Essays in Labor Economics and Public Policy

Gabriela Liliana Galassi

Thesis submitted for assessment with a view to obtaining the degree of Doctor of Economics of the European University Institute

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European University Institute
Department of Economics

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Gabriela Liliana Galassi

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Abstract

This thesis contains three chapters around two related questions: (1) what are the determinants of the decision to work?, and (2) what are the (unintended) effects of policies stimulating labor market participation? The first two chapters tackle the second question in the empirical setting of the Mini-Job reform in Germany, which expanded substantially the in-work benefits, or tax advantages for low-earning workers. The third chapter, dealing with the first question, focuses on the transmission of employment behavior and preferences for work across generations.

The first chapter analyzes how firms respond to changes in tax benefits for low-earning workers and how, through equilibrium effects, such policies also affect non-targeted, high-earning workers. Combining theoretical and empirical analysis, I document the presence of both job creation and substitution underlying firm responses induced by the Mini-Job Reform. In particular, I find that firms with a high pre-reform use of low-earning workers increase the demand for workers with better earnings, an important result.

The second essay provides an empirical analysis of the effects of the same reform on earnings and employment prospects of targeted workers. The findings question the role of in-work benefits as an antipoverty policy since they do not improve earnings of targeted workers. However, they also show that these benefits provide opportunities for jobless individuals to smoothly transit to better paid employment.

Finally, in the third chapter, joint with Lukas Mayr and David Koll, we analyze how employment status and attitudes towards work are related across generations. Using data for the US, we find a significant positive correlation between the employment status of mothers and children, after controlling for productivity and other observable factors. We interpret this finding as evidence of transmission of preferences for work. We show that the correlation

is unlikely to be driven by networks, transmission of specific human capital or local labor markets' conditions, and we provide suggestive evidence for a role model channel.

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Chapter 1

Labor demand responses to labor supply incentives: Evidence from the German Mini-Job reform

1.1 Introduction

Over the last decades, tax benefits for workers with low earnings have become a popular policy in many developed countries. These *in-work benefits* aim to provide incentives to work for individuals with low earning capacity, and to promote their self-sufficiency. There are numerous studies showing the effectiveness of these policies for expanding the labor supply of targeted groups.[1] This paper contributes to a much scarcer literature on demand-side and equilibrium effects of tax benefits for low-earning workers.

A series of recent studies for the UK (Azmat, 2014), US (Leigh, 2010; Rothstein, 2010) and Germany (Galassi, 2016) have documented that, when tax benefits are expanded, firms share the benefit because the before-tax wages of these workers decline.[2] My paper draws on this insight and investigates the response of firms to in-work benefits in terms of demand for both low-earning and high-earning workers. I argue that changes in labor demand induce spillovers from the labor of workers who are explicitly targeted by the policy, to the labor

[1] The effectiveness of tax credit programs on labor supply is documented in Eissa and Liebman (1996), Meyer and Rosenbaum (2001), Saez (2002), Eissa and Hoynes (2004), Saez (2010) and Chetty et al. (2013) for the US, Blundell et al. (2016), Blundell and Shephard (2011), Blundell (2006), Blundell (2000) and Blundell et al. (2000a) for UK, and Blundell and Hoynes (2004) for a comparison. The effectiveness of tax credits as redistributive policies is analyzed in Hoynes and Patel (2015).

[2] Tax shifting from the worker to the employer is a natural consequence of the expansion of the labor supply of workers with low earning capacity, as intended by the policy, and it depends on the sensitivity of labor demand for these workers (Eissa and Nichols, 2005).

of workers not targeted by the policy. When low-earning and high-earning workers differ in characteristics relevant for the production of goods and services (such as hours worked or skills), they are imperfect substitutes through the lenses of firms. Hence, a change in the pre-tax wage of low-earning workers provides incentives for firms to react to both the lower cost in this segment of the labor market, as well as the relative change in the cost of different types of labor.

Empirical evidence on firm responses to in-work benefits is provided by exploiting the Mini-Job reform in Germany in 2003, which led to a significant expansion of tax benefits for low-earning workers. Since the reform, workers in the so-called "mini-jobs", with gross monthly earnings below €400, are exempt from Social Security Contributions (SSC) and income tax, and workers in "midi-jobs" (between €400 and €800) have a subsidized SSC rate. Mini and midi-jobbers are known in the literature and policy discourse as "marginal workers". Workers whose earnings are above this threshold are considered in "regular" employment and are subject to full taxation. The Mini-Job reform led to a large increase in the number of mini-jobs, from approximately 4 million in 2002 to 7 million in 2004. The Mini-Job program in Germany is therefore comparable, in terms of coverage, to the well-known Earned Income Tax Credit (EITC) in the US.

I use a simple theoretical framework of the firm's decision on the use of heterogeneous labor to derive some testable implications. When low-earning (unskilled or part-time) and high-earning (skilled or full-time) workers are imperfect substitutes, the upward shift in the labor supply of low-earning workers after and expansion of in-work benefits leads to a reduction in the pre-tax wage of these workers relative to the wage of high-earning workers. The reaction of the firm which combines both these types of workers can thus be decomposed in terms of a scale effect (resulting from lower labor costs) and a substitution effect (resulting from changes in the relative cost of different types of jobs). While the scale effect induces an increase in the demand for both low-earning and high-earning labor, the substitution effect leads to a replacement of high-earning jobs with low-earning jobs. Furthermore, the scale effect is strong if a firm has a high ex-ante intensity (or cost-share) of low-earning workers, and the substitution effect dominates if the intensity is low.

I document the presence of both scale and substitution effects using a panel of German establishments between 2000 and 2007, matched to administrative data of workers. The significant expansion of tax benefits with the introduction of the Mini-Job reform allows to apply a differences-in-differences strategy, in which I exploit the variation in the pre-reform intensity in low-earning workers across establishments. According to the model, this variation determines the heterogeneity in the strength of the scale and substitution effects in response to changes in in-work benefits. The main identifying assumption is that in the

absence of the reform firm level outcomes, such as total employment or employment type, would have grown at the same pace in both high-intensity and low-intensity establishments (the so-called "parallel trends" assumption).[3] I verify that this is indeed the case for the years preceding the reform.

My estimates show that after the reform, (i) high-intensity establishments denote a larger increase in the use of high-earning workers than low-intensity establishments, (ii) the increase in employment of low-earning workers is smaller in high-intensity establishments than in low-intensity establishments, and (iii) total employment, in terms of both workers and hours, grows more in high-intensity establishments than in low-intensity establishments. One of the key implications of my model is that this pattern can only emerge when both scale and substitution effects occur simultaneously. Intuitively, firms that exhibited a higher intensity in low-earning workers ex-ante experience a stronger reduction in labor costs and thus manifest a stronger scale effect. On the other hand, low-intensity firms have a stronger incentive to substitute towards low-earning jobs because a larger fraction of their workforce is now relatively expensive.

Overall, the theoretical framework and the empirical results suggest that there is a slight convergence between high-intensity establishments (which grow relatively more and demand relatively more high-earning workers) and low-intensity establishments (which demand relatively more low-earning workers). This convergence across establishments is observed in the data.

To understand how firms change the demand for labor consistent with the previous observations, I analyze relative changes in the labor force composition within establishments. The relative expansion in high-earning workers of high-intensity establishments is driven by an increase in hours per worker (i.e., there are more full-time and less part-time workers), and by a change in the education level of workers (i.e., there are less low educated and more medium educated workers). The change in the educational composition of the workforce takes place in parallel with a larger increase in investment in physical capital (which has a higher complementarity with skilled labor) in high-intensity establishments than in low-intensity establishments. I also provide evidence of a relative change in tasks within establishments: high-intensity establishments tend to shift towards more complex tasks, whereas low-intensity establishments lean towards tasks with lower complexity. Finally, the results also suggest that high-intensity establishments upgrade earnings of incumbent workers and hire disproportionately more workers with high earnings. Multiple alternative specifications

[3] Throughout the remainder, I will use the expression "high-intensity establishments" for establishments with a relatively high intensity of low-earning workers prior to the reform, and "low-intensity establishments" for establishments with a relatively low intensity of low-earning workers prior to the reform.

that include firm-specific trends, lagged dependent variables, and different definitions of the intensity in low-earning workers support the robustness of these results.

The mechanism explored in this paper relies on two key assumptions, namely the expansion of the labor supply in the low-earning segment, and the imperfect substitutability between low-earning and high-earning workers. The paper also provides additional evidence to support these assumptions. First, I document that women and workers previously not participating in the labor market represent a substantial part of mini-jobbers, indicating an important role of the tax incentives in activating secondary workers. There is also an expansion of the proportion of workers taking up secondary jobs, which is related to the legal change brought by the reform regarding their tax exempt status if complying with the mini-job earnings threshold. All of these facts support the idea that the Mini-Job reform lead to an increase in the supply in the low-earning segment of the labor market. I also show that marginal and regular workers indeed differ along several dimensions that are crucial for the substitutability between these workers. For some low complexity occupations, substitution between high-earning and low-earning workers seems relatively easy to implement (e.g. by splitting full-time into part-time jobs), whereas for other occupations, the high-earning and low-earning workers appear to be closer to complements.

Finally, I use a parameterized version of the model that is consistent with my empirical results to shed light on the potential effects of the reform on overall employment and output. The main insights from this exercise is that total employment might increase as the decline in high-earning employment does not completely offset the increase in low-earning employment, and that, apart from the reallocation of high-earning employment from low-intensity to high-intensity establishments, the reform also lead to a reallocation of production from low-intensity to high-intensity establishments.

The ongoing political controversy over the Mini-Job reform, which has remained under scrutiny within Germany and other countries considering similar reforms, illustrates the policy relevance of my paper. Pundits and policy makers in Germany have attributed observed increases in labor precariousness to the Mini-Job reform. It is argued that the program mainly favoured firms who substituted high-earning occupations with low-cost workers, increasing precariousness of employment. At the same time, the strength of the German labor market over the last decade has led others to stress that the program may result in beneficial job creation.[4] I provide evidence for both effects, in particular for an unexpected effect on

[4] As opposed to the consensus about the positive effect on employment of the EITC (see e.g. the discussion by Hilary Hoynes in 2014 in "Building on the success of the Earned Income Tax Credit"), there is no apparent agreement about the employment effect of the Mini-Job design. Examples of negative opinions include "Fur eine hand voll euro" (Spiegel, 2004) or "The dark side of Germany's job miracle" (Reuters, 2012). Positive views include for instance "Putting Germany's mini-jobs in their context" (El Pais, 2015), "Our jobs market is

the employment of high-earning workers that were not targeted by the policy. More generally, my results show that the design of policies focusing on low-earning workers should take into account the labor demand response to such interventions, and the spillovers on the high-earning segment of the labor market.

Related literature

This paper makes several contributions to the existing literature. A large body of research documents the effects of tax benefits for low-earning workers on labor supply. In the case of the German Mini-Job reform, several papers suggest that it induced an increase in labor supply by encouraging secondary workers (e.g. married women) to participate in the labor market, and regular workers to take up marginal employment as a second job (Carrillo-Tudela et al., 2015; Caliendo and Wrohlich, 2010; Bargain et al., 2010; Fertig and Kluve, 2006; Freier and Steiner, 2008; Steiner and Wrohlich, 2005). My paper builds on the documented shift in labor supply to understand how firms respond to the consequent changes in wages of different types of workers.

In the spirit of some recent studies, my paper deals with labor demand responses to in-work benefits. The closest paper is Tazhitdinova (2018), which analyzes firms' role in magnifying the labor supply responses to the Mini-Job design, as estimated using the bunching at the tax kinks and notches. The mechanism is similar to Chetty et al. (2011) for Denmark. Firms disproportionately create employment at workers' tax discontinuities because tax-advantaged workers are more attractive for firms than workers slightly above the threshold due to a defacto higher flexibility.[5] Gudgeon and Trenkle (2017) use bunching estimators to analyze sluggish adjustment of workers from lower to higher earning thresholds in the context of the German Mini-Job reform. They show that firms with higher employment dynamics before the reform find it easier to adjust workers' earnings. In a different setting, Shephard (2016) analyzes the introduction of the WFTC in the UK, documenting spillovers from the demand for eligible workers to the demand for similar non-eligible workers which arise in the presence of labor market frictions, following the introduction of the WFTC in UK.[6] All of

broken - and Germany may have the answer" (The Telegraph, 2012). Apart from concerns about employment effects, political economy arguments may be contributing to the different opinion about the Mini-Job reform with respect to other in-work benefits, as reflected by the article by Krebs and Schaffer "German labour reforms: Unpopular success" which puts on the table a political economy argument behind the unpopularity of the Hartz reforms: the existence of a very concise group of losers, i.e. the long-term unemployed, more affected by the Hartz IV reform not analyzed in this paper.

[5] A similar result is documented by Haywood and Neumann (2017), and the mechanism is theoretically explored in Kolm and Tonin (2011).

[6] In the case of the WFTC and the EITC, workers' entitlements vary according to household structure, i.e. they are different across workers who compete within a unique labor market. This is not the case in the Mini-Job design, in which benefits directly depend on earnings and not on other traits of workers. The mechanism at work in the setting of the WFTC and the EITC is similar in spirit to Beaudry et al. (2014). A wage shock for a particular group of workers affects employment of other workers within the same labor

these studies provide evidence that firms' incentives are affected by tax benefits awarded to workers, which is crucial to the idea conveyed in my paper. However, the effects considered by these studies are confined to workers who compete in the same labor market and are perfect substitutes in the eyes of a firm. In contrast, I provide evidence for a different type of response by firms, which, to the best of my knowledge, has not been considered in the literature so far. I investigate the effects on the demand for both low-earning and high-earning workers, although the latter are not directly targeted by the reform. I show that a labor supply shock to low-earning workers induces a spillover to high-earning employment via firms' incentives to respond to the changes in relative wages. This evidence complements the documented effects on labor demand within the low-earning segment. The mechanisms at play in this analysis involve imperfect substitutability among production inputs, and imperfect elasticity of labor demand. See e.g. Acemoglu and Autor (2011) for an extensive review over the vast literature on technological change which has dealt with input substitutability, and Hamermesh (1986) for a discussion of the elasticity of labor demand.

Effects of the Mini-Job reform connected to the labor demand have also been explored with a more structural approach. Jacobi and Schaffner (2008) estimate the labor demand for heterogeneous labor using a flexible cost function framework in Germany, and documents no changes in the elasticity of substitution between unskilled and skilled labor after the Mini-Job reform. Also relying on parameter instability, Bradley and Kuegler (2017) assess the effects of the Hartz reforms on employment and wage levels, by estimating a structural model of the labor market featuring search frictions and heterogenous workers and firms. The main difference of my paper is that I propose a mechanism of labor demand response which relies on changes in relative wages and does not need time variation in structural parameters. This mechanism is confirmed by reduced form results using firm-level data.

My paper also contributes to the literature studying displacement effects of labor market policies, which has focused mainly on job seeker assistance. A paradigmatic example is Crepon et al. (2013), which uses a two-step randomized program of job-seeker assistance in France to compare the outcomes of untreated workers in treated and untreated areas.[7] The authors document that the positive impact on the job finding probability of a treated worker is partially outweighed by a negative impact for untreated job seekers in treated areas. More generally, the literature on displacement effects of labor market programs focuses on treated and untreated workers who compete for the same jobs, similar in nature to the studies on labor demand and in-work benefits. Instead, the mechanism that I investigate in this paper relies on substitution between low-earning and high-earning workers who operate in different

market due to the presence of frictions.

[7]The double randomized design of Crepon et al. (2013) is superior to the non-experimental designs in previous papers (see e.g. Blundell et al., 2004; Ferracci et al., 2010; Pallais, 2014; Gautier et al., 2015).

labor markets.

Finally, this paper also contributes to the growing literature on responses of labor demand to labor market policies (Harasztosi and Lindner, 2017; Cahuc et al., 2018; Garcia Perez and Rebollo Sanz, 2009). This strand of the literature examines labor demand policies (such as minimum wage, wage subsidies or hiring credits), as opposed to the policy examined here, where the benefit is provided to workers. The empirical strategy based on firm-level data in this paper relies partially on the approach used by Harasztosi and Lindner (2017) and Cahuc et al. (2018).

The rest of the paper is organized as follows. Section 2 provides details on the institutional context of the Mini-Job reform and describes the data sources used in the analysis. Section 3 presents descriptive evidence, and section 4 introduces the theoretical framework. Section 5 discusses the empirical strategy, and section 6 provides the results. Section 7 uses a parameterized version of the theoretical model to argue about the potential implications for overall employment and output, and section 8 concludes.

1.2 Institutional Context of the Mini-Job Reform and Data

This section discusses the institutional background of the Mini-Job reform. Next, it presents details about the data used in this paper.

1.2.1 Institutional context

The Mini-Job reform was part of a wider set of policies, the so-called Hartz reforms, which were gradually implemented between 2003 and 2005. The explicitly stated objective was to simultaneously reduce unemployment and increase competitiveness.

In this paper I focus on Hartz II or Mini-Job reform, one of the most controversial components of the Hartz reforms. Introduced in April 2003, it expanded the exemptions in social security contributions (SSC) and income tax for workers with low earnings.[8] Mini-jobs did already exist in Germany before the reform, but they were restricted to employment with a maximum of 15 hours a week and gross monthly earnings of €325, provided it was the only source of income for the worker.[9] Mini-jobbers were exempted from income tax and from the SSC,

[8] It is common to refer to the employment with tax advantages as "marginal", as opposed to "regular" employment, which is subject to full taxation.

[9] Mini-jobs as low-paid employment without SSC for employees existed in Germany with different labels

which amounted to 21% of gross earnings for regular employment, while employers paid 22% tax on gross wages, slightly above the 21% employer rate on regular jobs. If gross monthly earnings surpassed the €325 limit, the entire amount of earnings was subject to the 21% rate of SSC for each the employer and the employee, and to the income tax.

After the reform, the earnings limit was extended to €400 and the hours limit was eliminated. Employers' SSC rate increased to 25%.[10] A phase out category was introduced for monthly gross earnings between €400 and €800, so-called "midi-jobs", for which SSC increase linearly for the worker while employers are subject to the regular 21% rate, and for which the regular income tax applies. Secondary jobs with a different employer than in the main job were allowed to qualify as mini or midi-jobs if they were complying with the earnings limits for this particular job, irrespective of total earnings.[11]

The following example aims at clarifying the importance of the implicit subsidy of the Mini-Job reform: a single worker whose gross monthly earnings are €400 receives the full amount in net terms after the reform, in contrast to €316 (after paying SSC) before the reform. Ceteris paribus, this implies a subsidy of slightly above €1,000 per year. The subsidy is even larger if the worker was subject to income tax before the reform.[12] While the €400 threshold might seem low for a worker, the wage mini-jobbers receive is not unusual: mini-jobbers usually work around 15 hours a week, which yields an hourly wage of €7 for it to be compatible with the earnings limit of €400 (see Table (2.21) in the Appendix). The average hourly wage of mini-jobbers is thus similar to the after-tax hourly wage of full-time regular workers, even without controlling for education or other productivity characteristics.[13]

After the reform, the number of workers holding a mini-job surged, from approximately 13% of private wage-employment in the years before to 19% after, though the increase is more modest for workers with mini-job as main employment (15.5%), as shown in Figure (1.1).

since the introduction of the welfare state in the late XIX century (Schiller, 2016). In 1999 a reform attempted to bring them into the social security system and limit their scope. The hours limit was introduced, and it was further required that earnings from all jobs were considered before determining eligibility. Only if total earnings and hours were below the cutoffs, the worker was eligible for the tax benefit.

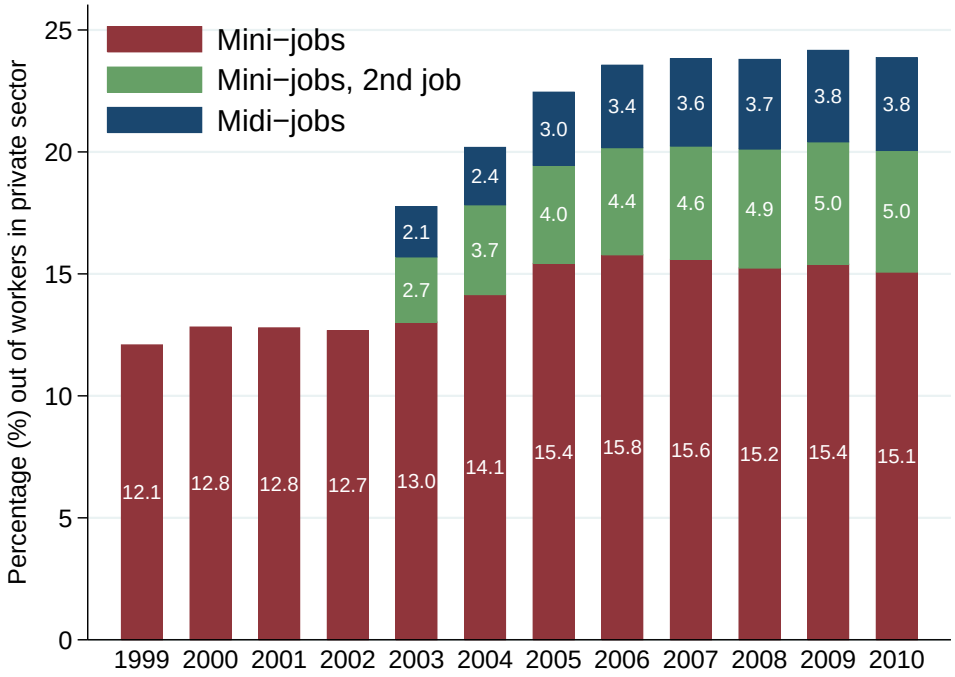
[10] A further raise to 30% in employers' rate of SSC on mini-jobs was introduced in July 1, 2006, simultaneously with a decrease in the workers' and employers' rate for regular jobs to 19.5%.

[11] See Table (1.A1) for the evolution of SSC rates. A special mini-job regime applies for private households. They however represent a very small amount of mini-jobbers (1.5% in 2004).

[12] The income tax exemption is relevant for mini-jobbers only if they hold a main regular job that surpasses a limit of non-taxable income (between €7,235 and €7,664 in the years around the reform) or if the spouse's earnings are such that jointly they surpass twice this amount. This is not the case for a single mini-jobbers, whose annual earnings are as much as €4,800. There was a Tax Reform in 2003-2004 which raised the minimum exempt and the progressivity in the income tax, but the changes were substantially small as compared with the modifications in the Mini-Job design.

[13] Controlling for observed characteristics (education, square polynomial of age and tenure, and part-time status) and unobserved time invariant heterogeneity, the penalty of mini-jobs in terms of daily wages is 6%, according to social security records.

Figure 1.1: Proportion of marginal workers out of total employment



Source: SIAB, annual data, main spell.

Including midi-jobs, marginal employment affects more than 20% of workers in the private sector. The proportion of workers with a tax-advantaged job hence is comparable to the incidence of EITC in the US, and doubles the number of workers with temporary contracts in Germany.

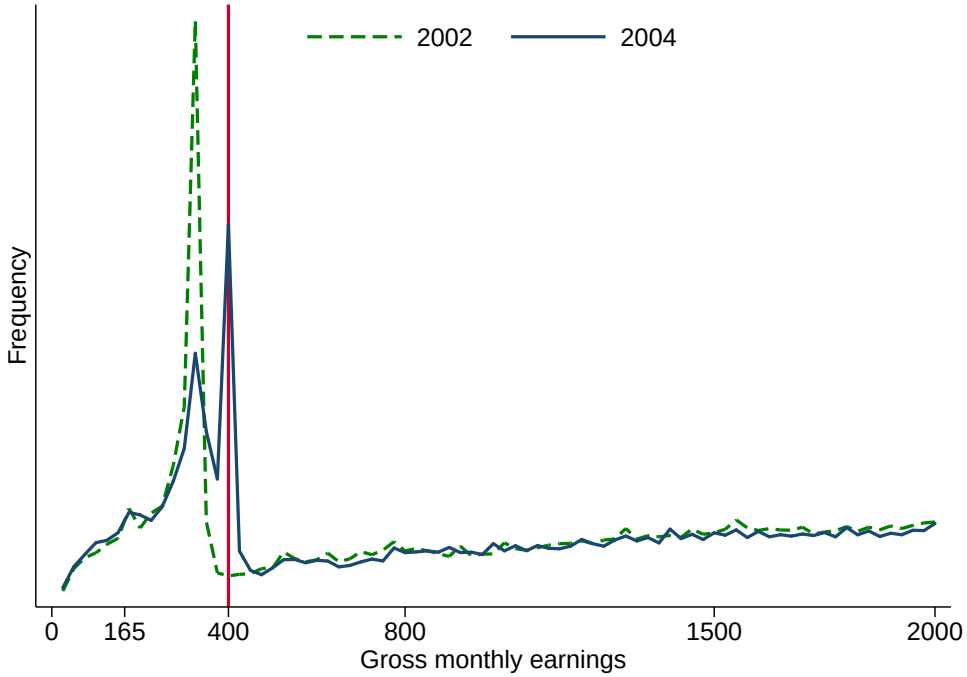
The distribution of earnings is affected by the mini-job design, as shown in Figure (2.21). In particular, there is a strong spike at the mini-job threshold, at €325 before the reform and €400 after the reform. The additional spike at the €165 level reflects an earnings disregard for the unemployment insurance, a feature that did not change with the reform. The change in the location of the spike happens the year of the reform, 2003, which rules out significant anticipation effects (see Figure (1.B2) in the Appendix).[14]

Marginal workers are entitled to most of the benefits of regular employees in Germany, including holidays, paid sickness days, employment protection against dismissal and parental leave. They do not have full pension entitlement though, but they can opt to contribute to the pension insurance system voluntarily.[15] Employers only pay insurance for work-related

[14]The Mini-Job Reform was announced, jointly with the other Hartz reforms, during the discussion of Chancellor Schroeder's 2010 Agenda on March 14, 2003. Stock prices reacted strongly to this announcement, indicating that agents were not anticipating the reform ("German recovery: it's the supply side", VoxEU column by Michael Burda).

