)	(0.0032)	(0.0032)	(0.0030)	(0.0030)
3 to 4	0.0165^{***}	0.0165^{***}	0.0001	0.0001	0.0687^{***}	0.0687^{***}
	(0.0035)	(0.0035)	(0.0041)	(0.0041)	(0.0044)	(0.0044)
4 to 5	0.0239^{***}	0.0239^{***}	0.0091	0.0091	0.0585^{***}	0.0585^{***}
	(0.0048)	(0.0048)	(0.0052)	(0.0052)	(0.0074)	(0.0074)
5 to 7	0.0160^{*}	0.0160^{*}	0.0012	0.0011	0.0416^{***}	0.0416^{***}
	(0.0064)	(0.0064)	(0.0068)	(0.0068)	(0.0110)	(0.0110)
above 7	0.0216	0.0215	−0.0009	−0.0011	0.0625	0.0628
	(0.0211)	(0.0211)	(0.0270)	(0.0270)	(0.0378)	(0.0378)
Clicks/1000	-0.0168^{***}	-0.0168^{***}	-0.0178^{***}	-0.0178^{***}	-0.0118^{***}	-0.0118^{***}
	(0.0023)	(0.0023)	(0.0028)	(0.0028)	(0.0017)	(0.0017)
$(\text{Clicks}/1000)^2$	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0000^{***}	0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Days online	0.0004^{***}	0.0004^{***}	0.0004^{***}	0.0004^{***}	0.0005^{***}	0.0005^{***}
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
Days online^2	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-4.2493^{***}	-4.1961^{***}	-5.8126^{***}	-5.7029^{***}	0.5703	0.4372
	(1.0954)	(1.1135)	(1.1472)	(1.1682)	(1.1580)	(1.1635)
Municipality dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
R^2	0.8530	0.8530	0.8549	0.8549	0.3750	0.3750
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 4.A5: Full Estimation Results: The Effect of the Property Tax Multiplier (1- and 2-year lagged) on Rental Outcomes

	Gross rent β/StdE	Net rent β/StdE	Operating costs β/StdE
Municipality characteristics			
Log tax multiplier	-0.0191^{**}	-0.0296^{***}	0.0169
	(0.0074)	(0.0084)	(0.0163)
Log lagged tax multiplier	-0.0015	-0.0150	0.0372^{*}
	(0.0070)	(0.0082)	(0.0156)
Log 2 period lagged tax multiplier	-0.0045	-0.0051	0.0106
	(0.0099)	(0.0106)	(0.0150)
Log population	0.2763^{***}	0.3646^{***}	-0.0590
	(0.0489)	(0.0534)	(0.0709)
Log GDP	-0.0318	-0.0181	-0.0842^{*}
	(0.0185)	(0.0195)	(0.0400)
Unemployment rate	0.1806	0.5077	-0.8027
	(0.3057)	(0.3567)	(0.6276)
Net migration	-0.3588^{***}	-0.3767^{***}	-0.1989
	(0.0612)	(0.0762)	(0.1240)
Log living area in apartments	-0.2923^{***}	-0.3838^{***}	0.0622
	(0.0512)	(0.0565)	(0.0884)
Log number of apartments	0.2761^{***}	0.3169^{***}	0.0830
	(0.0518)	(0.0556)	(0.0886)
Object characteristics			
Log square meter	0.8278^{***}	0.8849^{***}	0.6082^{***}
	(0.0093)	(0.0090)	(0.0118)
Age/10	-0.0571^{***}	-0.0668^{***}	-0.0240^{***}
	(0.0014)	(0.0016)	(0.0017)
$(\text{Age}/10)^2$	0.0036^{***}	0.0045^{***}	-0.0000
	(0.0002)	(0.0002)	(0.0001)
Number of rooms (ref.: less than 2)			
2 to 3	0.0002	-0.0114^{***}	0.0408^{***}
	(0.0027)	(0.0031)	(0.0030)
3 to 4	0.0172^{***}	0.0007	0.0698^{***}
	(0.0035)	(0.0041)	(0.0044)
4 to 5	0.0247^{***}	0.0097	0.0596^{***}
	(0.0048)	(0.0051)	(0.0075)
5 to 7	0.0167^{**}	0.0016	0.0430^{***}
	(0.0064)	(0.0068)	(0.0111)
above 7	0.0206	-0.0016	0.0611
	(0.0206)	(0.0264)	(0.0371)
Clicks/1000	-0.0180^{***}	-0.0189^{***}	-0.0127^{***}
	(0.0022)	(0.0027)	(0.0017)
$(\text{Clicks}/1000)^2$	0.0001^{***}	0.0001^{***}	0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)
Days online	0.0004^{***}	0.0004^{***}	0.0005^{***}
	(0.0001)	(0.0001)	(0.0000)
Days online^2	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)
Constant	0.0872	-1.1379	2.6041^{*}
	(0.6274)	(0.7094)	(1.0535)
Municipality dummies	yes	yes	yes
CZ-year dummies	yes	yes	yes
R^2	0.8549	0.8568	0.3794
Observations	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table 4.A6: Full Estimation Results: The Effect of the Property Tax Multiplier on Rental Outcomes in Rural and Urban Municipalities