[15]Employers pay 15% on gross earnings to the pension system for mini-jobbers, which implies a difference

Figure 1.2: Gross monthly earnings in 2002 (before the reform) and 2004 (after the reform)



Source: SIAB, annual data, main spell, gross monthly earnings computed from daily wages.

accidents for mini-jobbers, and they do not automatically provide health insurance. However, it is common that mini-jobbers have access to health insurance through their family members.

It is worth clarifying that at the time of the reform, Germany was undergoing a recession which had started at the beginning of 2000. The turning point in terms of labor market indicators coincides with the Hartz reforms, in particular the Hartz IV, which curtailed unemployment benefit and assistance entitlement for long-term unemployed workers. As this reform also affected incentives of low-earning workers, a natural concern is that it confounds effects of the Mini-Job reform. I argue that it is unlikely that conclusions drawn in this paper about the effects of in-work benefits that are affected by this additional reform. First, Hartz IV was introduced in 2005, two years after the Mini-Job Reform, while my empirical results show that the effects of the Mini-Job reform could already be noticed in 2003. Second, to the extent that the introduction of Hartz IV affected labor supply incentives by curtailing unemployment assistance, the reform should be seen as a complementary measure to the in-work benefits generated by the Mini-Job reform (Immervoll and Pearson, 2009).[16]

of 4.9 pp. with respect to the 19.9% contribution in regular employment. Only 3% of mini-jobbers contribute voluntarily paying this difference to gain full-pension entitlement (Guardiancich, 2010).

[16]Unemployment insurance and assistance were approximately €700 at the time of the reform. Benefits for long-term unemployed in Germany were much more generous than in the rest of the OECD countries before Hartz IV (see e.g. Engbom et al., 2015).

The remainder of the Hartz reforms were related to different aspects of the labor market, with little reason to believe that their introduction could confound the effects of the Mini-Job reform. Hartz I (introduced in January 1, 2003) included active labor market policies and obligations for job seekers to keep unemployment insurance, and extended the potential for temporary employment.[17] Hartz III (January 1, 2004) focused on improving the efficiency of the Public Employment Agency. Hartz II (the Mini-Job reform) also included the creation of a centralized office to simplify administrative tasks regarding marginal employment ("Minijob-Zentrale") and the introduction of subsidies for entrepreneurs coming from unemployment. Intuitively, all of these labor market policies affected the German labor market without a clear focus on the bottom of the earnings distribution, as it is indeed the case with the Mini-Job reform.

Another relevant factor is the incorporation of several Eastern European countries to the European Union in 2004. Given the free movement of people, this may have induced entry of low-skilled workers into Germany. However, the effects could only be seen since 2004, with a reasonable lag due to lagged effects on migration. Since I already note effects in 2003, this event is unlikely affecting the conclusions.

To sum up, I argue that the Mini-Job reform acted as the main activation measure for low-earning workers, in particular in a small horizon around the implementation of the reform. This is a relevant observation to interpret the results observed on labor demand as a result of the expansion of tax benefits for low-earning workers.

1.2.2 Data

My empirical analysis is based on linked employer-employee data provided by the Institute for Employment Research of the German Federal Employment Agency (IAB). These data are available through on-site visits and remote access provided by the Research Data Centre (FDZ) of the IAB. The firm-level analysis draws on the so-called Linked Employer-Employee (LIAB) data, Cross-Sectional Model 1993-2010. Assembled by the FDZ / IAB, it combines administrative social security data on individuals from the Integrated Employment Biographies (IEB) with establishment data from both the Establishment History Panel (BHP) and the IAB Establishment Panel through a unique establishment identifier. The main advantage of the LIAB is that it allows to follow establishments in time, providing individual

[17] Many aspects of temporary work were deregulated by the Hartz reforms. Although an important group of temporary workers are in the low-earning segment, the limited scope of temporary work compared to mini and midi-jobs (approximately 7.5% of workers in fixed-term contracts and 2.5% in temporary agency work) and the lack of change around the Mini-Job reform (see e.g. Eichhorst and Tobsch, 2014) potentially dissipate doubts about the possibility to act as confounders.

information about their employees.[18] Further details are available in Heining et al. (2013) and Heining et al. (2014).

The IAB Establishment Panel, available for West Germany since 1993 and for East Germany since 1996, consists of an annual survey (on June 30th each year) on a representative sample of approximately 16,000 establishments. There are periodical refreshments for establishment death and birth. The sampling design is stratified by establishment size, industry and federal state, it over-samples large establishments, and it excludes unipersonal and informal firms. Different longitudinal sections are constructed by the IAB. The longitudinal sections follow establishments that respond every year and account for establishment death and birth. Inference about the population of establishments requires the use of weights constructed by the IAB to correct for the disproportionate sampling design. The information on establishments includes a wide range of subjects related to the establishments' employment and some elements of their balance sheets, such as investment and business volume.

For the LIAB Cross-Sectional Model, the IAB draws the social security records of all the workers employed in the sampled establishments on June 30th each year (between 1.6 million and 2.5 million workers per year). Social security records in the IEB contain spells of employment, unemployment benefit receipt and job search. Employment spells are generated from notifications that employers send to the system. In absence of a major event, these notifications are sent annually. They are also sent in the case of new hires, terminations, interruptions, changes in contribution group or health insurance company of the employee, or changes in the payroll system of the employer. Civil servants, self-employed, short-term and family workers are not present in these data since their earnings are not reported via the social security system. The social security records hence cover 80% of the workers in Germany. Information about workers includes basic demographics (age, gender and education), daily earnings and benefits, and occupation, including whether it is part-time or full-time. Additional workplace information, such as industry branch and geographic location is available from the aggregation of social security records in the Establishment History Panel (BHP), which corresponds to June 30th each year.

Although I use the establishment level data for most of the analysis, I also draw descriptives from the Sample of Integrated Labor Market Biographies (SIAB) 1975-2010, which is a 2% random sample from the IEB (1.6 million workers). The SIAB allows to perform longitudinal analysis about workers as it contains all the spells of the labor history for each worker in the sample. More details are in vom Berge et al. (2013).

[18] The unit of observation in the data is the establishment (local economic unit) and not the firm, which may comprise several establishments. I use the words "firms" and "establishments" interchangeably in the analysis to refer to the later.

The first year in which marginal workers are included in the social security system is 1999. The window of analysis hence spans from that year to 2007, before the onset of the international crisis, and corresponds to the longitudinal section 2000-2007. Two important limitations of the data is the lack of information on hours worked and the censoring of earnings at the maximum for social security contributions (approximately €61,000 of annual gross earnings). My analysis relies on measures of employment, hence the lack of information on hours worked is relevant. To circumvent it, I generate a measure of "full-time equivalent" employment which consists in attributing part-time workers a weight lower than one. Regarding the censoring of earnings (which affects approximately 5% of the observations), I apply an imputation procedure modeling log-daily earnings using Tobit models by education and age groups (see e.g. Card et al., 2013; Dustmann et al., 2009; Gartner, 2005). It is worth noting that the censoring of earnings is not crucial for my analysis, as the upper limit for social security contributions is beyond the limit for tax-advantaged jobs. I provide more details about the data and these adjustments in section (1.C) of the Appendix.

1.3 Descriptives

In this section, I outline the main characteristics of the mini-jobbers relying on SIAB data. I discuss how they differ from other workers in Germany and how labor supply was affected by the Mini-Job reform. The goal of this section is to show that the Mini-Job reform effectively stimulated labor supply at the bottom of the earnings distribution, and that tax advantaged and non tax advantaged workers are not perfect substitutes through the lens of the firms' production function.

1.3.1 Who are the mini-jobbers?

Table (1.1) shows the characteristics of marginal workers, comparing them to regular workers and unemployed, for the year after the reform (the classification is in function of their main job). I focus on the contrast between mini-jobbers and regular workers, as midi-jobbers typically display characteristics in between the other two types.

Mini-jobbers are defined by a threshold of earnings. As earnings are the product of hours and wage, one would expect that they are characterized by either low hours worked, or low wages (skills or productivity), or both. Confirming this intuition, a salient characteristic of mini-jobbers is that they are eminently part-time (90% compared to 16.4% among regular workers). Part-time mini-jobbers represent about half of total part-time workers in the economy. The education level is also lower for mini-jobbers: one third of them do not have

"Abitur" (higher secondary school certificate) compared to 13% of regular workers.

There are some demographic groups that stick out among mini-jobbers, and this is associated to their sensitivity to the incentives created by the tax design. The over-representation of women among mini-jobbers (three out of four mini-jobbers are women) is in line with the well-documented fact that tax benefits are particularly relevant for secondary workers within households, especially in Germany due to the income tax exemptions and the joint taxation system. Previous non-participation seems a relevant trait among mini-jobbers, as suggested by the lower work experience and tenure, and similar average age and duration of reception of unemployment benefit of mini-jobbers as compared to regular workers. Long-term unemployed do not seem represented strongly among mini-jobbers (the history of unemployment benefit reception is much shorter for mini-jobbers than for unemployed). Younger (below 30 years old) and older (above 55 years old) workers constitute more than half of mini-jobbers, compared to one third of regular workers. This is not surprising as students and individuals in partial retirement usually work part-time. Furthermore, these groups are often entitled to particular benefits (BaföG for students and disability insurance or stipends for partial retirement for older workers) subject to €400 means-tests.

There are also large differences in the type of jobs that marginal and regular workers perform. Mini-jobbers carry out more interactive and manual non-routine tasks (15% and 49% of mini-jobs respectively, compared to 10% and 26% of regular workers), and less cognitive tasks (6% are in analytical non-routine tasks and 22% in cognitive routine tasks, compared to 18% and 33% of regular workers). Mini-jobbers work disproportionately in the service sector and less in manufacturing. They also have a higher representation in younger and smaller establishments.

The previous description highlights that there are systematic differences in workers' characteristics across job types, i.e. regular jobs and mini- or midi-jobs. The earnings test for tax benefits results in mini-jobbers being usually unskilled part-time workers, whereas regular workers are skilled or full-time. This differentiation is related to a well-known segmentation in the German labor market between "regular" and "atypical" employment (see e.g. Eichhorst and Tobsch, 2013; Keller and Seifert, 2012). Although atypical employment includes other types of workers (part-time above the mini-job threshold), temporary and agency employment, the so-called marginal employment (mini- and midi-jobs) is quantitatively the most important form of atypical employment.

As the reform also allows secondary jobs to be tax advantaged, as long as the income from the second job complies with the earnings limits, an important proportion of mini-jobs (between one fifth and one fourth) are secondary jobs. Table (1.2) shows the characteristics of secondary job holders, contrasting secondary mini-jobs with secondary regular jobs (included

Table 1.1: Characteristics of workers according to status: unemployed, mini-job, midi-job and regular employment

	Unemployed	Mini-job	Midi-job	Regular
Female	46.8%	71.3%	76.2%	43.0%
	(0.499)	(0.453)	(0.426)	(0.495)
Age	40.9	43.1	40.0	40.1
	(12.37)	(17.05)	(11.53)	(11.39)
Young (< 30)	22.0%	27.1%	22.2%	20.8%
	(0.414)	(0.444)	(0.416)	(0.406)
Prime age (30-55)	62.7%	43.9%	68.1%	69.7%
	(0.484)	(0.496)	(0.466)	(0.459)
Old (>55)	15.2%	29.0%	9.6%	9.5%
	(0.359)	(0.454)	(0.295)	(0.293)
No "Abitur"	21.7%	31.2%	20.6%	13.3%
	(0.412)	(0.463)	(0.404)	(0.339)
With "Abitur" or apprentices	72.4%	65.4%	75.3%	74.4%
	(0.447)	(0.476)	(0.431)	(0.437)
Professionals	5.9%	3.4%	4.2%	12.4%
	(0.236)	(0.181)	(0.200)	(0.329)
Daily wage/benefit	18.8	8.8	19.9	81.0
	(11.97)	(3.74)	(10.07)	(45.54)
Second job holder	0.4%	4.6%	8.5%	4.8%
	(0.065)	(0.208)	(0.279)	(0.214)
Part-time		90.0%	61.9%	16.4%
		(0.300)	(0.486)	(0.371)
Employment experience (years)	8.1	8.4	9.2	13.1
	(7.559)	(7.546)	(6.865)	(8.710)
Tenure (years)		3.1	4.4	7.3
		(3.864)	(5.058)	(7.272)
Duration of benefit receipt (months)	40.9	9.1	12.5	8.0
	(44.845)	(18.678)	(21.902)	(16.187)
Analytical non-routine tasks		6.4%	7.7%	18.3%
		(0.245)	(0.267)	(0.387)
Interactive non-routine tasks		15.3%	15.0%	10.1%
		(0.360)	(0.357)	(0.302)
Cognitive routine tasks		22.0%	25.4%	33.2%
		(0.414)	(0.435)	(0.471)
Manual routine tasks		7.1%	4.2%	12.2%
		(0.257)	(0.201)	(0.328)
Manual non-routine tasks		49.2%	47.7%	26.1%
		(0.500)	(0.499)	(0.439)
Establishment size (n. workers)		202	339	969
		(766.9)	(1528.7)	(4093.2)
Establishment age (years)		14	15	18
		(10.42)	(10.13)	(10.53)
Median full-time wage		66	58	86
		(26.08)	(32.17)	(30.48)
Agriculture, primary		1.9%	2.3%	2.6%
		(0.137)	(0.149)	(0.161)
Manufacturing		12.6%	8.0%	26.4%
		(0.331)	(0.271)	(0.441)
Construction		3.3%	3.2%	6.4%
		(0.178)	(0.176)	(0.245)
Retail, repair		22.5%	17.6%	14.7%
		(0.418)	(0.381)	(0.354)
Transport, communication		5.4%	5.5%	5.5%
		(0.225)	(0.228)	(0.228)
Financial intermediation		1.2%	2.0%	3.9%
		(0.109)	(0.139)	(0.193)
Services for businesses		19.7%	20.2%	11.6%
		(0.398)	(0.402)	(0.320)
Other services		27.4%	35.7%	20.3%
		(0.446)	(0.479)	(0.403)

Source: SIAB, annual data (2004), main spell. Standard errors in parenthesis.

midi-jobs), and compares them to workers who do not hold a secondary job. 91% of secondary jobs are mini-jobs. Age and gender differences across the groups are not as pronounced as those between regular workers and workers with a mini-job as a main occupation. Some disparities in the education level still remain, however, with more low and medium educated workers (workers without and with "Abitur" respectively) in the group holding a mini-job as their secondary job, and more professionals in the group holding a regular job as their secondary job.

Table 1.2: Characteristics of secondary job holders

		Secondary job holders	
	No secondary job	Mini-job	Regular-job
Female	47.3%	55.5%	55.6%
	(0.499)	(0.497)	(0.497)
Age	40.6	39.8	40.6
	(12.42)	(11.65)	(11.94)
Young (<30)	21.8%	22.1%	20.9%
	(0.413)	(0.415)	(0.406)
Prime age (30-55)	65.4%	68.7%	66.5%
	(0.476)	(0.464)	(0.472)
Old (>55)	12.9%	9.2%	12.6%
	(0.335)	(0.289)	(0.332)
No "Abitur"	16.6%	18.3%	13.8%
	(0.372)	(0.387)	(0.345)
With "Abitur" or apprentices	73.0%	75.8%	65.5%
	(0.444)	(0.428)	(0.475)
Professionals	10.4%	5.9%	20.7%
	(0.305)	(0.236)	(0.405)
Daily wage, second job		7.6	40.3
		(4.045)	(51.96)
Monthly earnings, second job		231.6	1,203.7
		(123.4)	(1342.4)
Part-time, main job	23.3%	32.5%	50.0%
	(0.300)	(0.486)	(0.370)

Source: SIAB, annual data (2004). Standard deviations in parenthesis.

1.3.2 Labor supply expansion with the Mini-Job Reform

The type of firms' responses to the Mini-Job reform analyzed in this paper requires an expansion of the labor supply in the bottom of the earnings distribution. I here show some descriptive statistics suggesting this was indeed the case.[19] First, I perform a simple accounting exercise based on changes in the earnings distribution to gauge the supply expansion caused by the Mini-Job reform. Intuitively, the mass of employment below the mini-job threshold after the reform comprises workers from three groups: (1) workers who were already below

[19]The article in the British newspaper "The Telegraph", "Our jobs market is broken - and Germany may have the answer" explains in plain words the labor supply incentives provided by the reform: "Take a lone mother who works 10 hours a week on the minimum wage. If she works 15 hours, she is no better off, because the extra money she earns is offset by the welfare she loses. [...] If the single mother in question were allowed to work under a mini-job contract, she could keep every penny.".

that earnings' level before the reform, (2) workers who were in non-employment and now find it profitable to work with lower taxes, and (3) workers whose earnings were above the new threshold before the reform and who work reduced hours or for lower gross wages to qualify for the tax exemptions. Assuming that most workers from the last category had earnings only moderately above the new threshold, the change in the mass below the mini-job threshold, net of the change in the mass moderately above the threshold, must represent additional workers who are incorporated into employment (details are in the Appendix in section (1.D.1)). For the specific empirical exercise, I set €1,200 as the upper limit for the mass that is moderately above the threshold. This choice can be justified by the observation that the earnings distribution above this value are approximately the same. The calculation suggests that the labor supply in the mini-job segment augmented by about 3.6%.[20]

Another way of gauging the degree in which new workers entered the workforce in the bottom of the earnings distribution is to look at the transitions from non-employment to different types of employment that occurred between 2002 and 2004 (Table (1.A3)). 40% of the workers in mini-jobs in 2004 were not employed in 2002, while only 13% of the workers who are in regular part-time or full-time employment in 2004 were not employed in 2002. This indicates a higher proportion of influx of new workers into the mini-job segment. More than one third of the transitions out of non-employment between 2002 and 2004 are through mini-jobs, who represent 15% of workers.[21]

Besides the entry new workers, the supply of mini-jobs increased due to secondary job holders. The proportion of workers with secondary jobs increased by around 50%, from 3.4% before the reform to 5% after the reform (shown in Table (1.A4)). This increase was particularly pronounced for women, prime-age and medium educated workers.[22]

A final source of employment in mini-jobs is constituted by workers who were previously earning above the threshold and whose gross earnings decrease. Looking at the workers close to the mini-job earnings threshold in 2004 (between €325 and €400) reveals that whereas 36% were non-employed in 2002, only 13.5% were earning more before the reform. This proportion is substantially larger among job movers (37%) than between job stayers (15.5%). The numbers suggest that, first, reduction of earnings is not a main source of

[20] There is an ongoing downward trend in employment and upward in unemployment in the period of reform. However, the distribution of earnings seems relatively stable in the pre-reform years (see Figures (1.B3)-(1.B6)), which suggests that the error from ignoring time trends in employment the comparison of the earnings distribution over a short horizon is likely to be small.

[21] Transitions vary by age and gender, not shown in the table. In particular, flows from non-employment to mini-jobs are specially relevant among women, young and old workers, whereas they are lower for prime-age men. The latter group has a higher participation among workers coming from higher earnings.

[22] Figure (1.B7) shows the cumulative distribution of earnings, comparing only main jobs and when all jobs (main or secondary) are included. The cumulative employment mass below the mini-job threshold increases dramatically when side jobs are included.

the increased employment mass in the bottom of the earnings distribution. Second, moving down the gross earnings ladder is not primarily an intra-firm phenomenon. A substantial proportion of workers close to the mini-job threshold seem to have experienced a reduction in hours (11% transit from full-time to part-time) or a change in occupation (23%). Both events are strongly associated with a change in the employer (see Table (1.A6)).

1.3.3 Low-earning and high-earning workers as production inputs

A key premise of this paper is that mini-jobbers and regular workers are imperfect substitutes. The observed differences in the traits of mini-jobbers and regular workers, in particular in characteristics linked to productivity (such as hours and education), suggest that they can be considered as different inputs that firms combine for the production of good and services. This section discusses further this argument. In line with the formal definition of mini-jobbers, which depends exclusively on earnings, I refer to mini-jobbers more broadly as low-earning workers, and high-earning workers are those in regular employment.

Workers in certain occupations (e.g., cooks, assistants, salespersons, drivers, workers in stores and transportation, office specialists and household workers) display frequent transitions between mini-jobs and regular employment. Switch in employment type responds typically to changes in full-time/part-time status. Hence one possible hypothesis is that, for some occupations, characterized by low or medium skill requirements, regular employment can be substituted by mini-jobs by splitting a full-time job into part-time. The type of jobs typically carried out by mini-jobbers have a large variability in terms of skills requirements (e.g., around one half of household cleaners, craftsmen, artists and sportsmen, auxiliary office workers, and teaching and research assistants at Universities are mini-jobbers). It is feasible that slight differences in responsibilities or skill requirements for a given occupation lead to a different wage level, and hence to admit either mini-jobs or regular employment for such occupation.[23] The possibility to substitute between full-time and part-time employment has been discussed in other contexts (see e.g. Goldin and Katz, 2016), and has been attributed to technological changes and the improvement in the information flows within the organization, and to new remuneration schemes that make pay more output dependent, and thus less directly dependent on the hours worked. Another argument in favor of substitutability of low-earning workers and high-earning workers is that similar workers in similar firms can have

[23]It is possible to find references in news articles arguing about this type of substitution. E.g. quoting "The dark side of Germany's job miracle" (Reuters, 2012), "regular full-time jobs are being split up into mini-jobs" and "there is little to stop employers paying mini-jobbers low hourly wages given they know the government will top them up and there is no legal minimum wage". The article also quotes a worker saying "a lot of my friends work as carpenters, but companies describe them as janitors in their contracts to avoid paying the salary negotiated in the collective wage agreement".

very different levels of earnings depending on the hierarchy level, or the degree of control over their own job, as documented by Bayer and Kuhn (2016).

At the same time, this type of substitutability has a limit. Technological constraints may limit the possibility of splitting occupations in shifts, or certain occupations may require particular skill levels. The proportion of workers with different education levels and hours worked (and their share in the labor cost) shows a considerable variability across industry branches even when narrowly defined (see Tables (1.A7) and (1.A8)). This observation suggests that establishments need to combine both low-earning and high-earning workers to produce, which act hence as complementary.[24]

Overall, the discussion in this section supports the premise that mini-jobbers —low-earning workers— are imperfect substitutes of regular —high-earning— workers. As shown in the next section, the degree of substitutability is important for understanding the labor demand response to the expansion of in-work benefits.

1.4 A Stylized Model of the Labor Market

Motivated by the evidence discussed earlier, I start from the premise that the Mini-Job reform stimulates labor supply in the low-earning sector. The theoretical framework then explains how the reform affects labor demand. To do so, I present a simple model of the firms' profit maximization problem, in which I derive the changes in equilibrium wages and demand for low-earning and high-earning workers. To motivate my empirical strategy, I focus on the relationship between the firm response and the pre-reform intensity in different types of labor. A more thorough theoretical analysis that shows that the intuition provided in this section also holds in general equilibrium is presented at the end of this paper.

1.4.1 Framework

There are two types of jobs, indexed by $j \in \{1, 2\}$, that are characterized by different before-tax hourly wages w_1 and w_2, and different tax rates, $\tau_1 < \tau_2$. Type-1 jobs comprise workers with gross earnings below a threshold K, that qualify for a lower tax rate. I delay the discussion of the individual labor supply decision to the final section of the paper. At this point, it suffices to say that individuals in type-1 jobs can be understood as low-educated part-time workers who in equilibrium have low-earnings, and individuals in type-2 jobs, as

[24]Furthermore, table (1.A8) in the Appendix shows that there is an important amount of variability in the use (intensity or cost-ratio) of low-earning and high-earning workers within the same (narrowly defined) industry, fact that has been shown to indicate that inputs are imperfect substitutes (Raval, 2011).

highly-educated or full-time workers whose earnings surpass the threshold for being eligible for tax benefits. This distinction is motivated by the descriptive evidence provided earlier. The aggregate labor supply (in hours) in type-1 jobs is N_1^s, and in type-2 jobs, N_2^S.

Labor demand for each type of job is determined by a firm that produces an output Y sold for consumption at price p. The firm combines the hours in the different jobs with an elasticity of substitution σ, and θ is the distribution parameter of factor returns, which captures differences in productivity across jobs.[25] The production function has a standard though flexible Constant Elasticity of Substitution (CES) specification:[26]

$$Y = F(N_1, N_2) = A[\theta N_1^{\frac{\sigma-1}{\sigma}} + (1-\theta)N_2^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{1.1}$$

where A is the total factor productivity, and N_j is the amount of labor (hours) in type-j jobs.

The firm solves the static problem of profit maximization: $\max_{Y,N_1,N_2} pY - w_1N_1 - w_2N_2$, which yields the standard first order condition:

$$\frac{w_1}{w_2} = \frac{\theta}{1-\theta}\left(\frac{N_1}{N_2}\right)^{-\frac{1}{\sigma}} \tag{1.2}$$

From equation (1.2), N_1/N_2 is increasing in θ, i.e. the relatively more productive are low-earning workers within the firm, the higher the importance of these workers with respect to the rest.

1.4.2 Expansion of in-work benefits and equilibrium wages

The expansion of tax-benefits for workers in low-earning jobs induces an increase in the labor supply in this segment, N_1^S, relative to the high-earning segment, N_2^S. Overall, the ratio N_1^S/N_2^S increases. As in equilibrium labor demand and supply for each job are equal, an increase in N_1^S/N_2^S is only possible if the intensity of the firm N_1/N_2 also increases. If labor in the low-earning segment is not perfect substitute of labor in the high-earning sector ($\sigma \nrightarrow \infty$), from Equation (1.2) it is straightforward to see that w_1/w_2 decreases.

[25] The assumption that different types of jobs, such as part-time vs. full-time, or skilled vs. unskilled, have different productivity is standard in the literature (see e.g. Kunn-Nelen et al., 2013).

[26] The CES specification nests other common cases as Cobb-Douglas ($\sigma = 1$), perfect complements ($\sigma = 0$) or perfect substitutes ($\sigma \to \infty$).

1.4.3 Scale and substitution effects

The fall in the relative before-tax wages, w_1/w_2, in equilibrium leads to the demand for labor to respond differently according to the firm's use of different types of labor. I assume competitive markets and free entry. Using the Hicks-Marshall rules of derived demand, and assuming without loss of generality that w_1 falls and w_2 remains constant, the following expression shows the marginal changes in demand for each type of job (derivations are in section (1.D.2) in the Appendix, and are based on Hamermesh, 1986):

$$\begin{array}{c} \frac{dlnN_1}{dlnw_1} = -[s_1\eta + (1-s_1)\sigma] \\ \frac{dlnN_2}{dlnw_1} = -[s_1\eta - s_1\sigma] \end{array} \tag{1.3}$$

where η is the absolute value of the price-demand elasticity for each good, and $s_1 \equiv w_1 N_1/pY$ denotes the cost-share of type-1 jobs.

The common term of both equations in (1.3), $s_1\eta$, captures the scale effect. The lower w_1 represents lower labor costs for the firm. As free entry drives profits to zero, the firm expands the production and increases labor demand for both type-1 and type-2 jobs. On the other hand, the substitution effect, reflected in the remaining term in both equations, induces an increase in labor demand for type-1 jobs, and a reduction in labor demand for type-2 jobs.

The crucial insight from this expression is that the change in the demand for labor in type-1 and type-2 jobs depends on the share of type-1 jobs in total labor costs, s_1. Intuitively, s_1 is positively associated with N_1/N_2 and θ (proof in Appendix (section 1.D.2)). Thus, the scale effect is strong if the firm is intensive in N_1. The substitution effect is stronger in terms of changes in N_1 (and weaker in terms of changes in N_2) if the intensity in N_1 is low. Overall, the demand for type-1 jobs increases unambiguously, mainly driven by the scale effect if the firm is N_1 intensive, and mainly driven by the substitution effect otherwise. In contrast, what happens with the demand for type-2 jobs is ambiguous, it increases or decreases depending on which effect dominates, scale or substitution. For $\sigma < \eta$, the demand for these jobs increases if the firm is more intensive in low-earning workers.

To test these predictions empirically, I exploit that different firms have different intensities in low-earning labor at the time of the Mini-Job reform. The measure of low-earning labor usage at the firm-level used in the analysis is the proportion of low-earning workers out of total employment. This formulation is in line with the literature evaluating the effects of other policies such as minimum wages on labor demand. I show in the Appendix, section (1.D.2), that there is a positive relationship between the cost-ratio of low-earning workers, and their proportion.

1.5 Empirical Strategy

The theoretical framework predicts that the response of firms to wage changes induced by the expansion of in-work benefits varies with their pre-reform intensity in low-earning workers. To test this hypothesis, I use a differences-in-differences approach (DiD hereafter), similar to other studies that have investigated the employment effects of other labor market policies such as minimum wage changes (Harasztosi and Lindner, 2017; Machin et al., 2003).[27] My results are based on the longitudinal section 2000-2007 of the LIAB. The main specification relates establishment-level outcomes to pre-reform use of low-earning workers as follows:

$$y_{kt} = \alpha_k + \lambda_t + \beta_t IntLE_k + \epsilon_{kt} \tag{1.4}$$

where y_{kt} stands for the outcome of establishment k in period t (mainly employment, but also wages and workers' flows among others), α_k are establishment fixed effects to capture time-invariant heterogeneity across firms such as productivity, λ_t are year fixed effects to absorb common macroeconomic shocks. $IntLE_k$ measures the fraction of workers that were below the mini-job threshold according to its new definition in 2003 at the establishment k in 2002, the year before the reform.[28] Standard errors are clustered at the establishment level to account for auto-correlation. The following discussions focus on the results based on the specification (1.4). I provide later a series of robustness checks that show the results do not change with less parsimonious specifications.

The coefficient of interest, β_t, is computed for each year by interacting $IntLE_k$ with year fixed effects. Estimates of β_t capture differences in the outcome paths between high-intensity (with respect to low-earning workers) establishments and low-intensity establishments, relative to the year before the reform, 2002. β_t measures the effect of the Mini-Job reform as the difference in the labor demand by firms with different pre-reform intensities, after controlling for heterogeneity at the establishment level and common macroeconomic shocks. The main identification assumption is that, in the absence of the reform, the evolution of outcomes would follow parallel trends across establishments with different pre-reform intensities. I

[27] Similar strategy for analyzing firm profitability and productivity has been applied in Draca et al. (2011) and Mayneris et al. (2017).

[28] The threshold effectively used is €400 net-of-SSC earnings, which amounts to €506.33 of gross earnings under pre-reform regulations ($400 = 506.33(1-0.21)$, where 21% is the pre-reform SSC rate). The regressions do not include establishment level controls which, since they are relatively constant in time, are highly collinear with the fixed effects. Since $IntLE_k$ is not observable for establishments born after 2002, I also exclude establishments born in 2000-2002. Establishment death is very low during the observation window. Still, I perform the analysis on the subgroup of surviving establishments until 2007 as a robustness check. Along the analysis, I included the 1999 observation for the establishments in the panel for which it is available (68%) to add one year for pre-trend tests. The results do not change when excluding this year.

show that this parallel trend assumption is not violated for the pre-reform years, for which the estimates of β_t are small and insignificant.

It is worth pointing out that in this specification, there are, strictly speaking, no treatment and control groups, and hence the assumption that some production units are not affected by the reform needs to be dispensed (the stable unit treatment value assumption —SUTVA— does not hold). Although establishments with a low pre-reform proportion of low-earning workers are less exposed to labor costs savings and hence the scale effect is not relevant for them, as opposed to establishments with high intensity, low intensity establishments are affected by the substitution effect. In particular, low-intensity establishments have incentives to increase the use of low-earning workers according to Equation (1.3). Hence, the post-reform differences in total employment trends as measured by β_t offer a conservative estimate of the employment effect in the context of the expansion of in-work benefits, as employment would be increasing in both high-intensity and low-intensity establishments. Differences in trends of employment by type (low-earning and high-earning workers) inform about which effect, scale or substitution, underly the general employment trends. I will discuss this in more detail when I comment the results.

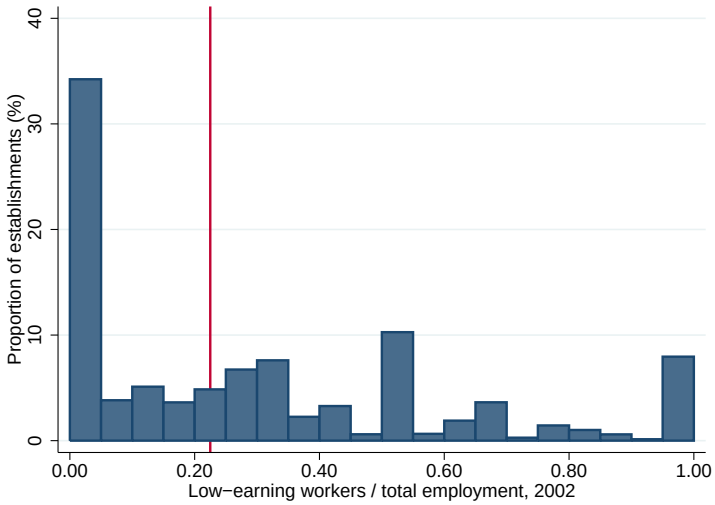
The sample I use to calculate the effects of the Mini-Job reform comprises 3,770 establishments matched to 621,900 workers. I present here some descriptives using the longitudinal sampling weights constructed by the IAB for the longitudinal section 2000-2007 to account for the disproportionately stratified sampling.[29]

For the empirical strategy to be successful, the variation in the pre-reform intensity in low-earning employment has to be sufficiently large. Figure (1.3) shows that while close to 35% of the establishments have a very low proportion of low-earning workers in 2002 (0-5%), the remaining 65% are distributed across a wide range of intensities. Half of the establishments have more than 21% of their workforce in the low-earning segment, 15% of the establishments have between 20% and 30% of their workers below the mini-job threshold, while 28% have more than half of their employees below the mini-job threshold.

Table (1.3) shows summary statistics of the panel of establishments for 2002, according to the weighted quintiles in terms of the proportion of low-earning workers, Q1 to Q5. Establishments with different pre-reform intensities in low-earning workers differ along several dimensions. As expected, high-intensity establishments pay lower average daily wages, but the gap is smaller within workers' groups such as full-time or part-time. It is worth high-

[29]Table (1.A9) in the Appendix shows summary statistics for 2002 for both the cross-section and longitudinal section, with and without weights. Characteristics of the cross-section and the panel units are similar. A comparison of characteristics using weights and not using weights is illustrative of the sampling (specifically, the over-sampling of big establishments).

Figure 1.3: Distribution of establishments according to the proportion of low-earning workers, 2002



Note: Panel 2000-2007.

lighting that the proportion of low-earning workers is non-monotonic with respect to key establishment characteristics, such as size or age. For instance, low-intensity establishments (quintiles 1 and 2) include both small and big establishments. More generally, there is only a weak relationship between the intensity in low-earning workers and other establishment characteristics. This observation lends confidence that the estimated coefficient related to $IntLE_k$ in Equation (1.4) does not pick up establishment traits such age or size, but it captures different trends due to diverse use of low-earning workers, as required by the analyzed mechanism.

Furthermore, even though the proportion of high-intensity establishments is larger in certain industries such as services, retail trade and repair, there is a significant presence of high-intensity-establishments in all industries, as shown in Figure (1.4) where the proportion of intensive establishments (fraction of low-earning workers above the median) fluctuates between one third and two thirds. This also holds for a finer definition of industries (224 categories), and suggests that the estimates are also not linked to industry level variation, but to a variation of low-earning labor intensity.

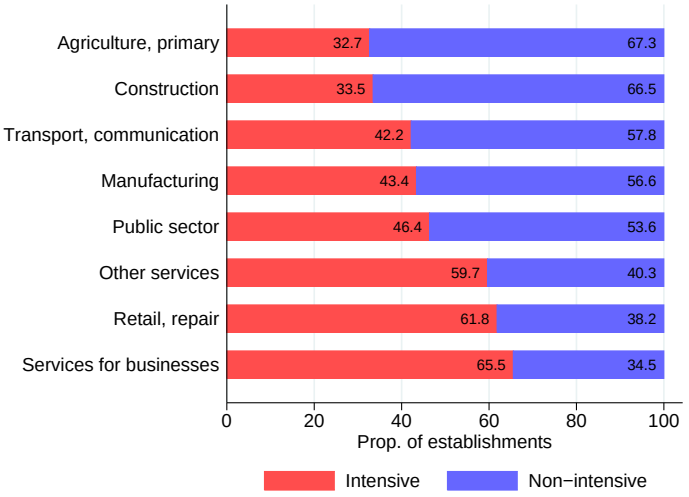
Importantly, the differences in characteristics of firms with different intensities in low-earning workers do not invalidate the DiD identification strategy. This strategy is motivated in the theoretical framework presented before, and relies on the parallel trends assumption, verified for the years that preceded the reform. The DiD strategy allows to overcome confounding effects from macroeconomic shocks, a particularly relevant feature as Germany found itself in a strong economic slump around the years of the reform. The next section presents the

Table 1.3: Characteristics of establishments by proportion of low-earning workers (quintiles), 2002

	Q1	Q2	Q3	Q4	Q5
Proportion of workers below 2003 MJ threshold	0%	6.2%	24.3%	46.3%	83.2%
Proportion of workers below 2003 MidiJ threshold	11.8%	11.2%	34.0%	54.6%	85.7%
Establishment age	14.7	18.5	14.7	13.0	11.8
Establishment size (n. workers)	9.1	97.2	14.6	9.2	6.2
Establishment size (full-time equivalent)	8.4	87.3	11.5	6.3	3.3
Proportion of part-time workers	13.0%	17.7%	28.7%	42.7%	67.9%
Proportion of low-educated workers	9.2%	13.2%	12.2%	13.7%	11.6%
Proportion of medium-educated workers	65.6%	66.2%	60.2%	51.8%	43.2%
Proportion of highly-educated workers	5.6%	9.1%	4.5%	2.9%	0.4%
Vacancies/employment	3.0%	1.6%	1.2%	1.6%	0.7%
Median daily gross wage	59.0	72.8	50.8	31.2	9.9
Median daily gross wage (growth)	19.0%	2.9%	9.6%	22.6%	-7.2%
Median daily gross wage of full-time workers	64.5	80.2	63.8	56.2	38.8
Median daily gross wage of full-time workers (growth)	4.2%	2.5%	0.7%	5.6%	4.2%
Median daily gross wage of part-time workers	46.2	33.9	16.4	12.4	9.0
Median daily gross wage of part-time workers (growth)	16.6%	22.0%	10.3%	7.1%	14.5%
Per capita monthly labor cost	1,548	2,148	1,551	1,068	783
Monthly wage bill	23,581	263,505	28,967	11,041	4,878
Inequality (P75/P25) full-time workers	1.38	1.39	1.67	2.30	1.61
Hirings/employment	0.14	0.18	0.19	0.25	0.23
Separations/employment	0.30	0.19	0.20	0.26	0.33
Investment (million)	0.057	0.777	0.057	0.033	0.037
Sales (million)	1.627	21.291	1.565	0.566	0.448
Exports/revenues	4.2%	11.8%	2.5%	3.4%	3.1%
Work council	11.2%	37.3%	7.6%	4.5%	1.4%
Collective agreement	47.3%	58.8%	49.6%	40.5%	28.6%
Agriculture, primary	7.9%	1.7%	2.0%	2.5%	3.0%
Manufacturing	13.0%	25.3%	10.5%	13.6%	8.9%
Construction	16.0%	12.9%	12.5%	3.2%	3.6%
Retail, repair	19.4%	12.8%	24.1%	23.6%	24.2%
Transport, communication	6.6%	5.9%	2.5%	2.4%	6.6%
Financial intermediation	3.5%	2.6%	1.9%	1.3%	1.8%
Services for businesses	8.5%	12.3%	18.3%	26.2%	16.4%
Other services	19.1%	18.5%	26.0%	24.8%	27.2%
Public sector	5.9%	8.0%	2.3%	2.5%	8.4%
Workers in analytical non-routine tasks	15.6%	15.2%	9.0%	8.1%	7.2%
Workers in interactive non-routine tasks	9.0%	11.0%	10.2%	12.4%	16.3%
Workers in cognitive routine tasks	32.1%	33.2%	41.2%	38.3%	34.0%
Workers in manual routine tasks	12.2%	10.5%	8.2%	7.3%	3.9%
Workers in manual non-routine tasks	29.8%	27.8%	28.8%	28.5%	35.4%
Observations	1,041	1,288	852	306	283

Note: Panel 2000-2002. Establishments classified according to the (weighted) quintile of the proportion of low-earning workers.

Figure 1.4: Proportion of establishments by intensity in low-earning workers (above/below median) by industries, 2002



Note: Panel 2000-2007. Intensive and non-intensive establishments refer to whether they are above or below the (weighted) median of proportion of low-earning workers.

estimation results of the DiD analysis.

1.6 Results

In this section, I present the estimates of the coefficient β_t in equation (1.4) for a variety of firm level outcomes. Even though the independent variable $IntLE_k$ is continuous (between 0 and 1), I refer to the results as difference between "high-intensity" (in low-earning workers) establishments and "low-intensity" establishments.[30] The results are presented in graphical format in Figures (1.5) to (1.13); Table (1.A13) shows estimates in a compressed format.

1.6.1 Effects on employment

I first discuss the estimates of β_t from equation (1.4) for the outcome of total employment, shown in Figure (1.5). According to the previous discussion, these provide a conservative estimation of the effect of the reform on the demand for total employment. The left panel shows the differential paths in the total number of workers across firms with different pre-

[30] In the section on robustness checks, I discuss that changing the continuous variable $IntLE_k$ for a binary variable which takes the value 1 for establishments with a pre-reform intensity in low-earning workers above the median, and 0 for establishments with below median intensity, does not change the results.

reform intensities in low-earning workers.[31] Estimates correspond to the difference in the number of workers in each period with respect to the baseline year 2002. High-intensity establishments, which exhibited similar changes as low-intensity establishments in the number of workers before 2003, show a noticeable expansion (relative to low-intensity establishments) after the reform. The estimated coefficients are statistically significant for 2005 and 2006 and borderline significant for 2004. Economically, the magnitude of the estimated coefficients implies an increase of 4% with respect to the average establishment size in the pre-reform year, and 8% with respect to the size of establishments with above-median intensity in low-earning workers, by the second year after the reform.

To rule out that the increase in employment is not driven by the substitution of full-time by part-time positions (which would contradict the mechanism proposed), I confirm that employment in hours (as measured in full-time equivalent terms) also increases in high-intensity establishments, relative to low-intensity establishments, as shown by the right panel of Figure (1.5). The difference is statistically significant for all years following the reform. It represents 2 full-time equivalent workers more in high-intensity establishments, as compared to low-intensity establishments, which amounts to 7% of the initial full-time equivalent employment in the sample, and 22% of the initial full-time equivalent employment in high-intensity establishments, by the second year after the reform.

Raw trends comparing high-intensity (fraction of low-earning workers above the median) and low-intensity establishments are shown in the Appendix, Figure (1.B9). Whereas the number of workers in total and in full-time equivalent employment is declining for low-intensity establishments, it is slightly increasing for high-intensity establishments in the post-reform years.[32]

Figure (1.6) shows the estimates of β_t for the growth rate of low-earning and high-earning

[31] I estimate the effect of the Mini-Job reform on employment level and not growth rates because the parallel trend assumption, which requires that employment level was changing in similar magnitudes for establishment with different pre-reform intensities in low-earning workers, is verified empirically. It does not hold though for growth rates. Intuitively, this implies that the elasticity of total employment with respect to the wage of low-earning workers (targeted by the reform) is not constant along the labor demand curve. This is indeed reasonable in a setting in which the labor cost shock induced by the reform impacts high-intensity firms more strongly, since these firms are, on average, smaller than low-intensity firms. Instead, a constant elasticity would imply that the impact of the labor cost shock increases with firm size, which seems implausible. The specification with respect to employment hence assumes an additive treatment effect on total employment, as opposed to a multiplicative treatment effect (see e.g. Fisher and Ciani, 2014). When considering low-earning and high-earning workers separately, the parallel trends assumption holds for growth rates, indicating a constant elasticity within each type of labor and consistent with the theoretical framework (see Equation (1.3)).

[32] Average employment in the sample is declining, as it is to be expected due to the cohort nature of the sample. It is a well known fact that the main contributors to employment growth are new entrants, which cannot be included in the analysis by construction since the comparison is across establishments according to their pre-reform intensity.

Figure 1.5: Effect on total employment

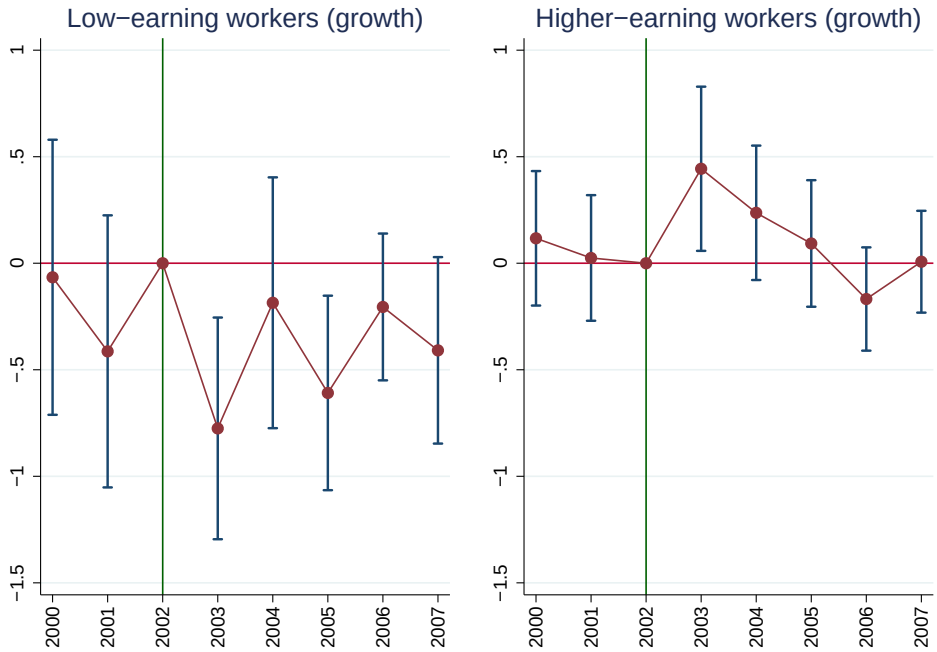
Note: Confidence intervals correspond to 95% level.

workers separately. These estimates exclude firms with only one type of worker (i.e., firms that are in the 1^{st} and 5^{th} quintile of the intensity distribution). High-intensity establishments exhibit a relatively higher growth rate of high-earning workers after the reform (statistically significant for 2003, with point estimates of 44 pp.) and a relatively lower growth of low-earning workers (significant in 2003 and 2005, with point estimates of -78 pp. and -61 pp., respectively). Figure (1.B10) in the Appendix shows the evolution of both types of employment across establishment with different pre-reform intensities. In high-intensity establishments, the time trend in low-earning employment seems to change with the reform (i.e., a noticeable upward trend turns into a downward trend) while the reverse occurs in low-intensity establishments.

Overall, the estimates suggest that the effect of the reform is a relative expansion in terms of total employment in high-intensity establishments as compared to low-intensity establishments.[33] Within each establishment type (high-intensity and low-intensity), there is a relative growth of employment of the less abundant type: high-earning in high-intensity (in

[33]The fact that the gap closes since 2006 is not surprising, given the reversal in the tax benefits implied by the increase in the SSC rate for the employer to 30% for mini-jobs, and the decrease of the SSC rate for both employer and employee to 19.5% for regular jobs. Furthermore, reversal in the incentives even under the same level of tax benefits would be expected as low-intensity firms become relatively more intensive in low-earning workers.