	Gross rent		Net rent		Operating costs	
	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE	β/StdE
Municipality characteristics						
Log tax multiplier*Rural	−0.0413***	−0.0270**	−0.0643***	−0.0397***	0.0467**	0.0227
	(0.0092)	(0.0083)	(0.0097)	(0.0088)	(0.0180)	(0.0174)
Log tax multiplier*Urban	0.0139	0.0001	0.0054	−0.0053	0.0262	0.0056
	(0.0143)	(0.0108)	(0.0156)	(0.0122)	(0.0271)	(0.0262)
Log lagged tax multiplier*Rural	–	−0.0236*	–	−0.0428***	–	0.0465**
	–	(0.0093)	–	(0.0101)	–	(0.0177)
Log lagged tax multiplier*Urban	–	0.0204	–	0.0133	–	0.0388
	–	(0.0164)	–	(0.0192)	–	(0.0271)
Log population	0.2463***	0.2412***	0.3257***	0.3200***	−0.0443	−0.0459
	(0.0486)	(0.0483)	(0.0530)	(0.0525)	(0.0731)	(0.0731)
Log GDP	−0.0289	−0.0291	−0.0143	−0.0147	−0.0860*	−0.0856*
	(0.0184)	(0.0183)	(0.0191)	(0.0190)	(0.0399)	(0.0398)
Unemployment rate	0.0333	0.0147	0.3220	0.2973	−0.7391	−0.7325
	(0.2996)	(0.2969)	(0.3479)	(0.3447)	(0.6377)	(0.6397)
Net migration	−0.3509***	−0.3409***	−0.3651***	−0.3537***	−0.2048	−0.2018
	(0.0610)	(0.0610)	(0.0756)	(0.0757)	(0.1242)	(0.1233)
Log living area in apartments	−0.2550***	−0.2487***	−0.3369***	−0.3284***	0.0490	0.0461
	(0.0491)	(0.0487)	(0.0533)	(0.0528)	(0.0885)	(0.0889)
Log number of apartments	0.2528***	0.2479***	0.2882***	0.2810***	0.0893	0.0931
	(0.0503)	(0.0499)	(0.0536)	(0.0532)	(0.0879)	(0.0881)
Object characteristics						
Log. square meter	0.8278***	0.8278***	0.8849***	0.8849***	0.6082***	0.6082***
	(0.0093)	(0.0093)	(0.0090)	(0.0090)	(0.0118)	(0.0118)
Age/10	−0.0571***	−0.0571***	−0.0667***	−0.0667***	−0.0240***	−0.0241***
	(0.0014)	(0.0014)	(0.0016)	(0.0016)	(0.0017)	(0.0017)
$(\text{Age}/10)^2$	0.0036***	0.0036***	0.0045***	0.0045***	−0.0000	−0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Number of rooms (ref.: less than 2)						
2 to 3	0.0002	0.0002	−0.0114***	−0.0114***	0.0408***	0.0408***
	(0.0027)	(0.0027)	(0.0031)	(0.0031)	(0.0030)	(0.0030)
3 to 4	0.0172***	0.0172***	0.0007	0.0007	0.0698***	0.0698***
	(0.0035)	(0.0035)	(0.0041)	(0.0041)	(0.0044)	(0.0044)
4 to 5	0.0247***	0.0247***	0.0097	0.0097	0.0596***	0.0596***
	(0.0048)	(0.0048)	(0.0051)	(0.0051)	(0.0075)	(0.0075)
5 to 7	0.0167**	0.0167**	0.0015	0.0015	0.0430***	0.0430***
	(0.0064)	(0.0064)	(0.0068)	(0.0068)	(0.0111)	(0.0111)
above 7	0.0206	0.0205	−0.0016	−0.0018	0.0609	0.0611
	(0.0206)	(0.0206)	(0.0264)	(0.0264)	(0.0371)	(0.0371)
Clicks/1000	−0.0180***	−0.0180***	−0.0189***	−0.0189***	−0.0127***	−0.0127***
	(0.0022)	(0.0022)	(0.0027)	(0.0027)	(0.0017)	(0.0017)
$(\text{Clicks}/1000)^2$	0.0001***	0.0001***	0.0001***	0.0001***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Days online	0.0004***	0.0004***	0.0004***	0.0004***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
Days online^2	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***	−0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.2421	0.3079	−0.9741	−0.8551	2.6823**	2.5544*
	(0.6005)	(0.5984)	(0.6741)	(0.6706)	(1.0361)	(1.0412)
Municipality dummies	yes	yes	yes	yes	yes	yes
CZ-year dummies	yes	yes	yes	yes	yes	yes
R^2	0.8549	0.8549	0.8568	0.8568	0.3794	0.3794
Observations	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110	3,455,110

*Source: ImmobilienScout24, Destatis, own calculations. Notes: Results present estimated coefficients and robust standard errors (clustered at the municipality level) obtained from an OLS regression. The dependent variable in each column is included as a logarithm. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

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