Figure 1.6: Effect on the growth rate of low-earning and high-earning workers



Note: Establishments with both low and high earning workers in the pre-reform year (quintiles 2-4 of intensity). Confidence intervals correspond to 95% level.

low-earning workers) establishments, and low-earning in low-intensity establishments. Going back to the discussion of the mechanism, these results are actually expected (see expression (1.3)), and they are consistent with imperfect substitution between the types of jobs performed by low-earning and high-earning workers. The scale effect has a stronger bite on high-intensity establishments, for whom labor costs are reduced by virtue of the reform. The substitution effect instead, due to the change in the relative cost of low-earning workers, induce particularly low-intensity establishments to increase the lists of low-earning workers.

Unfortunately, the empirical strategy does not allow to tier apart scale and substitution effects, because the DiD coefficients mix up scale and substitution across establishment and workers' types. A crucial question is whether the empirical results are compatible with only one of these effects in place. Let us start by discussing the case with only substitution effect, which would be the case if $\sigma \to \infty$ in terms of the model presented earlier. Expression (1.3) suggests that high-earning employment (N_2) should decrease more in high-intensity establishments than in low-intensity ones, which implies a negative coefficient in the DiD analysis, which is rejected by the results. On the other hand, the case with only scale effect ($\sigma = 0$) is also counterfactual. Employment in both types of workers should increase more in high-intensity establishments, which should be reflected in a positive coefficient in the DiD

estimates for the growth of both low-earning and high-earning workers. Hence, the negative coefficient for low-earning workers contradicts the possibility of only scale effect in place. Table (1.A12) in the Appendix provides more intuition regarding this discussion.

1.6.2 Effects on hours and wages

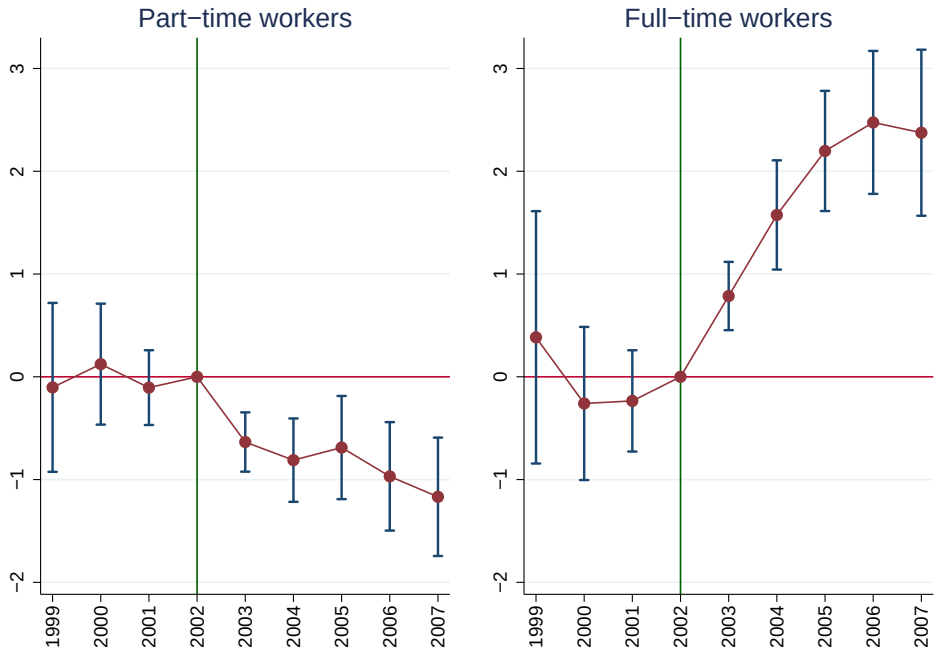
The relative expansion of high-intensity establishments in terms of high-earning employment may be driven by either a relative increase in wages ("productivity channel", or change in the education of the workforce) or by an increase in the number of hours per workers ("hours channel", or change in full-time vs. part-time mix). I show here evidence suggestive of both channels. Figure (1.7) shows that after the reform the number of full-time workers increases and the number of part-time workers decreases in high-intensity establishments with respect to low-intensity establishments. The coefficients in 2004 represent 0.8 fewer workers in part-time jobs in high-intensity establishments than in low-intensity establishments, and 1.6 more workers in full-time in high-intensity establishments than in low-intensity establishments (20% and 35% respectively with respect to the baseline number of workers of each type). Figure (1.B11) in the Appendix shows a pick-up in the trend in part-time employment after the reform, leaded by establishments with low-intensity in low-earning workers. On the other hand, high-intensity establishments seem to reduce the speed of the downward trend in full-time employment.

Figure (1.8) shows that high-intensity establishments increase relatively the number of medium-educated workers (with "Abitur" and/or vocational training), with a difference of 0.6 worker more as compared to low-intensity establishments (3% with respect to the baseline). High-intensity establishments also experience a relative reduction in the proportion of low-educated workers (without "Abitur") of 3 pp., which represents one fourth of the baseline proportion in 2002 (see Figure (1.B12) in the Appendix for the trends).

Further support regarding the change in the workforce skill composition, investment in physical capital (more complementary with skilled labor) increases more in high-intensity establishments than in low-intensity establishments after the reform, as shown in Figure (1.9). The DiD coefficient for 2004 (significantly different from 0) is €32 thousand, close to the initial value of investment in high-intensity establishments, and almost one third of the average amount in the sample (trends are in Figure (1.B13) in the Appendix).

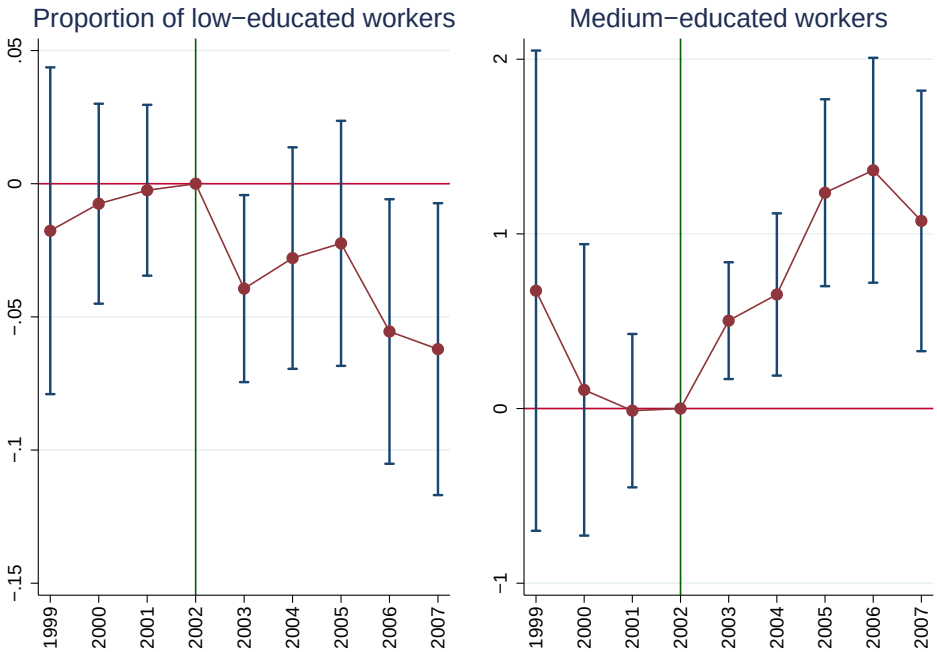
The increase in both hours worked and wages is further supported by a higher growth rate of median daily wages in high-intensity establishments than in low-intensity establishments (1.10). The after-reform upward trend holds when splitting between part-time and full-time workers, though estimates are not statistically significant (see Figure (1.B14), and Figures

Figure 1.7: Effect on employment by part-time and full-time status



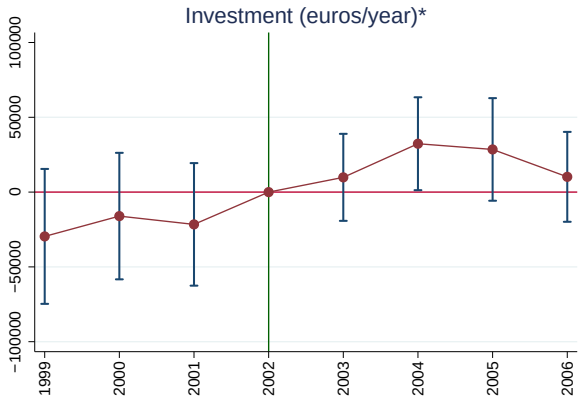
Note: Confidence intervals correspond to 95% level.

Figure 1.8: Effect on employment by education level



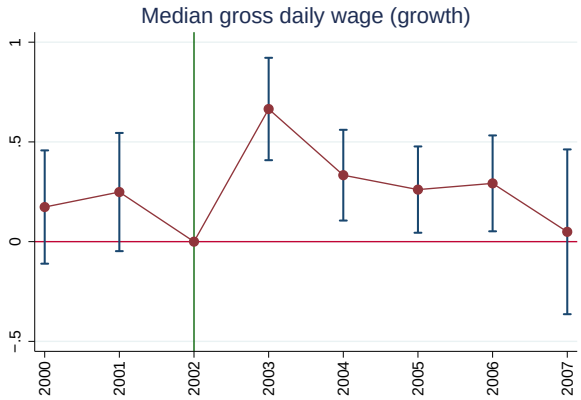
Note: Confidence intervals correspond to 95% level.

Figure 1.9: Effect on investment in physical capital



Note: Using as regressor a binary variable: 1 for above median and 0 for below median intensity in low-earning workers. Confidence intervals correspond to 95% level.

Figure 1.10: Effect on median daily wages



Note: Confidence intervals correspond to 95% level.

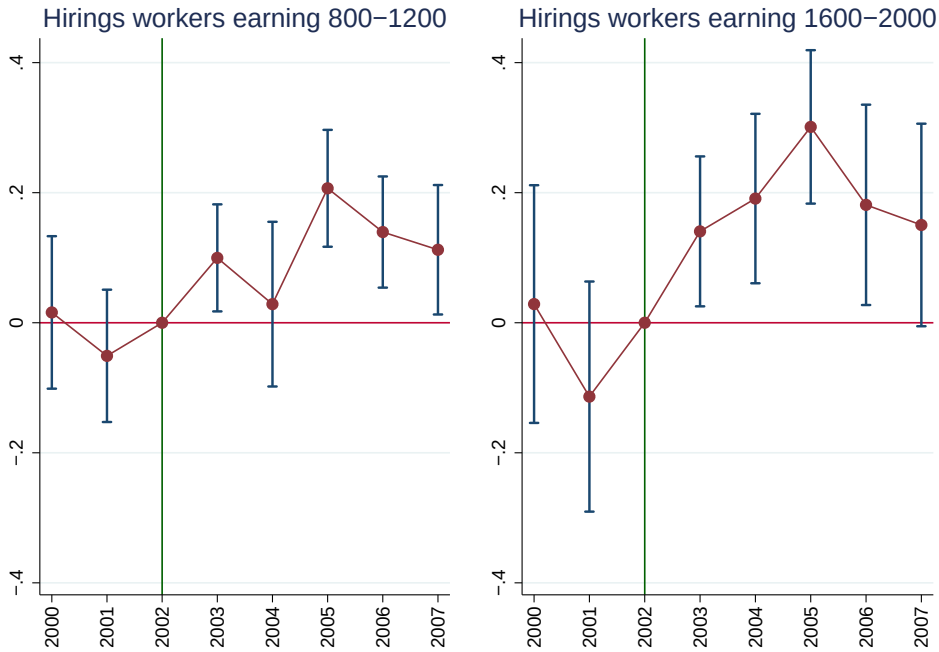
(1.B15) and (1.B16) for trends, in the Appendix).

1.6.3 Effects on workers' flows and promotions

For high-intensity establishments to expand in high-earning workers relative to non-intensive establishment, they either hire more high-earning workers (net of separations) or upgrade earnings of incumbent workers.[34] Vacancy openings increase more in high-intensity establishments than in low-intensity establishments after the reform (Figures (1.B17) and (1.B18)

[34]The results of the DiD estimates in this section become highly imprecise, because workers' flows are particularly small. I hence show in the text those for which coefficients are significant, and I discuss more descriptive evidence observing the raw trends for the rest.

Figure 1.11: Effect on hirings of workers by gross monthly earnings



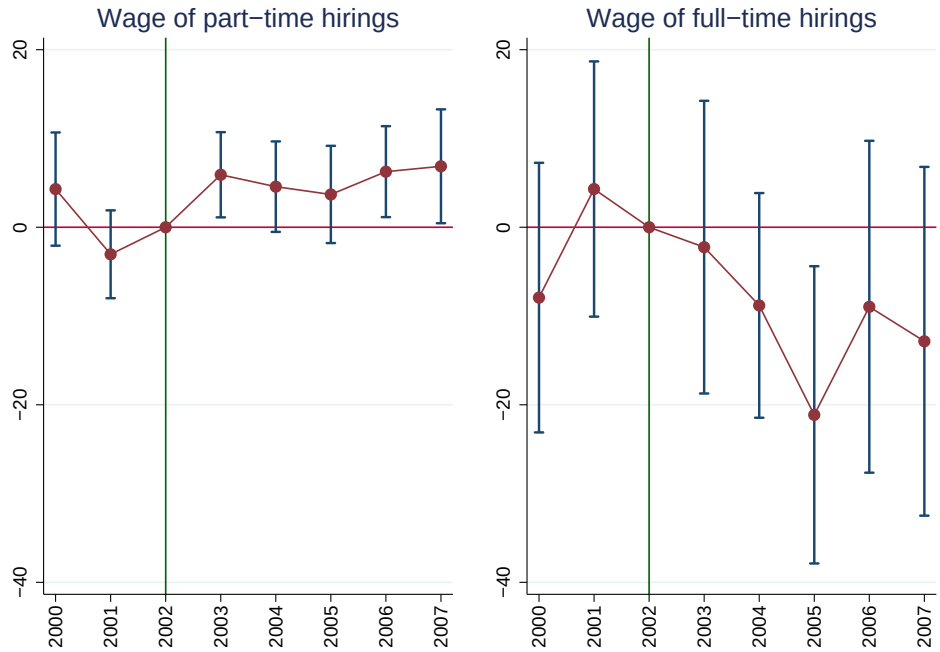
Note: Confidence intervals correspond to 95% level.

in the Appendix). Differences in hiring are significant for workers with earnings above the mini-job threshold, as shown in Figure (1.12). Figures (1.B19) and (1.B20) in the Appendix further show that low-intensity establishments increase hiring of workers below the €400 threshold, whereas separations of these workers seem larger in high-intensity establishments. Separations of workers above the midi-job threshold appear to decrease in low-intensity establishments as compared to high-intensity establishments, although there is also less hiring of these workers.

The raise in full-time workers in high-intensity establishments seems supported by the fact that these firms are hiring these workers at lower wages than low-intensity firms, as shown in Figure (1.B22). Similarly, inflows of part-time workers in low-intensity units is accompanied by lower relative wages offered to them by these establishments, as compared to high-intensity establishments.

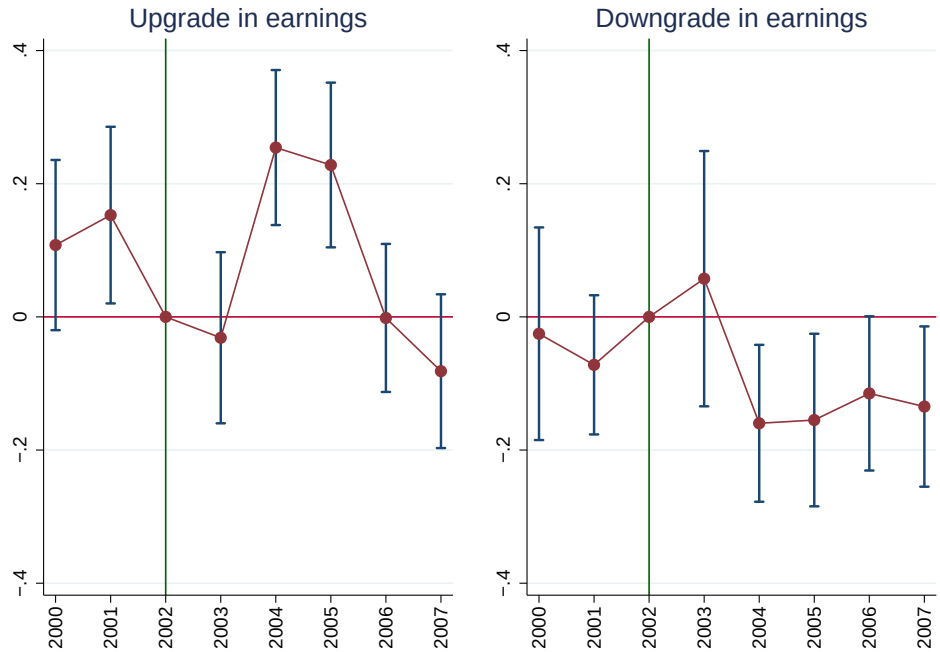
Incumbent workers seem to be taking part in the process of change in the workers' structure as well. From Figure (1.13), a smaller proportion of workers suffer reduction in gross earnings in high-intensity establishments than in low-intensity establishments. Wage upgrades also seem more frequent in high-intensive establishments than in low-intensity establishments (Figure (1.B21)).

Figure 1.12: Effect on wages of hirings of part-time and full-time workers



Note: Confidence intervals correspond to 95% level.

Figure 1.13: Effect on wage changes for workers within establishments



Note: Confidence intervals correspond to 95% level.

1.6.4 Effects on task composition of the workforce

Some trends regarding the task composition appear to change after the reform (see Figure (1.B23)). It seems that high-intensity establishments increase relatively the proportion of workers carrying out analytical and manual non-routine tasks, and low-intensity establishments take up in terms of interactive non-routine and cognitive routine tasks. No apparent differences in the number of job titles (344 categories) can be seen across establishment intensity in low-earning workers after the reform. However, the downward trend in the number of occupations within establishments for the years before the reform seems reverted afterwards in all types of firms.

1.6.5 Heterogeneous effects

In this section I investigate whether the effects are heterogeneous by industry, establishment age, size, and status with respect to collective agreements. The outcomes examined are total employment, part-time and full-time employment, and workforce by education level.[35] The econometric specification is a modification of equation (1.4), as follows:

$$y_{kt} = \alpha_k + \phi Post_t + \sum_m \beta_m IntLE_k \times Post_t \times Heter_{mk} + \sum_m \gamma_m Heter_{mk} + \sum_p \lambda_p t^p Ind_k + \epsilon_{kt} \tag{1.5}$$

where $Post_t$ is a dummy which takes the value 1 after the reform, and 0 otherwise, $Heter_{mk}$ is a set of dummies that take the value 1 for the establishments which belong to the group m, and $\sum \lambda_p t^p * Ind_k$ control for a quadratic polynomial on the industry-level (224 categories) trend. Table (1.A14) in the Appendix shows the estimates of coefficients β_m (the baseline in each case is specified, and the coefficients on the remaining categories show the differences with respect to the baseline). I base the discussion here on the size of the point estimations. I discuss statistical significance of the differences in each case, as estimates are highly imprecise when performing cuts on the data.

Differences across industries are not statistically significant. The point estimates though suggest that the relative changes in employment (in high-intensity establishments with respect to low-intensity establishments) are stronger within manufacturing than within services.

Employment effects are larger for more mature establishments, statistically different for full-time and part-time employment within establishments above 20 years old. Regarding establishment size, bigger establishments seem to experience the stronger employment effects.

[35] These results need to be taken with caution, as the stratification of the sample does not consider all these dimensions (only industry and size).

Differences are significant for establishments with more than 200 workers in terms of full-time workers, and between 20 and 200 workers with respect to total employment and medium-educated workers.

The relative employment expansion of high-intensity establishments, specially in full-time employment, is significantly higher in establishments under industry or company level collective agreement. As collective agreements impose limits to wage reductions, this observation is encouraging regarding the expansionary effect of the reform on labor demand.

1.6.6 Robustness and validity of the empirical results

In this section, I discuss a series of checks for robustness of the results. Regarding the definition of the variable of interest $IntLE_k$, I change the specification in several ways: (i) defining low-earning workers as those earning below the midi-job €800 threshold, (ii) defining $IntLE_k$ as a binary variable which takes the value 1 for establishments with an intensity above the median in the sample, and 0 otherwise, useful exercise to rule out that outliers are driving the results and confirm the linearity of the effects, (iii) excluding younger and older workers, who were disproportionately affected by the policy, from the definition of the intensity in low-earning workers, and (iv) using the intensity in part-time and low-educated workers at the firm and industry level. In all the cases, results do not change qualitatively. Furthermore, for (i)-(iii), coefficients estimates and significance are virtually the same to the benchmark estimation. In the case of (iv), point estimates are very similar to the main estimates, but precision is much lower as expected, since low-earning workers do not correspond exactly with the group of low-educated part-time workers. The invariance of results to these different specifications of the variable $IntLE_k$ reinforces its interpretation as capturing a feature of the production function of firms. Results of these robustness checks are available upon request.

Although the longitudinal section 2000-2007 is meant to avoid attrition between one wave and the following, and I exclude establishment birth during the whole observation window in the main estimations, some establishments die during the period (7%). I verify that the analysis does not change if I use the subgroup of establishments which survived until 2007 (3,494). The invariance of the results also suggests that the effects of the reform on establishment death may have been negligible. To maximize the pre-reform period, I use the observation in 1999 when it is available for establishments in the 2000-2007 panel.[36] Even

[36]The Establishment Panel provides a limited number of longitudinal sections, and there is no section which comprises the reform period and starts in 1999, first year for which marginal employment is available in the social security records.

though one-third of them does not have information for 1999, estimates for 2000 on do not change when excluding this year. These results are also omitted and available upon request.

I further estimate a variant of equation (1.4) controlling for specific trends. I perform several exercises, following the specification:

$$y_{kt} = \alpha_k + \lambda_t + \beta_t IntLE_k + \sum_p \lambda_p t^p \times Indicator_k + \epsilon_{kt} \tag{1.6}$$

First, I control for quadratic trends at the industry level, where $Indicator_k$ is a set of binary variables which take the value 1 for the industry (224 categories) to which the establishment corresponds. Second, I do a similar exercise but for different levels of pre-reform intensity in low-earning workers (quintiles). A third exercise controls for a establishment specific linear trend, by taking first differences of (1.6):

$$\Delta y_{kt} = \Delta\lambda_t + \Delta\beta_t IntLE_k + \epsilon_{kt} \tag{1.7}$$

Furthermore, I control for variables that are arguably exogenous to the effect of the reform at the establishment level, by estimating the following specification:

$$y_{ktci} = \alpha_k + \lambda_t + \beta_t IntLE_k + \phi_0 Int_{i(-c)} + \phi_1 Int_{c(-i)} + \epsilon_{ktci} \tag{1.8}$$

where $Int_{i(-c)}$ is the proportion of low-earning workers in industry i in all commuting zones except where the establishment is, and $Int_{c(-i)}$ is the proportion of low-earning workers in the commuting zone c in all industries except the one in which the establishment operates. This exercise is aimed at controlling for omitted trends in local labor markets and industry level, which can be considered related to labor supply shifts. Tables (1.A15) to (1.A23) in the Appendix show the estimates for β_t for all these specifications, as compared to the benchmark from equation (1.4). The main lesson from these exercises is that estimates remain virtually unaffected after controlling for specific trends in a variety of ways. The specification in first differences to control for firm-specific trends though yields lower point estimates and precision levels, given the variations are year to year and not with respect to the pre-reform year as in the rest of the estimations.

Finally, I address concerns about potential biases in the estimators that would arise if the dependent variables were persistent (Nickell, 1981). The specification with lagged dependent variable is:

$$y_{kt} = \alpha_k + \rho y_{kt-1} + \lambda_t + \beta_t IntLE_k + \epsilon_{kt} \tag{1.9}$$

Due to the endogeneity introduced by the lagged dependent variable in the fixed effects estimation, I estimate this model using dynamic panel data techniques. The system of equations in levels and in differences is estimated by General Method of Moments (GMM), instrumenting differenced lags and lagged levels of the dependent variable by further lags of this variable. I also use lags of other covariates (average gross wages and investment) to improve efficiency, following the approach by Blundell and Bond (1998), with the Arellano and Bover (1995) transformation to use forward orthogonal deviations (the implementation follows Roodman, 2009). Estimates of β_t are shown in Figures (1.B24) to (1.B26) in the Appendix. Results hold qualitatively, as point estimates generally preserve the signs reported in the main results. However, there is an important loss of precision due to the use of instruments and most estimates are not statistically significant. An important exception is the results regarding the differential evolution of part-time and full-time workers, which remain statistically significant.

I further estimate the model both via OLS (ignoring the establishment fixed effects) and introducing the lagged dependent variable in the within estimation directly. According to Angrist and Pischke (2009), these two estimates should provide bounds for the true value of the parameter, as the former is downward biased and the latter upward biased. Point estimates are in Figures (1.B24) to (1.B26) in the Appendix, and they show that conclusions hold for estimates within these bands.

1.6.7 Discussion and interpretation

The empirical findings suggest that the Mini-Job reform had important consequences for employment, no only for workers who were targeted (low-earning) but also for workers who were outside the scope of the policy (high-earning). Actually, establishments intensive in one type of worker seem to lean towards employment of the opposite worker type after the reform. Intuitively, this would lead to a convergence, establishments decreasing the gap in terms of intensity and becoming more similar to each other. Some pieces of evidence seem to support this intuition.

Figure (1.B27) in the Appendix shows that within the panel of establishments used for estimation, there is more mass with medium levels of low-earning workers and less mass with low levels of them. Changes in the earnings distributions of workers across establishment pre-reform intensity in low-earning workers (Figure (1.B28)) also point in the direction of production units become more similar in their payroll, and establishments in the bottom of the intensity in low-earning employment to respond stronger in terms of bunching at the threshold than more intensive establishments.

Figure (1.B29) shows that within the panel of establishments 2000-2007, the proportion of those which are highly intensive in low-earning workers decreases after the reform in industries in which they were initially abundant, such as services and retail commerce. At the same time, some originally high-paid activities, such as agriculture or primary, see an augmented portion of establishments with a high-intensity in low-earning workers. This does not hold when looking at the whole universe of establishments (cross-sections of the LIAB), as shown in Figure (1.B30). Most industry branches seem to be either keeping or increasing the proportion of high-intensity establishments in low-earning workers. This is the case if lower labor costs in certain industries due to the reform not only induce incumbents to expand, but also encourages entry of new establishments with similar characteristics. The number of establishments in fact increases in industries with initially high intensity in low-earning workers relative to industries initially less intensive, as shown in Figure (1.B31). Establishments in services and retail commerce represent 60.5% of the total number of establishments in 2002, and 62.8% in 2007, whereas the share of production units in manufacturing and construction shrink from 22.7% in 2002 to 21.6% in 2007.

Complementing the evidence about convergence at the industry level, the proportion of low-earning workers increases more in local labor markets with initially low presence of these workers. The maps in Figures (in Figures (1.B32) and (1.B33) in the Appendix show that whereas the German Northwest had a higher presence of low-earning workers in 2002, the increase is stronger in the Northeast. Table (1.A24) in the Appendix confirms this result, showing that the correlation between the initial proportion in low-earning workers and its variation at the local labor market level, is negative (-0.33 for 2002-2004, and -0.71 for 2002-2007).

These signs of slight convergence across establishment types (high and low-intensity) is consistent with, and supports, the results from both the theoretical and empirical analysis. Furthermore, the fact that the data seems to indicate that entry of establishments with high-intensity in low-earning workers is encouraged by the expansion of in-work benefits, raises questions about the allocation efficiency of such a policy, a point that is discussed in the following section.

1.7 Implications

The empirical strategy does not allow to evaluate total employment effects within each firm class, as it provides relative statements. To discuss the implications of the results in terms of employment levels and output, I enrich the theoretical framework used for the discussion

about the mechanism. I introduce the labor supply decision, following the literature on labor supply and taxation (see e.g. Saez, 2010; Chetty et al., 2011; Tazhitdinova, 2017). I further model the product market and the government budget. I compute the general equilibrium of the model and discuss the role of the degree of substitution between different workers.

1.7.1 Framework

Labor supply: There is a continuum of workers, who are heterogeneous in a parameter α that captures taste for work. α is distributed with a cumulative distribution function $F(\alpha)$ and a density function $f(\alpha)$. Workers choose whether to participate or not in the labor market, and the number of hours worked depending on the take-home wage and their taste for work. Their labor supply decision determines their sorting in two jobs, indexed by $j \in \{1, 2\}$. Jobs differ in the before-tax hourly wage w_1 and w_2, and in the tax rate on gross earnings, $\tau_1 < \tau_2$.[37]

The utility maximization problem of the worker is:

$$\max_{c,n} U(c, n) = c - \alpha^{-\frac{1}{\epsilon}} \frac{n^{1+\frac{1}{\epsilon}}}{1+\frac{1}{\epsilon}} - \beta I\{n > 0\} \tag{1.10}$$

s.t.

$$c = \begin{cases} b + tr & \text{if } n = 0 \\ (1-\tau_2)w_2 n = \hat{w}_2 n + tr & \text{if } n > 0 \\ (1-\tau_1)w_1 n = \hat{w}_1 n + tr & \text{if } n > 0 \text{ and } w_1 n \leq K \end{cases} \tag{1.11}$$

where c is consumption, n is hours of work in efficiency units, β is a fixed cost of working, b is the income in case of non-employment (unemployment benefit or social assistance), and tr is a lump-sum transfer from the government. I denote the take-home hourly wage as $\hat{w}_j \equiv w_j(1-\tau_j)$. The utility function is quasi-linear and hence implies no income effects, and ϵ is the constant elasticity of labor supply with respect to the wage. This specification is standard in the literature of labor supply and taxation. I extend the model to include the participation decision (see e.g. Blundell et al., 2011), as it is relevant for the discussion of in-work benefits.

[37] The tax rates are defined as $\tau_j \equiv \frac{(\tau_j^w + \tau_j^e)}{(1+\tau_j^e)}$, where τ_j^w and τ_j^e are the worker and employer paid tax rates respectively, in type-j job. There is a direct relation between τ_j and τ_w. The purpose of this simplification is to define the take-home (or net) wage of the worker as a linear function of the tax rate and the before-tax wage (labor cost per hour). In this section, I use the terms "before-tax" and "gross" interchangeably for simplification, as they move one-to-one with the labor costs for the employer, for whom taxes barely change with the reform.

As pointed out by Tazhitdinova (2017), the interesting case for the Mini-Job setting is such that $(1-\tau_1)w_1 = \hat{w}_1 > \hat{w}_2 = (1-\tau_2)w_2$. Otherwise, all workers would take up type-2 jobs, which are not subject to the earnings means test K. There exist α_0^*, α_1^* and α_2^* such that the individual labor supply is (derivations are in section (1.D.2) in the Appendix):

$$n = \begin{cases} 0 & \text{if } \alpha \leq \alpha_0^* \\ \alpha \hat{w}_1^\epsilon & \text{if } \alpha_0^* < \alpha \leq \alpha_1^* \\ \hat{K}/\hat{w}_1 & \text{if } \alpha_1^* < \alpha < \alpha_2^* \\ \alpha \hat{w}_2^\epsilon & \text{if } \alpha \geq \alpha_2^* \end{cases} \tag{1.12}$$

where $\hat{K} = (1-\tau_1)K$. The region between α_1^* and α_2^* corresponds to the bunching in the earnings distribution at the cutoff K of gross earnings. The aggregate labor supply is:

$$\begin{array}{c} N_1^S = \int_{\alpha_0^*}^{\alpha_1^*} \alpha \hat{w}_1^\epsilon f(a)da + \int_{\alpha_1^*}^{\alpha_2^*} \frac{\hat{K}}{\hat{w}_1} f(a)da \\ N_2^S = \int_{\alpha_2^*}^{\infty} \alpha \hat{w}_2^\epsilon f(a)da \end{array} \tag{1.13}$$

It is straightforward to show that when there is an expansion in tax benefits for low-earning workers, given the wages, aggregate supply in jobs type 1 increases, while aggregate supply in jobs type 2 decreases (derivations in section (1.D.2) in the Appendix). As a result, N_1^S/N_2^S increases.

Labor demand, product market and government budget: Both the output and the labor market are competitive. There are two firms, indexed by $k \in \{H, L\}$, and they produce two differentiated goods, Y_H and Y_L. H and L stem for "high-intensity" and "low-intensity" in low-earning workers respectively. The prices in the output market are p_H and p_L, with $p_L = 1$ as a normalization. The production function of the firms is defined by equation (1.1), to which I add some firm-level heterogeneity. Output is heterogeneous Y_k, and potentially total factor productivity, A_k. Importantly, firms differ in the distribution parameter of factor returns, such that $\theta_H > \theta_L$. This means that firm H has a comparative advantage in low-earning workers, while firm L in high-earning workers. The production function including these heterogeneities across firms is: $Y_k = F_k(N_{1k}, N_{2k}) = A[\theta_k N_{1k}^{\frac{\sigma-1}{\sigma}} + (1-\theta_k)N_{2k}^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$. From the first order condition of the firms (see e.g. Equation (1.2)), the intensity in low-earning jobs with respect to high-earning jobs is higher in firm H, $N_{1H}/N_{2H} > N_{1L}/N_{2L}$.

Aggregate labor demand is: $N_1^D = N_{1H} + N_{1L}$ and $N_2^D = N_{2H} + N_{2L}$. Aggregate output is: $Y = Y_H + Y_L$. Aggregate income in the economy, Inc, equals consumption. The goods are imperfect substitutes at the aggregate level, and each of them faces an aggregate downward sloping demand. The government collects revenues from payroll taxes, T, and finances

Table 1.4: Simulation of the Mini-Job reform in the model vs. DID estimates

	Model	Data
In terms of baseline averages (2002)		
$DiD_{\text{low-earning employment}}$	-2.8%	-18.5%
$DiD_{\text{high-earning employment}}$	4.3%	12.4%
$DiD_{\text{total employment}}$	4.1%	7.0%
Changes in % of pre-reform levels		
Low-earning in Intensive firm	46.2%	
Low-earning in Non-intensive firm	36.3%	
High-earning in Intensive firm	5.4%	
High-earning in Non-intensive firm	-1.7%	
Total employment in Intensive firm	8.9%	
Total employment in Non-intensive firm	-1.1%	

Note: Mini-Job reform simulated by setting: $K = 400$, $\tau_1 = 20\%$, $\tau_2 = 35\%$. The DiD estimates in the top panel are the values of the coefficient estimates of regression (1.4) corresponding to 2004, as a proportion of the pre-reform average across firms, both in the model and the data. I use the estimates corresponding to the number of part-time and full-time workers for low-earning and high-earning respectively, and for full-time equivalent employment for total employment. The bottom panel shows the changes simulated by the model in terms of the pre-reform employment of each firm.

the benefits for non-employed workers with them, distributing the remainder in lump-sum transfers. All these elements are specified in the Appendix, section (1.D.2).

Equilibrium: The competitive equilibrium of this economy is defined as the set of prices, w_1, w_2 and p_H, such that the labor market for each job clears, the output market clears, workers and firms optimize, and profits are zero.

1.7.2 Simulation exercises

The model is solved and parameterized as explained in the Appendix, section (1.D.2). I set the parameter values to match the moments in the data for the pre-reform period. Then I simulate the reform by changing the earnings limit K up to which workers receive the lower tax rate τ_1. Table (1.4) shows that this framework is able to generate qualitatively the results obtained by the DiD analysis. In terms of the pre-reform averages, the model accounts for 60% of the change in hours in the high-intensity firms with respect to low-intensity firms. The relative increase in high-earning employment is 4% in the model and 12% in the data, and the relative decrease in low-earning employment is 3% in the model and 19% in the data.

Importantly, the simulation of the reform using the model allows to tier apart the changes in employment by type (bottom panel of Table (1.4)), which was not feasible using the

DiD strategy. According to the model, total employment in firm H increases by 9%, with a 46% increase in hours in low-earning jobs, and 5% in hours in high-earning jobs. Total employment in firm L shrinks by 1%, through a reduction in the hours in high-earning jobs (-2%) which more than compensates the increase in the hours in low-earning jobs (36%) as the latter are more scarce to begin with.

It is worth noting that the key parameters for these results are σ and κ, given that they drive the scale and substitution effects, as explained in section (1.4). In this exercise, $\sigma = 2.462$, a value which is pinned down from the estimation of the equation corresponding to the first order condition of the firms. I set $\kappa = 10$ for this exercise. Table (1.A28) in the Appendix shows that if the elasticity of substitution is much higher (20 times more), representing a case where the substitution effect is very strong, the model generate counterfactual predictions. Importantly, in this case the firm which is expanding is L whereas H is contracting. This point is important, since understanding what is the elasticity of substitution between different types of labor and its role facing policy changes has generated a substantial amount of interest in labor economics (Hamermesh and Grant, 1979; Hamermesh, 1982).

Table (1.5) shows further insights from the theoretical framework. In the first column, I show the benchmark for which the model is computed, the pre-reform period, in which tax-benefits exist already. The second column contains the values of the simulation of the Mini-Job reform, the "reform" counterfactual. The third column shows the counterfactual results in absence of in-work benefits, denoted "no policy" scenario (although N_1 is delimited by monthly gross earnings of €325, as before the reform, all the workers pay the SSC rate of regular workers). The other two columns show the variation in the two simulations with respect to the benchmark. The "no-policy" and "reform" counterfactuals are particularly interesting as they illustrate the changes in employment (and output) across different firms for different levels of in-work benefits. Whereas the comparison of the benchmark to the simulated reform shows the effects of expanding in-work benefits, the contrast between the benchmark and the no-policy scenario is illustrative of the introduction of in-work benefits.

Let us focus on the consequences of the Mini-Job reform as compared to the pre-reform scenario (columns 1 and 2, and 4). The comparison is of particular interest as it allows to understand the potential general equilibrium effects of the policy, that were not possible to disentangle in the empirical analysis. The model predicts that before-tax wages of low-earning workers drops by 12%, whereas the before-tax wage of high-earning workers remains constant. The drop in w_1 embeds the tax benefit shifting from the workers to the employers, and is driven by a stronger increase in labor supply than in labor demand for these workers. In equilibrium, both the total number of hours and of workers in tax-advantaged occupations increases. The constant w_2 is accompanied by a decrease in the total number of workers in

Table 1.5: Simulation of the model

	Pre-Reform (benchmark)	Mini-Job Reform (counterfactual 1)	No-Policy (counterfactual 2)	Variation Count. 1 vs. Benchm.	Variation Benchm. vs. Count. 2
w_1	24.5	21.5	30.5	-12%	-24%
w_2	24.8	24.8	24.8	0%	0%
w_1/w_2	1.0	0.9	1.2	-12%	-24%
$\hat{w}_1$	20.1	17.2	19.8	-14%	1%
$\hat{w}_2$	16.1	16.1	16.1	0%	0%
Employment rate	94.6%	93.3%	94.5%	-1.2pp.	0.1pp.
Workers in mini-jobs (%)	14.9%	16.9%	10.1%	14%	-32%
N_1	1.6	2.3	0.9	40%	43%
N_2	63.6	63.0	64.4	-1%	-1%
$N_1/(N_1+N_2)$	2.5%	3.5%	1.4%	40%	-43%
N_1+N_2	65.2	65.3	65.3	0.1%	0%
N_{1H}	0.7	1.0	0.4	46%	46%
N_{2H}	7.4	7.8	6.8	5%	8%
N_{1L}	0.9	1.3	0.6	36%	40%
N_{2L}	54.7	53.7	56.3	-2%	-3%
N_1/N_2 in H	0.092	0.127	0.054	39%	42%
N_1/N_2 in L	0.017	0.023	0.010	39%	42%
T	558	557	568	-0.1%	-2%
Inc	1,614	1,614	1,623	0%	-1%
Y	1,570	1,567	1,581	-0.1%	-1%
p_H	1.25	1.24	1.27	-1%	-2%
Y_H/Y	10.2%	11.1%	8.9%	9%	13%
Y_L/Y	89.8%	88.9%	91.1%	-1%	-1%

Note: No-Policy: $K = 325$, $\tau_1 = \tau_2 = 35\%$. Pre-reform: $K = 325$, $\tau_1 = 18\%$, $\tau_2 = 35\%$. Mini-Job reform: $K = 400$, $\tau_1 = 20\%$, $\tau_2 = 35\%$. Comparison is inverted in the last column, to be comparable to the effects of the column before.

these occupations, particularly due to the receding labor supply.

An important prediction of the model is that, as a consequence of the labor expansion in firm H and contraction in L, the configuration of total output shifts towards the former. This is not trivial as firms have different productivity for different workers and firm H has a lower total factor productivity, as suggested by the data. Overall, the model predicts that total employment in hours should increase (due to a big expansion of hours in low-earning jobs which more than compensates a small decline in high-earning jobs), and total output should decline.

Shifting attention to the no-policy scenario (columns 3 and 5) adds the interesting insight with respect to the total employment effect of the reform. Even though the before-tax wage for low-earning workers falls as a consequence of the introduction of in-work benefits, the net wage remains above the no-policy level. There is then a positive effect on the employment rate of the introduction of in-work benefits. There is still though a negative effect on output due to the reallocation towards the least productive firm.

To sum up, these exercises provide valuable insights with respect to the labor demand side responses when in-work benefits are introduced and expanded. In particular, they show how production and employment reallocate across firms as a consequence of the policy. Wages

are depressed for the low-earning segment, without changes for high-earning workers.[38]

1.8 Conclusions

This paper analyzes firm responses to an expansion of in-work benefits in the form of lower taxes for low-earning workers. Unlike the existing literature, which has focused mainly on *labor supply* responses to such interventions, I provide an analysis of the *labor demand* responses. The paper shows that in-work benefits do not only affect employment of targeted low-earning workers, but also generate *spillovers* on the employment of higher-earning workers who are not directly targeted by the policy. The empirical analysis focuses on the German Mini-Job reform of 2003, which had a dramatic impact on the German labor market. After the reform, about 20% of all private sector workers hold so-called marginal jobs that qualify for the tax benefits.

The existing literature has documented that employers share part of the tax benefits provided to workers, which results in a change in labor costs when in-work benefits are expanded. In this paper, I show that firm responses are affected both by the implied decrease in total labor costs (and thus a "scale effect"), and the change in the relative costs of tax-advantaged versus non-tax-advantaged workers (and thus a "substitution effect"). To motivate my empirical analysis, I first present a simple theoretical framework that relates the strength of the scale and substitution effects of a particular firm to its pre-reform intensity in low-earning workers. The theoretical analysis suggests that the scale effect is stronger in firms which are more intensive in low-earning workers, whereas the substitution effect dominates in firms with a relatively low intensity in low-earning workers.

I then test these predictions using a panel of establishments matched to administrative data of workers. The identification strategy relies on a differences-in-differences approach that exploits the expansion of in-work benefits with the Mini-Job reform and the pre-reform intensity in low-earning workers across establishments. I document that establishments with a high intensity of low-earning workers prior to the reform expand relative to low-intensity establishments. Importantly, this relative expansion of initially high-intensity establishments is concentrated in high-earning, non-tax advantaged workers. On the other hand, initially low-intensity establishments seem to substitute employment towards low-earning workers without expanding total employment at the same pace. These changes in firms' workforce are the result of changes within firms in the relative importance of part-time and full-time employment, in the skill level of the workforce, and in the type of tasks that workers perform.

[38] Interpretation of aggregate employment levels, income and total output in this version of the model are affected by the parsimonious modelling of the extensive margin decision of the labor supply.

While the relative responses of initially high-intensity and initially low-intensity firms provide evidence on the presence of both the scale and the substitution effects, the differences-in-differences approach does not allow to analyze employment levels and output in each type of firms. To provide some sense of the implications of the empirical findings in these dimensions, I extend the simple theoretical framework, which focuses on labor demand, to a general equilibrium model by adding the labor supply-side and introducing two types of firms. Simulations of the Mini-Job reform suggest that the equilibrium wages of low-earning workers decline, whereas the wages of high-earning workers remain constant. In this framework, the differential responses in terms of employment across firms that are observed in the data are driven by an increase in employment in the low-earning segment across all firms, and by a reallocation of high-earning workers from firms in which they are more abundant to firms in which high-earning workers are scarcer. There is also reallocation of production from low-intensity (in low-earning workers) firms to high-intensity firms. Since the data seem to suggest that high-intensity firms are less productive, this reallocation has a cost in terms of lower total output.

The effects documented in this paper are inherently important for the design of in-work benefits, and more broadly, for any type of labor market intervention that targets workers that are imperfect substitutes to the rest of the workforce. My findings suggest that labor supply incentives targeting low-earning workers can have non-trivial labor demand effects and can create spillovers to employment not targeted by the policy. Finally, the results help to shed light on the ongoing debate regarding the pervasive effects of the German Mini-Job reform, which is often cited as a major cause of the observed increase in precarious employment in Germany, and which is considered as a potential role model by several other countries that are seeking to implement labor market reforms.

Appendix

1.A Additional Tables

Table 1.A1: Social Security average tax rates and monthly gross earnings limits

	Earnings	Worker rate	Employer rate	Income tax
	Regular Jobs			
1999-30 Mar 2003	€326+	21%	21%	YES
1 Apr 2003-30 Jun 2006	€801+	21%	21%	YES
1 Jul 2006-31 Dec 2007	€801+	19.5%	19.5%	YES
	Mini-Jobs			
1999-30 Mar 2003	€0-€325	0%	22%	NO
1 Apr 2003-30 Jun 2006	€0-€400	0%	25%	NO
1 Jul 2006-31 Dec 2007	€0-€400	0%	30%	NO
	Midi-Jobs			
1999-30 Mar 2003	-			
1 Apr 2003-30 Jun 2006	€401-€800	4.1%-21%	21%	YES
1 Jul 2006-31 Dec 2007	€401-€800	4.1%-19.5%	19.5%	YES

Note: Only for the period 1999-2007. SSC rates are in terms of gross earnings, income tax rates (to which mini-jobs are exempted) are not included.

Table 1.A2: Hours of work by type of worker, 2005

Type of job	Hours a week	Hourly (net) wage
Regular part-time	13	19
	(5.68)	(21.20)
Regular full-time	41	9
	(9.50)	(4.16)
Mini-job (main)	14	10
	(12.00)	(25.59)
Mini-job (secondary)	40	9
	(13.97)	(6.59)
Midi-job (main)	26	8
	(13.86)	(16.41)
Midi-job (secondary)	36	15
	(16.96)	(12.38)
Total	34	10
	(15.21)	(11.94)

Note: Data from G-SOEP. Standard errors in parenthesis. Hours worked and hourly net earnings for valid responses. Workers 17-65 years old.

Table 1.A3: Transitions between 2002 and 2004

Row totals	Inactive	Unemployed	Mini-job	Midi-job	Regular PT	Regular FT	Total
Inactive	20%	21%	23%	2%	6%	27%	100%
Unemployed	1%	64%	7%	2%	5%	21%	100%
Mini-job	6%	4%	79%	2%	4%	5%	100%
Regular PT	1%	9%	4%	6%	72%	8%	100%
Regular FT	0%	9%	1%	1%	3%	86%	100%
Total	4%	16%	12%	2%	12%	54%	100%
Column totals	Inactive	Unemployed	Mini-job	Midi-job	Regular PT	Regular FT	Total
Inactive	81%	23%	34%	21%	9%	9%	17%
Unemployed	3%	40%	6%	9%	4%	4%	10%
Mini-job	11%	2%	52%	9%	3%	1%	8%
Regular PT	2%	6%	4%	36%	70%	2%	11%
Regular FT	3%	29%	5%	25%	14%	85%	54%
Total	100%	100%	100%	100%	100%	100%	100%

Note: SIAB, annual, main spell. Inactivity is inferred if the worker either appears or disappears from the social security records.

Table 1.A4: Proportion of workers with secondary job

	Total	Men	Women	Young (<30)	Prime-age	Old (>55)	Low-educated	Medium-educated	Highly-educated
Before (2002)	3.4%	3.0%	3.8%	3.8%	3.3%	3.0%	4.2%	3.4%	2.4%
After (2004)	5.0%	4.3%	5.7%	5.1%	5.1%	4.1%	5.6%	5.0%	3.6%
Var (pp.)	1.6	1.3	1.8	1.3	1.8	1.1	1.4	1.7	1.2
Var (%)	45.5%	42.0%	48.0%	33.1%	53.7%	37.2%	33.3%	49.7%	49.6%

Note: SIAB, spell data.

Table 1.A5: Mini-jobbers close to the threshold in 2004

Status/Earnings in 2002	**Total mini-jobs earning 325-400 in 2004**	**Mini-jobs earning 325-400 in 2004, employed in 2002**	
		Do not change job	**Change job**
out of total employed		73.5%	26.5%
Inactive	30.7%		
Unemployed	5.2%		
(0, 325]	45.6%	76.3%	56.6%
(325, 400]	5.0%	8.3%	6.6%
(400, 800]	5.6%	7.8%	11.5%
more than 800	7.9%	7.7%	25.4%

Note: SIAB, annual data, main spell.

Table 1.A6: Mini-jobbers close to the threshold in 2004, employed in 2002

Mini-jobs earning 325-400 in 2004 (changes with respect to 2002)	Full-time to Part-time	Different occupation
Total	11.3%	23.1%
Of those who do not change establishment	7.6%	7.6%
Of those who change establishment	21.8%	62.9%

Note: SIAB, annual data, main spell.

Table 1.A7: Proportion of workers by education and part-time/full-time status (2002)

Tasks	Low-educated		Medium-educated		Highly-educated		Total
	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	(% workers)
Primary activities and construction							
Analytical non-routine			5.3%	52.9%	1.7%	37.9%	7.6%
Interactive non-routine			29.2%	57.8%			1.1%
Cognitive routine	2.0%	2.7%	16.9%	72.3%	0.8%	5.3%	23.3%
Manual routine	2.9%	12.4%	6.0%	77.3%			9.9%
Manual non-routine	2.0%	8.9%	4.7%	83.8%			58.1%
Manufacturing							
Analytical non-routine	0.5%	2.3%	3.8%	52.5%	1.5%	39.3%	15.5%
Interactive non-routine	5.3%	3.0%	26.8%	57.2%	0.4%	7.2%	4.9%
Cognitive routine	1.2%	5.1%	9.6%	73.0%	0.7%	10.4%	35.0%
Manual routine	2.8%	21.6%	4.6%	70.3%	0.1%	0.5%	33.0%
Manual non-routine	11.6%	15.3%	12.3%	59.9%	0.2%	0.6%	11.6%
Services							
Analytical non-routine	1.4%	2.3%	12.2%	48.2%	7.3%	28.6%	18.6%
Interactive non-routine	7.2%	2.6%	34.9%	42.3%	3.0%	10.0%	14.3%
Cognitive routine	3.0%	2.6%	24.4%	60.8%	1.6%	7.6%	31.3%
Manual routine	10.0%	13.4%	15.9%	59.7%	0.2%	0.8%	3.5%
Manual non-routine	14.8%	8.9%	26.8%	47.2%	0.9%	1.4%	32.3%

Note: SIAB, annual data, main spell. Low-educated correspond to individuals without "Abitur" (upper secondary certificate), medium-educated to individuals with "Abitur" or apprentices and highly-educated to individuals with a higher-education degree.

Table 1.A8: Dispersion (inter-quartile range) in low-earning labor/high-earning labor and cost ratio within industries (2002)

	Median	P25	P75	Min	Max
Low-earning / high-earning workers	0.250	0.040	0.60	0.000	9.667
... (in full-time equivalent)	0.077	0.002	0.211	0.000	4.000
Factor cost ratio (in FTE)	0.030	0.004	0.110	0.000	8.959

Note: LIAB, cross-section of establishments. Industries are classified in 224 categories.

Table 1.A9: Characteristics of establishments in 2002, cross-section and panel (2000-2007), weighted/unweighted

	Cross-section		Panel	
	Unweighed	Weighted	Unweighed	Weighted
Establishment age	15.2	13.2	14.5	14.2
Establishment size (n. of workers)	164.4	15.6	161.6	18.5
Proportion of workers below 2003 MJ threshold	15.5%	27.8%	16.0%	29.2%
Proportion of workers below 2003 MidiJ threshold	21.4%	37.7%	21.4%	37.6%
Proportion of marginal part-time workers	9.9%	18.6%	10.5%	20.4%
Proportion of part-time workers	23.2%	31.2%	23.0%	32.1%
Proportion of temporary workers	5.7%	3.0%	5.3%	3.1%
Proportion of low-educated workers	13.8%	13.0%	12.6%	11.5%
Proportion of medium-educated workers	62.7%	58.6%	65.9%	58.0%
Proportion of highly-educated workers	7.5%	3.7%	7.5%	4.3%
Proportion of female workers	46.2%	55.1%	46.4%	56.7%
Proportion of working proprietors	8.4%	20.4%	9.5%	19.8%
Proportion of trainees/apprentices	5.1%	4.6%	5.0%	4.7%
Median daily gross wage	61.2	44.3	58.3	45.0
Median daily wage full-time	72.6	59.7	68.9	61.5
Median daily wage part-time	32.8	20.0	32.8	19.6
Median daily wage low-earnings	9.2	9.1	8.9	9.2
Median daily wage high-earnings	68.0	56.8	65.1	58.8
Monthly per capita labor cost	1,865.2	1,353.1	1,748.3	1,396.3
Total monthly labor cost	479,785	33,551	478,390	43,405
Investment (million)	2.146	0.116	1.877	0.118
Sales (million)	37.483	2.493	29.975	2.967
Exports/revenues	10.9%	4.2%	10.5%	4.1%
Hirings/employment	0.19	0.21	0.17	0.19
Separations/employment	0.60	0.32	0.25	0.26
Work council	40.4%	10.2%	38.7%	9.9%
Collective agreement	57.8%	43.5%	57.3%	44.6%
Agriculture, primary	4.3%	3.7%	4.4%	4.0%
Manufacturing	26.1%	11.9%	28.6%	12.9%
Construction	8.9%	10.8%	9.7%	10.5%
Retail, repair	13.0%	22.1%	12.5%	21.5%
Transport, communication	3.6%	5.1%	3.1%	4.8%
Financial intermediation	3.0%	2.3%	2.6%	2.3%
Services for businesses	11.4%	15.3%	8.3%	15.7%
Other services	19.4%	23.5%	18.3%	23.2%
Public administration	10.4%	5.3%	12.5%	5.0%
Proportion of workers in analytical non-routine tasks	14.8%	10.6%	13.5%	11.1%
Proportion of workers in interactive non-routine tasks	8.9%	12.0%	8.7%	11.3%
Proportion of workers in cognitive routine tasks	31.5%	34.6%	31.4%	35.9%
Proportion of workers in manual routine tasks	12.8%	8.2%	14.5%	8.7%
Proportion of workers in manual non-routine tasks	28.5%	31.5%	28.2%	30.1%
New firm (Estab. Panel)	2.5%	9.2%		
Firm death	1.6%	2.9%		
Observations	14,591		3,770	

Table 1.A10: Characteristics of establishments by proportion of low-earning workers (below/above median), 2002

	Below median	Above median
Proportion of workers below 2003 MJ threshold	4.6%	53.8%
	(0.0685)	(0.251)
Proportion of workers below 2003 MidiJ threshold	14.5%	60.7%
	(0.234)	(0.251)
Establishment age	15.6	12.9
	(9.088)	(8.328)
Establishment size (n. of workers)	28.4	8.5
	(132.2)	(28.88)
Employment, full-time equivalent	25.2	5.8
	(120.7)	(20.59)
Proportion of part-time workers	16.5%	47.7%
	(0.251)	(0.318)
Proportion of low-educated workers	10.8%	12.2%
	(0.201)	(0.206)
Proportion of medium-educated workers	64.6%	51.4%
	(0.350)	(0.349)
Proportion of highly-educated workers	6.2%	2.4%
	(0.171)	(0.0904)
Vacancies/employment	2.5%	1.1%
	(0.0884)	(0.0494)
Median daily gross wage	61.4	28.5
	(24.88)	(21.36)
Median daily gross wage (growth)	12.2%	10.0%
	(0.959)	(0.643)
Median daily gross wage of full-time	68.6	53.3
	(26.10)	(26.60)
Median daily gross wage of full-time (growth)	2.9%	3.7%
	(0.165)	(0.285)
Median daily gross wage of part-time	32.7	11.8
	(22.94)	(9.733)
Median daily gross wage part-time (growth)	18.5%	9.3%
	(0.716)	(1.009)
Median daily gross wage of low-earning workers	9.3	9.1
	(3.600)	(3.043)
Median daily gross wage of low-earning workers (growth)	9.5%	7.1%
	(1.460)	(0.900)
Median daily gross wage of high-earning workers	62.9	53.9
	(24.98)	(22.06)
Median daily gross wage of high-earning workers (growth)	2.0%	4.6%
	(0.172)	(0.229)
Average monthly labor cost	1,720	1,071
	(1,044.6)	(749.4)
Monthly wage bill	75,929	10,725
	(471,472.9)	(45,367.3)
Inequality (P75/P25) full-time workers	1.41	1.93
	(0.512)	(20.17)
Observations	2,746	1,024

Note: Panel 2000-2007. Establishments classified according to whether they are below or above the (weighted) median of the proportion of low-earning workers (20%). Standard errors in parenthesis.

Table 1.A11: Characteristics of establishments by proportion of low-earning workers (below/above median), 2002 (continuation)

	Below median	Above median
Hirings/employment	0.16	0.22
	(0.206)	(0.244)
Separations/employment	0.25	0.27
	(0.481)	(0.564)
Investment (million)	0.200	0.036
	(2.159)	(0.256)
Sales (million)	5.328	0.667
	(60.039)	(1.777)
Exports/revenues	5.2%	3.0%
	(21.94)	(19.01)
Work council	16.5%	3.4%
	(0.372)	(0.180)
Collective agreement	49.6%	39.5%
	(0.500)	(0.489)
Agriculture, primary	5.5%	2.5%
	(0.228)	(0.158)
Manufacturing	15.5%	10.3%
	(0.362)	(0.305)
Construction	15.4%	5.5%
	(0.361)	(0.229)
Retail, repair	18.7%	24.4%
	(0.390)	(0.430)
Transport, communication	5.6%	4.0%
	(0.230)	(0.196)
Financial intermediation	3.0%	1.7%
	(0.170)	(0.130)
Services for businesses	11.7%	19.7%
	(0.321)	(0.398)
Other services	19.3%	27.1%
	(0.395)	(0.445)
Public administration	5.4%	4.7%
	(0.226)	(0.211)
Workers in analytical non-routine tasks	14.6%	7.6%
	(0.268)	(0.181)
Workers in interactive non-routine tasks	9.9%	12.8%
	(0.240)	(0.272)
Workers in cognitive routine tasks	32.7%	39.2%
	(0.361)	(0.371)
Workers in manual routine tasks	11.4%	6.1%
	(0.262)	(0.184)
Workers in manual non-routine tasks	29.4%	30.8%
	(0.374)	(0.354)
Observations	2,746	1,024

Note: Panel 2000-2007. Establishments classified according to whether they are below or above the (weighted) median of the proportion of low-earning workers (20%). Standard errors in parenthesis.

Table 1.A12: Empirical test: variations in employment by type

Coexistence of scale and substitution effect ($0 < \sigma < \eta$)			
	Intensive	Non-intensive	Diff. (Int. - Non Int.)
Low-earning employment	$\uparrow$ (scale)	$\uparrow$ (substitution)	$\lesseqgtr 0$
High-earning employment	$\uparrow\uparrow$	$\uparrow$	> 0
Total employment	$\uparrow\uparrow$	$\uparrow$	> 0
Only substitution effect ($\sigma > \eta$)			
	Intensive	Non-intensive	Diff. (Int. - Non Int.)
Low-earning employment	$\uparrow$	$\uparrow\uparrow$	< 0
High-earning employment	$\downarrow\downarrow$	$\downarrow$	< 0
Total employment	$\downarrow\uparrow$	$\uparrow\downarrow$	$\lesseqgtr 0$
Only scale effect ($\sigma = 0$)			
	Intensive (s_{1H})	Non-intensive (s_{1L})	Diff. (Int. - Non Int.)
Low-earning employment	$\uparrow\uparrow$	$\uparrow$	> 0
High-earning employment	$\uparrow\uparrow$	$\uparrow$	> 0
Total employment	$\uparrow\uparrow$	$\uparrow$	> 0

Note: The direction and magnitudes of the effects correspond to the expression:

$$\frac{dlnN_1}{dlnw_1} = -[s_1\eta + (1 - s_1)\sigma]$$
$$\frac{dlnN_2}{dlnw_1} = -[s_1\eta - s_1\sigma]$$

Total employment is inferred intuitively. The change in total employment should be approximately equal to the change in each employment type weighted by the respective proportion of each type of worker.

Table 1.A13: Estimates of the differences-in-differences coefficients

	1999-2002			*2002-2004*	*2002-2007*
	$\hat{\beta}_{1999}$	$\hat{\beta}_{2000}$	$\hat{\beta}_{2001}$	$\hat{\beta}_{Post}$	
Total employment	-0.063	-0.289	-0.344	0.463	0.873*
	(0.8148)	(0.5562)	(0.3313)	(0.2577)	(0.3632)
Total full-time equivalent employment	0.651	0.136	-0.134	0.763***	1.370***
	(0.7153)	(0.4749)	(0.2692)	(0.2238)	(0.2912)
Low-earning workers (growth)		-0.127	-0.488	-0.447*	-0.413**
		(0.3555)	(0.3351)	(0.2149)	(0.1558)
Higher-earning workers (growth)		0.170	0.067	0.300	0.103
		(0.1694)	(0.1449)	(0.1596)	(0.1093)
Part-time workers	-0.178	0.105	-0.069	-0.723***	-0.852***
	(0.3878)	(0.2911)	(0.1825)	(0.1608)	(0.1961)
Full-time workers	0.586	-0.030	-0.118	1.182***	1.873***
	(0.5732)	(0.3638)	(0.2463)	(0.2069)	(0.2711)
Proportion of low-educated workers	-0.014	-0.014	-0.004	-0.038*	-0.042*
	(0.0312)	(0.0164)	(0.0154)	(0.0187)	(0.0204)
Number of medium-educated workers	0.794	0.236	0.052	0.578**	0.963***
	(0.6540)	(0.4179)	(0.2219)	(0.1865)	(0.2453)
Median gross daily wage (growth)		0.175	0.235	0.497***	0.324***
		(0.1756)	(0.1588)	(0.1144)	(0.1084)
Median gross daily wage full-time (growth)		0.057	0.002	0.134	0.093
		(0.1056)	(0.0570)	(0.0730)	(0.0482)
Median gross daily wage of part-time (growth)		0.103	-0.151	0.451***	0.054
		(0.1408)	(0.0982)	(0.1279)	(0.2144)
Total investment (euros)	-61,213	-45,864	-61,997	9,235	6,408
	(40870.5)	(34493.8)	(43756.7)	(32644.1)	(32603.5)
Vacancies (ln)		0.092	0.411	0.395	0.269
		(0.2960)	(0.3240)	(0.2017)	(0.1817)
Hirings of workers earning 800-1200		0.024	-0.045	0.069	0.117***
		(0.0598)	(0.0525)	(0.0402)	(0.0340)
Hirings of workers earning 1600-2000		0.052	-0.107	0.163**	0.189***
		(0.0970)	(0.0919)	(0.0541)	(0.0571)
Wage of part-time hiring		7.121	0.124	1.692	4.524*
		(3.7899)	(3.1635)	(2.2834)	(2.2909)
Wage of full-time hiring		-9.124	5.391	-0.587	-10.362
		(8.3273)	(7.8964)	(5.5420)	(6.6588)
Frequency of wage upgrade		0.148*	0.164*	0.098	0.069
		(0.0673)	(0.0705)	(0.0524)	(0.0440)
Frequency of wage downgrade		-0.037	-0.031	-0.062	-0.098
		(0.0734)	(0.0496)	(0.0690)	(0.0572)
Proportion of workers in analytical non-routine tasks	0.019	0.023	0.010	0.011	0.016
	(0.0250)	(0.0176)	(0.0121)	(0.0089)	(0.0096)
Proportion of workers in interactive non-routine tasks	0.009	0.002	-0.005	-0.006	-0.006
	(0.0165)	(0.0102)	(0.0090)	(0.0086)	(0.0100)

Note: Estimates from equation (1.4). Different rows correspond to different outcomes. Columns 1-3 shows estimates of β over the 1999-2002 period. Column 4 shows estimates of β for the 2002-2004 period (short-run), and column 5, for 2002-2007 (medium-run), both using an indicator variable *Post* that takes the value 1 for 2003 on. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001. Growth rates of low-earning and high-earning workers are estimated on the subsample of establishments with both types of workers (quintiles 2 to 4 of intensity in low-earning workers).

Table 1.A14: Estimates of the differences-in-differences coefficients, heterogeneous effects

	Employment	FTE employment	Part-time	Full-time	Low-educated (proportion)	Medium-educated
			Industry			
IntLE	1.65*	1.68**	0.02	1.64**	-0.09	1.19*
(baseline: Primaries, construction)	(0.688)	(0.583)	(0.434)	(0.522)	(0.110)	(0.480)
IntLE × Manufacturing	0.88	1.65	-1.16	2.43	0.15	1.31
	(1.912)	(1.676)	(0.968)	(1.610)	(0.113)	(1.394)
IntLE × Services	-0.39	-0.25	-0.41	0.03	0.04	0.19
	(0.878)	(0.726)	(0.521)	(0.655)	(0.112)	(0.612)
R^2	0.11	0.12	0.06	0.12	0.07	0.09
			Establishment age			
IntLE	0.90	0.67	0.22	0.54	-0.02	0.91
(baseline: 0-9 y.o.)	(0.730)	(0.588)	(0.370)	(0.528)	(0.022)	(0.515)
IntLE × 10-19 y.o.	0.70	1.45	-0.56	1.79	-0.05	1.33
	(1.237)	(1.015)	(0.514)	(0.956)	(0.059)	(0.869)
IntLE × 20-29 y.o.	0.72	1.54	-1.68**	2.55**	-0.02	0.47
	(1.139)	(0.972)	(0.564)	(0.908)	(0.052)	(0.751)
R^2	0.11	0.12	0.06	0.12	0.07	0.09
			Establishment size			
IntLE	0.35	0.34	-0.25	0.44	-0.05	0.56
(baseline: 1-5 work.)	(0.410)	(0.359)	(0.196)	(0.325)	(0.028)	(0.317)
IntLE × 6-20 work.	1.03	0.55	1.13	-0.09	0.03	0.72
	(0.839)	(0.665)	(0.610)	(0.618)	(0.031)	(0.613)
IntLE × 21-200 work.	5.23	7.18*	2.22	6.04	0.09	7.05*
	(5.217)	(3.483)	(3.381)	(3.115)	(0.051)	(2.980)
IntLE × 201 or more work.	20.21	41.93	-4.72	48.29**	0.07	24.24
	(37.146)	(23.775)	(31.229)	(17.603)	(0.039)	(15.611)
R^2	0.11	0.13	0.09	0.14	0.07	0.09
			Collective agreement (industry or company level)			
IntLE	0.73	0.83	-0.21	0.90*	-0.04	1.07**
(baseline: No agreement)	(0.515)	(0.436)	(0.258)	(0.406)	(0.025)	(0.361)
IntLE × Agreement	1.66	1.92*	-0.51	2.38**	-0.00	0.91
	(0.994)	(0.784)	(0.523)	(0.730)	(0.051)	(0.619)
R^2	0.11	0.12	0.06	0.12	0.07	0.09

Note: Estimates from equation (1.6.5). Different columns correspond to different outcomes, and different panels correspond to different variables in the heterogeneity analysis. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001. Controlling for industry specific (224 categories) quadratic trends.

Table 1.A15: Estimates for $\hat{\beta}_t$ for total employment - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	-0.109	2.819	0.114		-0.121
	(0.8734)	(2.1425)	(0.7532)		(0.8745)
2000 -0.409	1.229	-0.522	-0.496	-0.411	
	(0.5696)	(1.2483)	(0.5381)	(0.5147)	(0.5692)
2001	-0.472	0.182	-0.491	-0.395	-0.469
	(0.3362)	(0.6493)	(0.3398)	(0.6099)	(0.3362)
2002			*baseline*		
2003	0.276	-0.049	0.406	-0.058	0.286
	(0.2140)	(0.4726)	(0.2302)	(0.3990)	(0.2127)
2004	0.666	0.304	0.914**	0.070	0.677*
	(0.3400)	(0.9055)	(0.3478)	(0.4347)	(0.3398)
2005	1.246**	1.120	1.569***	0.262	1.243**
	(0.4326)	(1.2710)	(0.4602)	(0.4419)	(0.4327)
2006	1.325**	1.748	1.767***	-0.220	1.297**
	(0.4755)	(1.6606)	(0.5366)	(0.4028)	(0.4822)
2007	0.891	2.147	1.374*	-0.760	0.867
	(0.5657)	(2.2076)	(0.6290)	(0.4124)	(0.5692)
LE industry (other commuting zones)					-7.263
					(7.0162)
LE commuting zone (other industries)					-0.480
					(1.9197)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A16: Estimates for $\hat{\beta}_t$ for total full-time equivalent employment - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	0.506	2.145	0.799		0.489
	(0.7722)	(1.8038)	(0.6559)		(0.7739)
2000 -0.077	0.824	-0.141	-0.537	-0.081	
	(0.4881)	(1.0433)	(0.4710)	(0.4366)	(0.4884)
2001 -0.264	0.065	-0.241	-0.416	-0.267	
	(0.2752)	(0.5404)	(0.2748)	(0.4817)	(0.2756)
2002			*baseline*		
2003	0.434*	0.344	0.529**	0.329	0.441*
	(0.1849)	(0.3896)	(0.1941)	(0.3138)	(0.1836)
2004	1.087***	1.105	1.285***	0.566	1.091***
	(0.2917)	(0.7457)	(0.2945)	(0.3486)	(0.2900)
2005	1.783***	2.105*	2.056***	0.588	1.776***
	(0.3324)	(0.9797)	(0.3512)	(0.3514)	(0.3333)
2006	1.903***	2.748*	2.307***	0.055	1.885***
	(0.3796)	(1.2435)	(0.4080)	(0.3236)	(0.3886)
2007	1.678***	3.251*	2.159***	-0.338	1.659***
	(0.4450)	(1.5847)	(0.4696)	(0.3186)	(0.4507)
LE industry (other commuting zones)					-4.404
					(6.4675)
LE commuting zone (other industries)					0.376
					(1.6108)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A17: Estimates for $\hat{\beta}_t$ for growth rate of low-earning employment - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
2000	-0.066	-1.142	-0.125		-0.075
	(0.3293)	(0.6044)	(0.3278)		(0.3312)
2001	-0.414	-0.869*	-0.451	-1.061	-0.408
	(0.3258)	(0.3612)	(0.3382)	(0.8706)	(0.3250)
2002			*baseline*		
2003	-0.775**	-0.498	-0.776**	-1.065*	-0.782**
	(0.2654)	(0.3013)	(0.2697)	(0.4971)	(0.2660)
2004	-0.186	0.199	-0.200	0.288	-0.187
	(0.3003)	(0.3528)	(0.3005)	(0.5066)	(0.2997)
2005	-0.609**	-0.290	-0.645*	-0.708	-0.605**
	(0.2329)	(0.3433)	(0.2514)	(0.5341)	(0.2322)
2006	-0.205	-0.124	-0.222	-0.059	-0.198
	(0.1758)	(0.4351)	(0.1946)	(0.4197)	(0.1771)
2007	-0.409	-0.737	-0.403	-0.709	-0.396
	(0.2233)	(0.5995)	(0.2423)	(0.4517)	(0.2208)
LE industry (other commuting zones)					2.067
					(1.2267)
LE commuting zone (other industries)					-0.204
					(0.4018)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A18: Estimates for $\hat{\beta}_t$ for growth rate of high-earning employment - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
2000	0.117	0.423*	0.143		0.122
	(0.1610)	(0.2135)	(0.1667)		(0.1580)
2001	0.025	0.140	0.035	-0.069	0.029
	(0.1504)	(0.1695)	(0.1493)	(0.2740)	(0.1502)
2002			*baseline*		
2003	0.443*	0.398	0.453*	0.530	0.444*
	(0.1966)	(0.2091)	(0.1988)	(0.3232)	(0.1961)
2004	0.237	0.219	0.242	-0.302	0.241
	(0.1609)	(0.1862)	(0.1589)	(0.1926)	(0.1610)
2005	0.093	0.174	0.097	-0.203	0.094
	(0.1515)	(0.1798)	(0.1547)	(0.2369)	(0.1510)
2006	-0.168	0.084	-0.163	-0.298	-0.162
	(0.1237)	(0.1633)	(0.1284)	(0.1846)	(0.1220)
2007	0.007	0.499*	-0.023	0.020	0.008
	(0.1219)	(0.2148)	(0.1339)	(0.1949)	(0.1226)
LE industry (other commuting zones)					-0.524
					(0.8959)
LE commuting zone (other industries)					-0.445*
					(0.2204)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A19: Estimates for $\hat{\beta}_t$ for number of part-time workers - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	-0.103	0.639	-0.470		-0.118
	(0.4192)	(1.1710)	(0.3412)		(0.4191)
2000	0.123	0.573	-0.168	0.264	0.119
	(0.3003)	(0.6870)	(0.2588)	(0.2751)	(0.3000)
2001	-0.105	0.131	-0.246	-0.193	-0.108
	(0.1856)	(0.3513)	(0.1951)	(0.3574)	(0.1856)
2002			*baseline*		
2003	-0.635***	-0.878**	-0.526***	-0.669*	-0.630***
	(0.1471)	(0.2738)	(0.1550)	(0.2641)	(0.1471)
2004	-0.811***	-1.306**	-0.618**	-0.233	-0.809***
	(0.2069)	(0.4883)	(0.2087)	(0.2522)	(0.2080)
2005	-0.688**	-1.451	-0.420	0.092	-0.694**
	(0.2561)	(0.7634)	(0.2601)	(0.2604)	(0.2560)
2006	-0.969***	-2.002	-0.649*	-0.332	-0.982***
	(0.2692)	(1.1142)	(0.3029)	(0.2299)	(0.2659)
2007	-1.168***	-2.489	-0.823*	-0.245	-1.182***
	(0.2939)	(1.6077)	(0.3357)	(0.2000)	(0.2911)
LE industry (other commuting zones)					-2.948
					(2.9340)
LE commuting zone (other industries)					0.474
					(1.1140)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A20: Estimates for $\hat{\beta}_t$ for number of full-time workers - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	0.384	1.588	0.963		0.374
	(0.6264)	(1.7176)	(0.5887)		(0.6288)
2000	-0.260	0.379	-0.111	-0.680	-0.262
	(0.3801)	(0.9966)	(0.4205)	(0.4120)	(0.3811)
2001	-0.235	-0.045	-0.110	-0.246	-0.235
	(0.2514)	(0.5083)	(0.2490)	(0.3460)	(0.2521)
2002			*baseline*		
2003	0.786***	0.841*	0.802***	0.675*	0.791***
	(0.1695)	(0.3631)	(0.1745)	(0.2787)	(0.1683)
2004	1.575***	1.889**	1.634***	0.710*	1.579***
	(0.2711)	(0.6959)	(0.2680)	(0.3132)	(0.2691)
2005	2.198***	2.974***	2.281***	0.512	2.194***
	(0.2983)	(0.8853)	(0.3136)	(0.3257)	(0.2998)
2006	2.475***	3.937***	2.654***	0.220	2.462***
	(0.3548)	(1.0831)	(0.3625)	(0.3013)	(0.3645)
2007	2.375***	4.738***	2.616***	-0.209	2.362***
	(0.4122)	(1.2957)	(0.4179)	(0.2904)	(0.4191)
LE industry (other commuting zones)					-3.273
					(6.1716)
LE commuting zone (other industries)					0.135
					(1.5413)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A21: Estimates for $\hat{\beta}_t$ for proportion of low-educated workers - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	-0.018	0.054	-0.029		-0.018
	(0.0313)	(0.0822)	(0.0305)		(0.0314)
2000	-0.008	0.029	-0.011	-0.002	-0.008
	(0.0192)	(0.0492)	(0.0199)	(0.0349)	(0.0192)
2001	-0.002	0.010	-0.003	0.008	-0.003
	(0.0164)	(0.0263)	(0.0166)	(0.0215)	(0.0164)
2002			*baseline*		
2003	-0.039*	-0.042	-0.040*	-0.046	-0.039*
	(0.0179)	(0.0268)	(0.0182)	(0.0243)	(0.0179)
2004	-0.028	-0.023	-0.030	0.008	-0.028
	(0.0212)	(0.0381)	(0.0217)	(0.0192)	(0.0212)
2005	-0.022	-0.000	-0.027	-0.005	-0.022
	(0.0235)	(0.0449)	(0.0242)	(0.0243)	(0.0235)
2006	-0.055*	-0.005	-0.064*	-0.043	-0.055*
	(0.0253)	(0.0541)	(0.0263)	(0.0253)	(0.0251)
2007	-0.062*	0.026	-0.074*	-0.003	-0.062*
	(0.0280)	(0.0704)	(0.0316)	(0.0220)	(0.0278)
LE industry (other commuting zones)					0.056
					(0.1900)
LE commuting zone (other industries)					0.007
					(0.0546)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A22: Estimates for $\hat{\beta}_t$ for number of medium-educated workers - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
1999	0.675	1.664	0.350		0.672
	(0.7014)	(1.5966)	(0.5483)		(0.7049)
2000	0.107	0.707	-0.182	-0.489	0.108
	(0.4257)	(0.9230)	(0.4162)	(0.3802)	(0.4258)
2001	-0.012	0.252	-0.109	-0.112	-0.009
	(0.2240)	(0.4737)	(0.2457)	(0.4476)	(0.2238)
2002			*baseline*		
2003	0.503**	0.332	0.692***	0.559	0.508**
	(0.1706)	(0.3469)	(0.1846)	(0.2861)	(0.1695)
2004	0.653**	0.359	1.013***	0.204	0.659**
	(0.2370)	(0.6522)	(0.2530)	(0.3041)	(0.2350)
2005	1.236***	0.859	1.756***	0.651*	1.236***
	(0.2730)	(0.8547)	(0.3088)	(0.2864)	(0.2732)
2006	1.364***	0.975	2.084***	0.213	1.351***
	(0.3285)	(1.0800)	(0.3637)	(0.2893)	(0.3375)
2007	1.074**	0.722	1.933***	-0.235	1.065**
	(0.3805)	(1.3552)	(0.4112)	(0.2868)	(0.3861)
LE industry (other commuting zones)					-3.414
					(6.0019)
LE commuting zone (other industries)					-0.475
					(1.4333)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A23: Estimates for $\hat{\beta}_t$ for growth rate of median daily wage - Specific trends

	Benchmark	*Quadratic trend quintiles LE share*	*Quadratic trend industry*	*Linear trend firm-specific (FD)*	*Controls for pre-trend*
2000	0.173	0.546	0.126		0.173
	(0.1449)	(0.3644)	(0.1499)		(0.1431)
2001	0.249	0.386*	0.203	0.344	0.248
	(0.1511)	(0.1926)	(0.1546)	(0.2802)	(0.1497)
2002			*baseline*		
2003	0.665***	0.617***	0.690***	0.917***	0.666***
	(0.1309)	(0.1591)	(0.1337)	(0.2669)	(0.1310)
2004	0.333**	0.326*	0.372**	-0.121	0.334**
	(0.1160)	(0.1650)	(0.1189)	(0.2003)	(0.1150)
2005	0.261*	0.388*	0.299**	0.169	0.258*
	(0.1103)	(0.1856)	(0.1126)	(0.1806)	(0.1083)
2006	0.292*	0.646**	0.311*	0.258	0.285*
	(0.1226)	(0.2408)	(0.1281)	(0.1813)	(0.1227)
2007	0.049	0.718**	0.032	-0.026	0.042
	(0.2107)	(0.2677)	(0.1939)	(0.2762)	(0.2067)
LE industry (other commuting zones)					-1.524
					(1.3901)
LE commuting zone (other industries)					0.040
					(0.5315)

Note: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A24: Correlation between proportion of low-earning workers in 2002 and variation (%) in the proportion of low-earning workers in 2004/2007

	2002-2004	2002-2007
Industry level (41 categories)	0.33*	0.06
	(0.0327)	(0.7130)
Commuting zone of residence (142 categories)	-0.33***	-0.71***
	(0.0001)	(0.0000)

Note: SIAB data. p-values in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

Table 1.A25: Comparison of flows and occupational structure in 2002 and 2004

	2002		2004		Diff. 2002-2004	
	Below med.	Above med.	Below med.	Above med.	Below med.	Above med.
Proportion of low-earnings workers	3.4%	51.3%	10.9%	44.4%	7.5	-6.9
	(0.0569)	(0.255)	(0.181)	(0.301)		
Intensity	0.018	0.456	0.083	0.618	0.065 (361%)	0.162 (35.5%)
	(0.038)	(0.622)	(0.239)	(1.355)		
Wage of hirings						
Total	56.1	25.0	46.3	25.3	-9.8	0.3
	(30.63)	(22.67)	(32.16)	(22.95)		
Part-time	31.0	12.5	23.0	12.0	-11.0	-0.5
	(20.86)	(10.94)	(20.25)	(11.97)		
Full-time	70.0	52.4	68.8	47.4	-1.2	-5
	(31.19)	(28.70)	(34.15)	(26.53)		
Total with respect to incumbents	0.91	0.98	0.79	0.69	-0.22	-0.29
	(0.455)	(0.905)	(0.370)	(0.728)		
Wage of separations						
Total	32.1	16.8	32.5	17.1	-0.4	0.3
	(33.99)	(24.49)	(39.53)	(24.39)		
Part-time	7.2	4.2	7.4	3.4	0.2	-0.8
	(17.44)	(9.87)	(19.96)	(8.291)		
Full-time	34.6	17.3	34.5	18.5	-0.1	1.2
	(39.45)	(29.36)	(44.07)	(31.65)		
Total with respect to incumbents	0.51	0.48	0.54	0.49	0.03	0.01
	(0.514)	(0.703)	(0.622)	(0.756)		
Occupational distribution						
Analytical non-routine tasks	14.7%	7.9%	14.3%	8.4%	-0.4	0.5
	(0.273)	(0.181)	(0.259)	(0.186)		
Interactive non-routine tasks	9.7%	12.9%	9.8%	12.6%	0.1	-0.3
	(0.236)	(0.273)	(0.238)	(0.274)		
Cognitive routine tasks	32.7%	38.8%	33.0%	37.7%	0.3	-1.1
	(0.265)	(0.184)	(0.352)	(0.354)		
Manual routine tasks	11.5%	6.2%	10.6%	6.5%	-0.9	0.3
	(0.377)	(0.353)	(0.248)	(0.187)		
Manual non-routine tasks	29.4%	30.7%	29.4%	31.0%	0.0	0.3
	(0.377)	(0.353)	(0.367)	(0.354)		
Number of job titles	4.6	2.9	4.7	3.0	0.1	0.1
	(6.612)	(2.503)	(6.529)	(2.503)		
Observations	2,682	1,088	2,667	1,082		

Note: LIAB, panel 2000-2007. Standard error in parentheses.

Table 1.A26: Parameter values

Parameter	Meaning	Value
σ	Elasticity of substitution N_1 w.r.t. N_2	2.462
θ_H	Productivity N_1 in firm H	0.273
θ_L	Productivity N_1 in firm L	0.159
A_H	TFP firm H	32.00
A_L	TFP firm L	33.57
ϵ	Elasticity of supply of hours w.r.t. wage	0.2
β	Fixed cost of work	10
μ	Scale parameter in Weibull $F(\alpha)$	40
γ	Shape parameter in Weibull $F(\alpha)$	1.2
b	Non-employment benefit	100
κ	Elasticity of substitution of Y_H w.r.t. Y_L	10

Note: The value of ϵ is obtained from Tazhitdinova (middle point of the range of elasticities $[0.07 - 0.32]$). Values of σ, θ_H, θ_L, A_H and A_L are computed by estimating equation (1.52) and the production function normalized to 2002, using LIAB cross-sectional data at the industry level (224 categories) for 1999-2007.

Table 1.A27: Comparison of moments data vs. model

Moments	Data (1999-2002)	Model
Employment rate	87.1%	94.6%
Proportion of mini-jobs	12.6%	14.9%
Mini-jobs in bunch/total employment	4.2%	7.8%
N_1/N_2 in industries H	0.155	0.092
N_1/N_2 in industries L	0.035	0.017

Note: Data from SIAB (1999-2002) is used for the moments. The policy parameters of the model are set to the pre-reform levels: $K = 325$, τ_1 =18%, τ_2 =35%.

Table 1.A28: Simulation of the Mini-Job Reform in the model vs. DID estimates

	Scale + substitution ($\sigma = 2.465$)	Substitution ($\sigma = 50$)	Data
In terms of baseline averages (2002)			
$DiD_{\text{low-earning employment}}$	-2.8%	123.3%	-18.5%
$DiD_{\text{high-earning employment}}$	4.3%	-19.0%	12.4%
$DiD_{\text{total employment}}$	4.1%	-10.0%	7.0%
Changes in % of pre-reform levels			
Low-earning in Intensive firm	46%	62%	
Low-earning in Non-intensive firm	36%	159%	
High-earning in Intensive firm	5%	-34%	
High-earning in Non-intensive firm	-2%	5%	
Total employment in Intensive firm	9%	-5%	
Total employment in Non-intensive firm	-1%	5%	

1.B Additional Figures

Figure 1.B1: Gross and net (of SSC) earnings of a worker as implied by the payroll tax schedule before (left) and after (right) the Mini-Job Reform

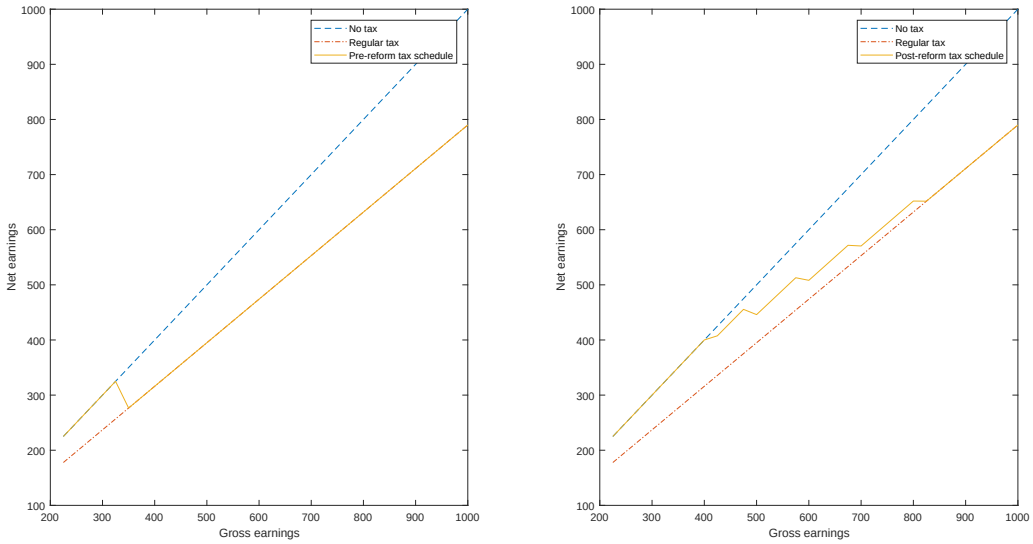
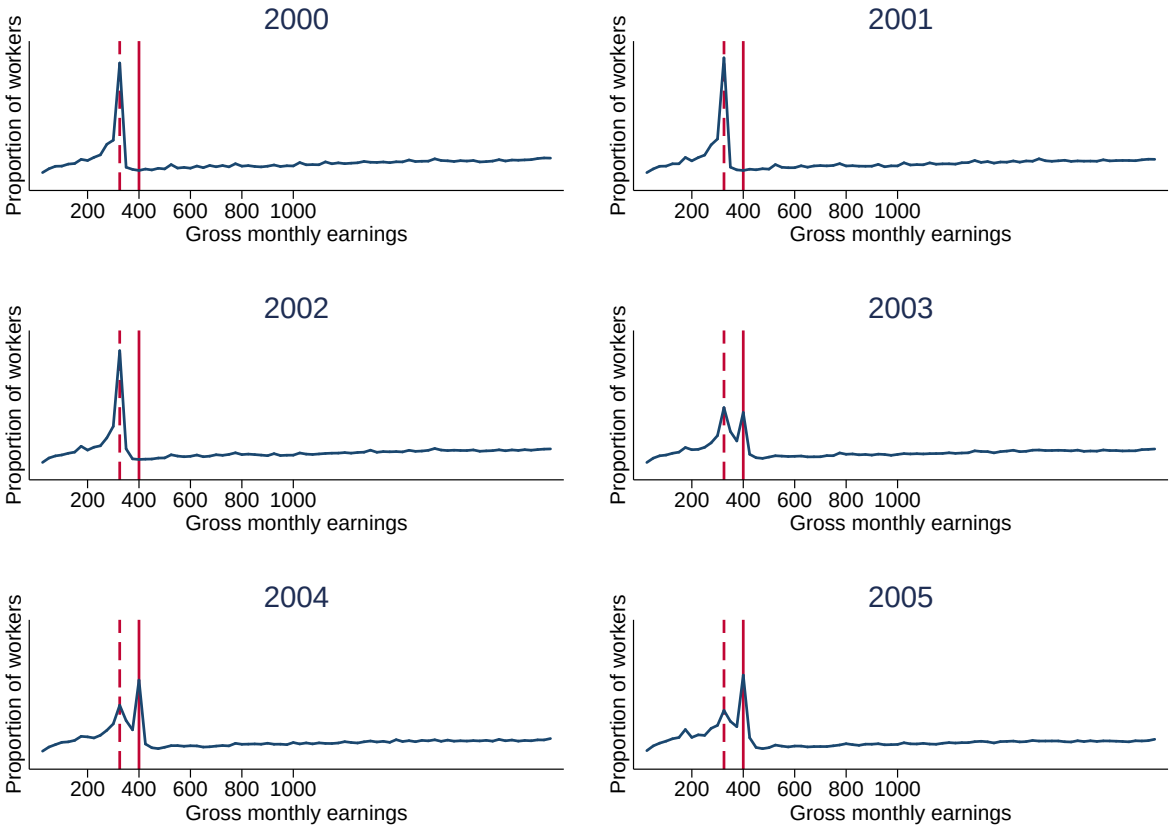
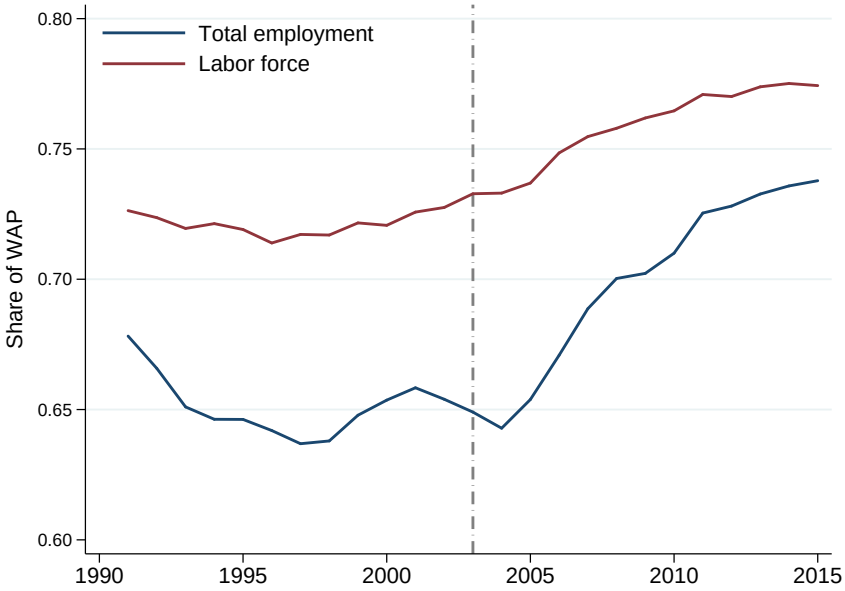


Figure 1.B2: Gross monthly earnings in 2000-2005



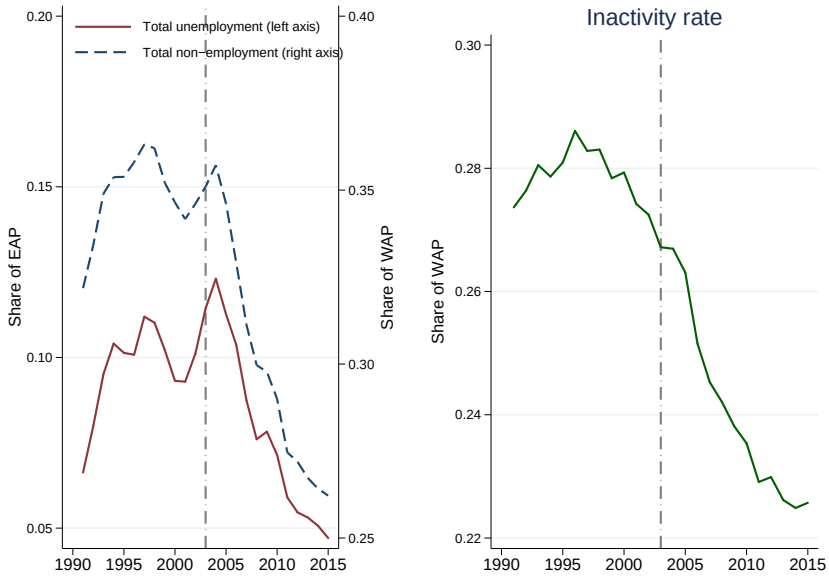
Source: SIAB, annual data, main spell, gross monthly earnings computed from daily wages.

Figure 1.B3: Employment rate and labor force participation



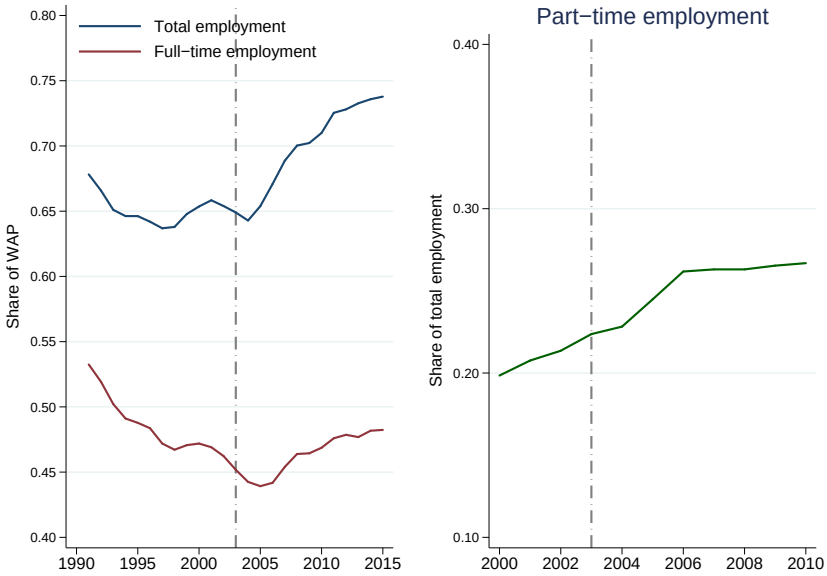
Note: Data from DESTATIS. WAP stems for Working Age Population.

Figure 1.B4: Unemployment, non-employment and inactivity rate



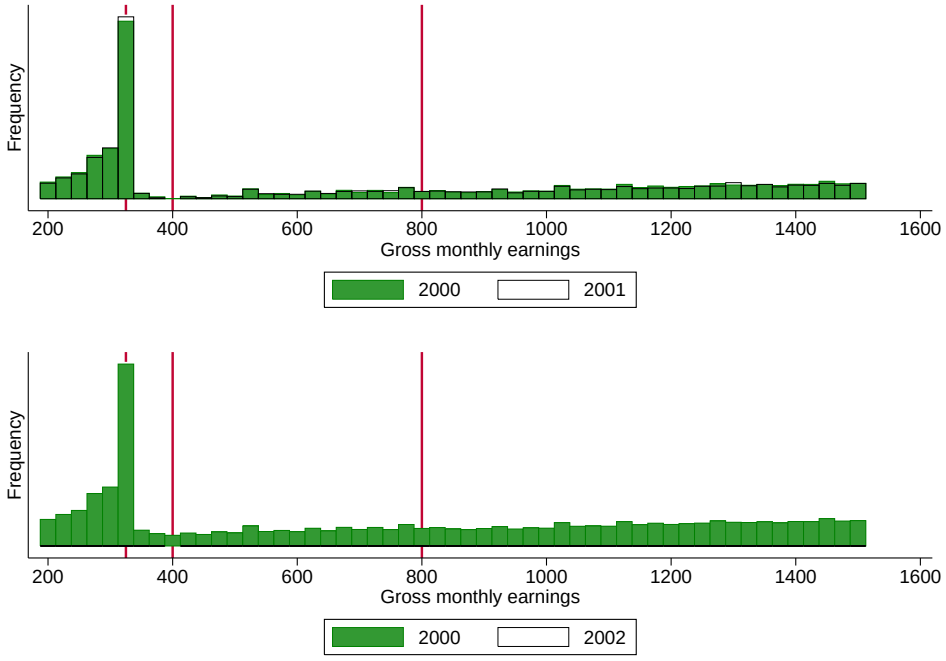
Note: Data from DESTATIS. EAP stems for Economic Age Population, and WAP for Working Age Population.

Figure 1.B5: Employment, full-time and part-time



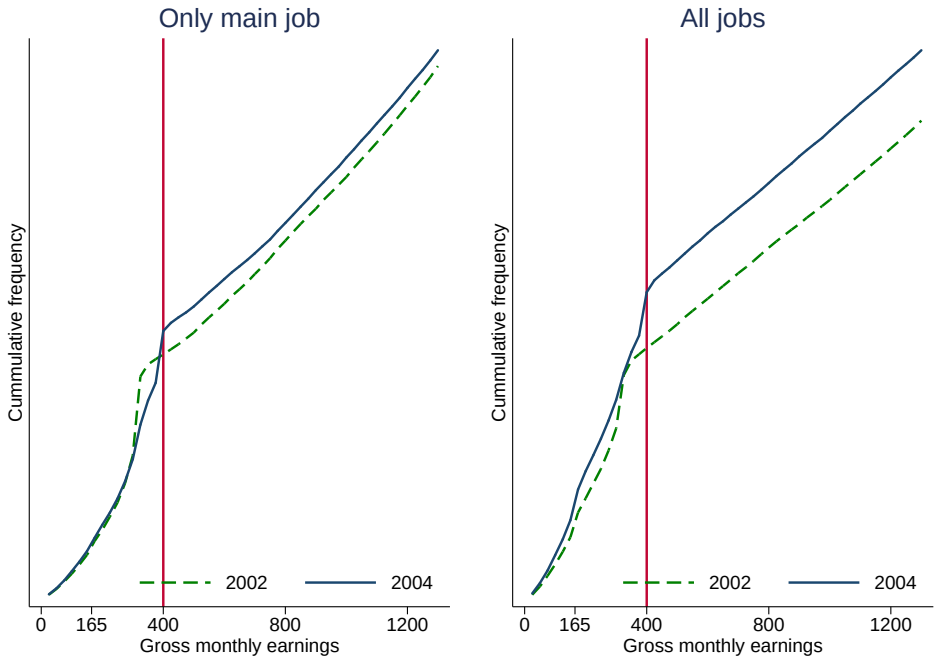
Note: Data from DESTATIS. WAP stems for Working Age Population.

Figure 1.B6: Distribution of monthly gross earnings



Source: SIAB, annual, main spell, gross monthly earnings computed from daily wages.

Figure 1.B7: Cumulative distribution of monthly gross earnings



Source: SIAB, annual (left) and spell (right), gross monthly earnings computed from daily wages.

Figure 1.B8: Accounting exercise on the earnings distribution: expansion of in-work benefits

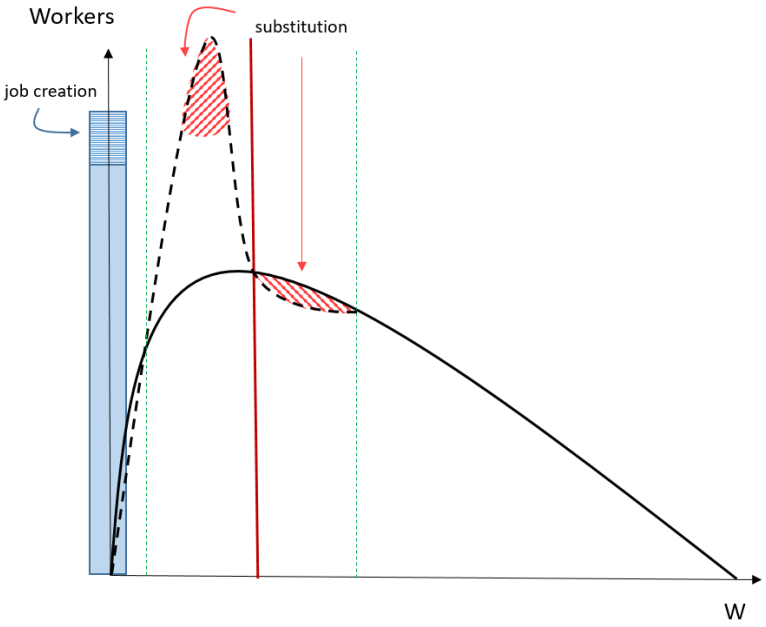
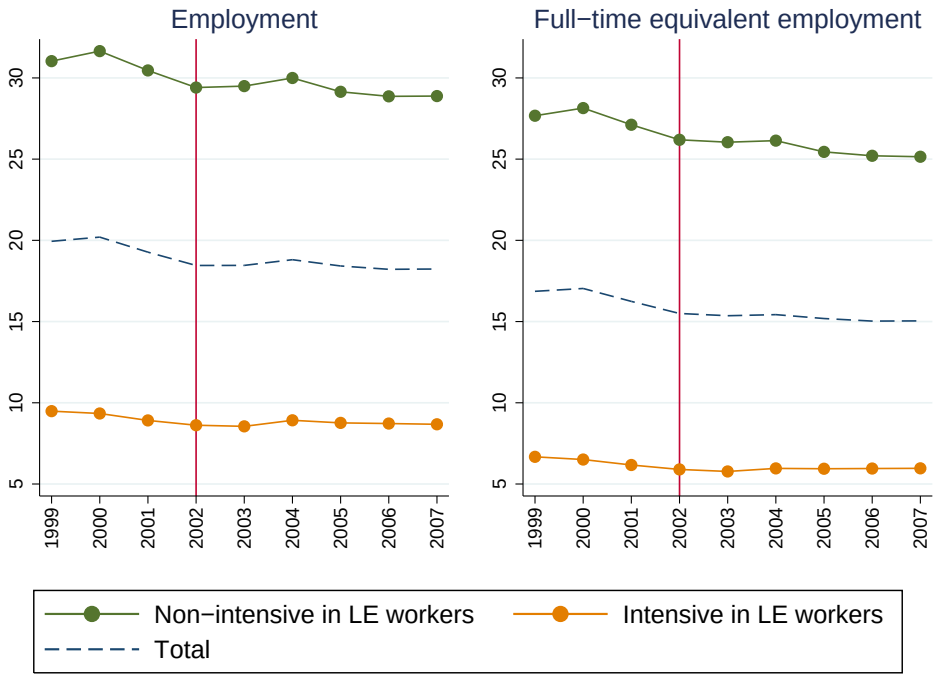
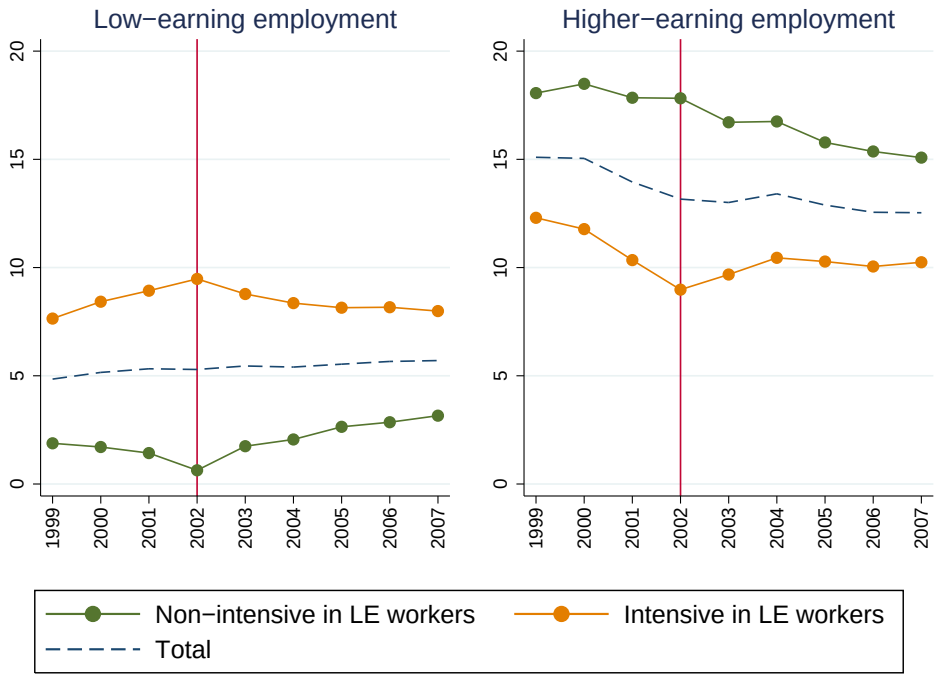


Figure 1.B9: Evolution of establishment-level employment



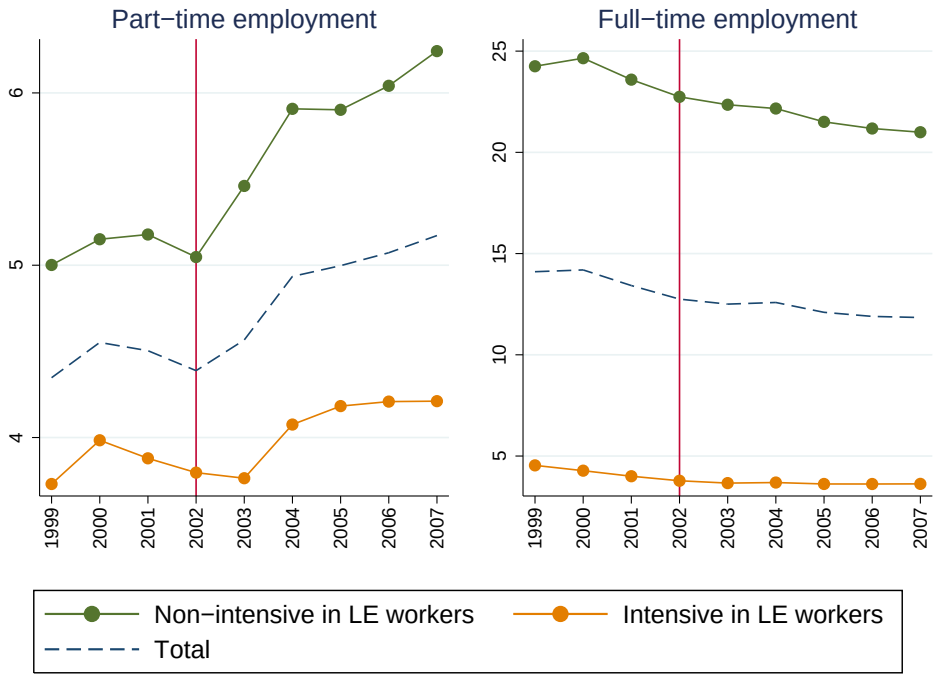
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B10: Evolution of low-earning and high-earning workers per establishment



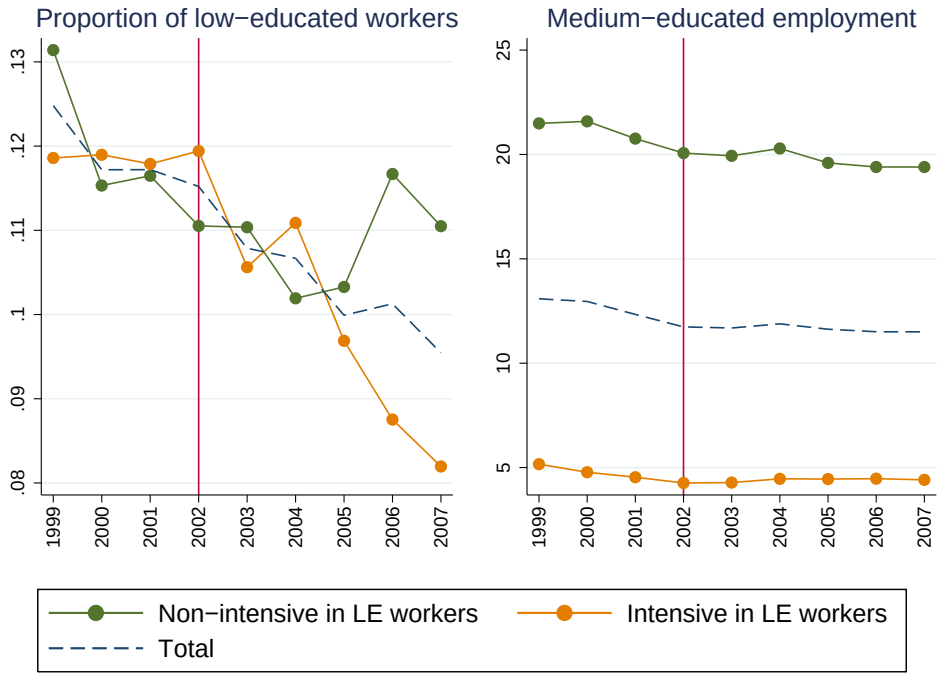
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B11: Evolution of part-time and full-time workers per establishment



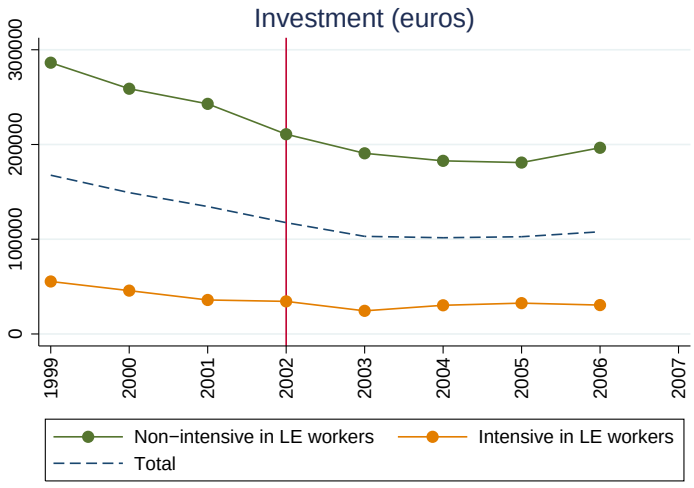
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B12: Evolution of medium-educated and low-educated workers per establishment



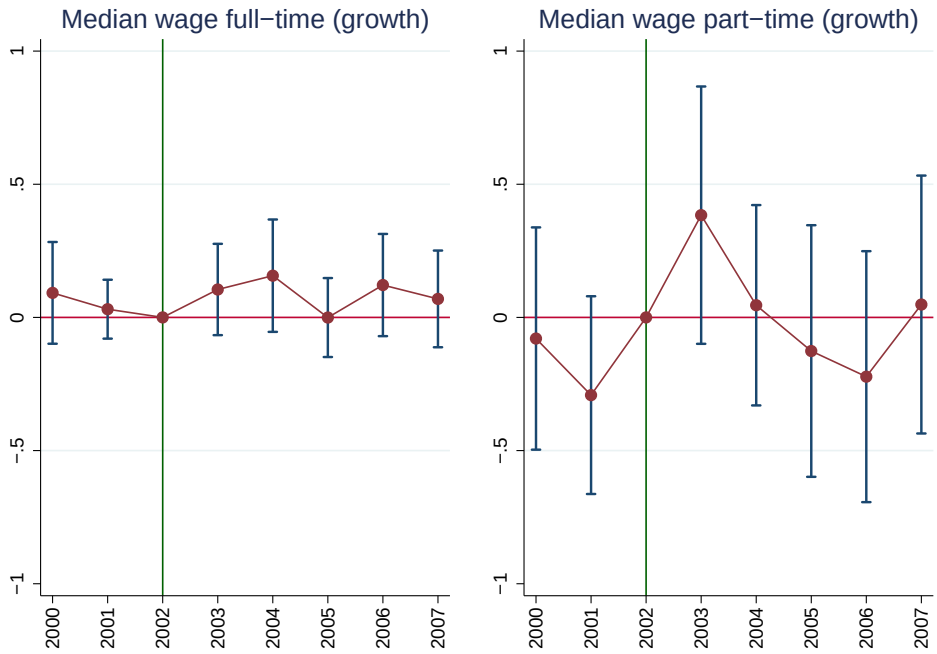
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B13: Evolution of investment in physical capital per establishment



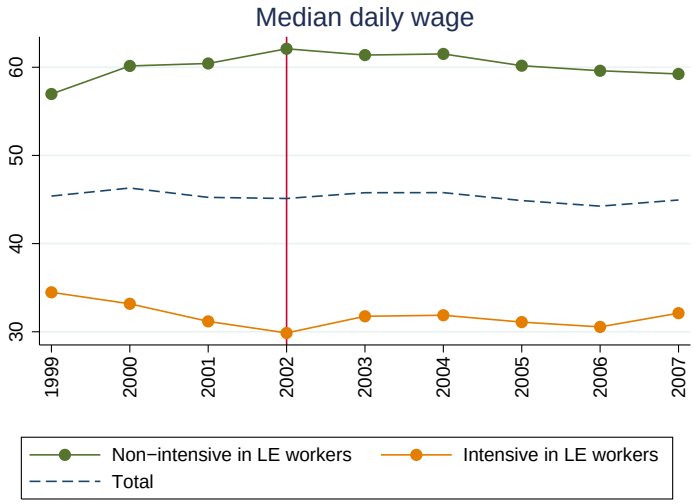
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B14: Effect on median daily wages of full-time and part-time workers



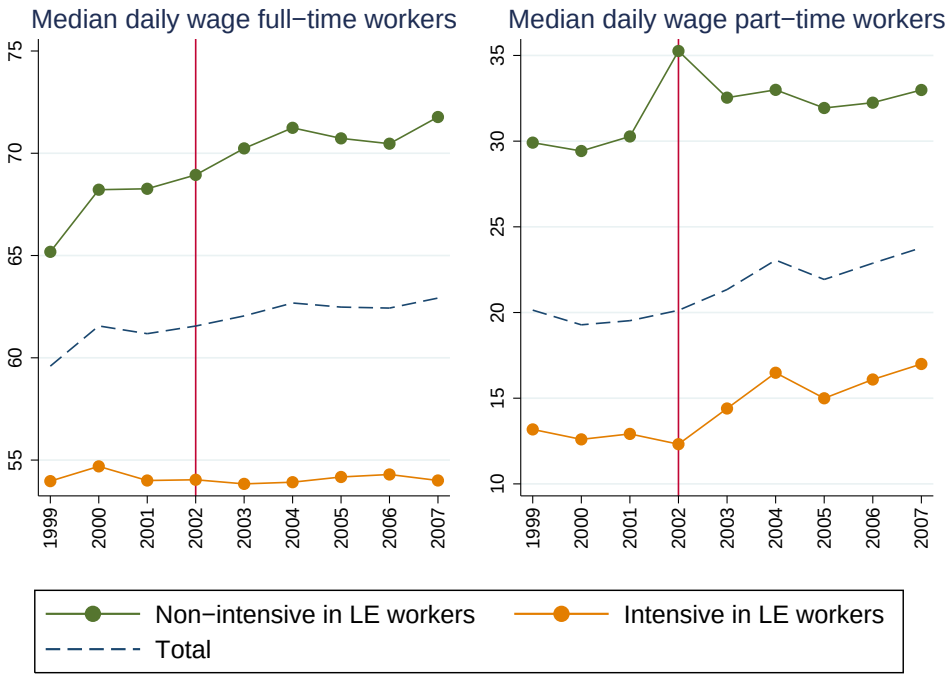
Note: Confidence intervals correspond to 95% level.

Figure 1.B15: Evolution of median wages within establishments



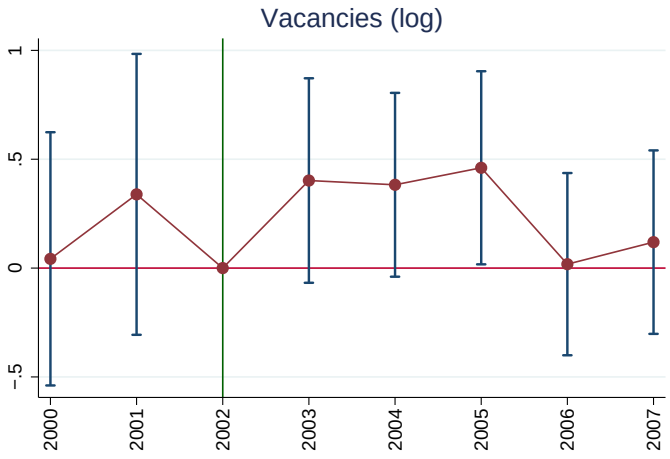
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B16: Evolution of median wages within establishments, for full-time and part-time workers



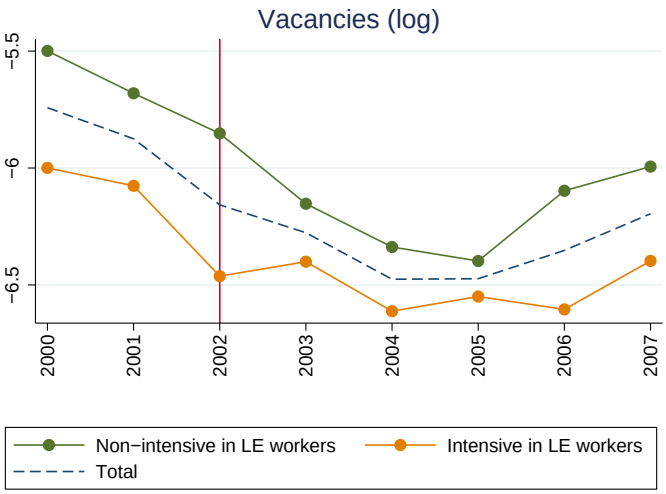
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B17: Effect on vacancies



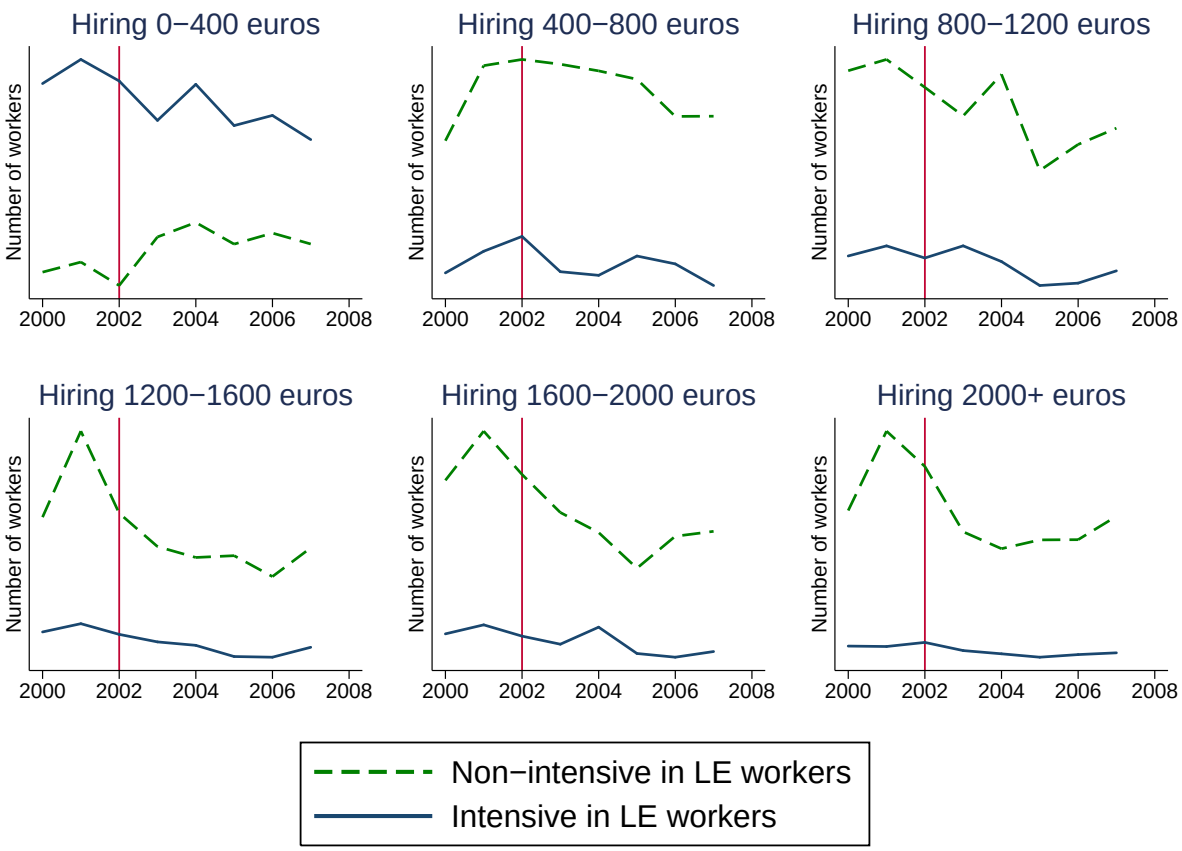
Note: Confidence intervals correspond to 95% level.

Figure 1.B18: Evolution of vacancies



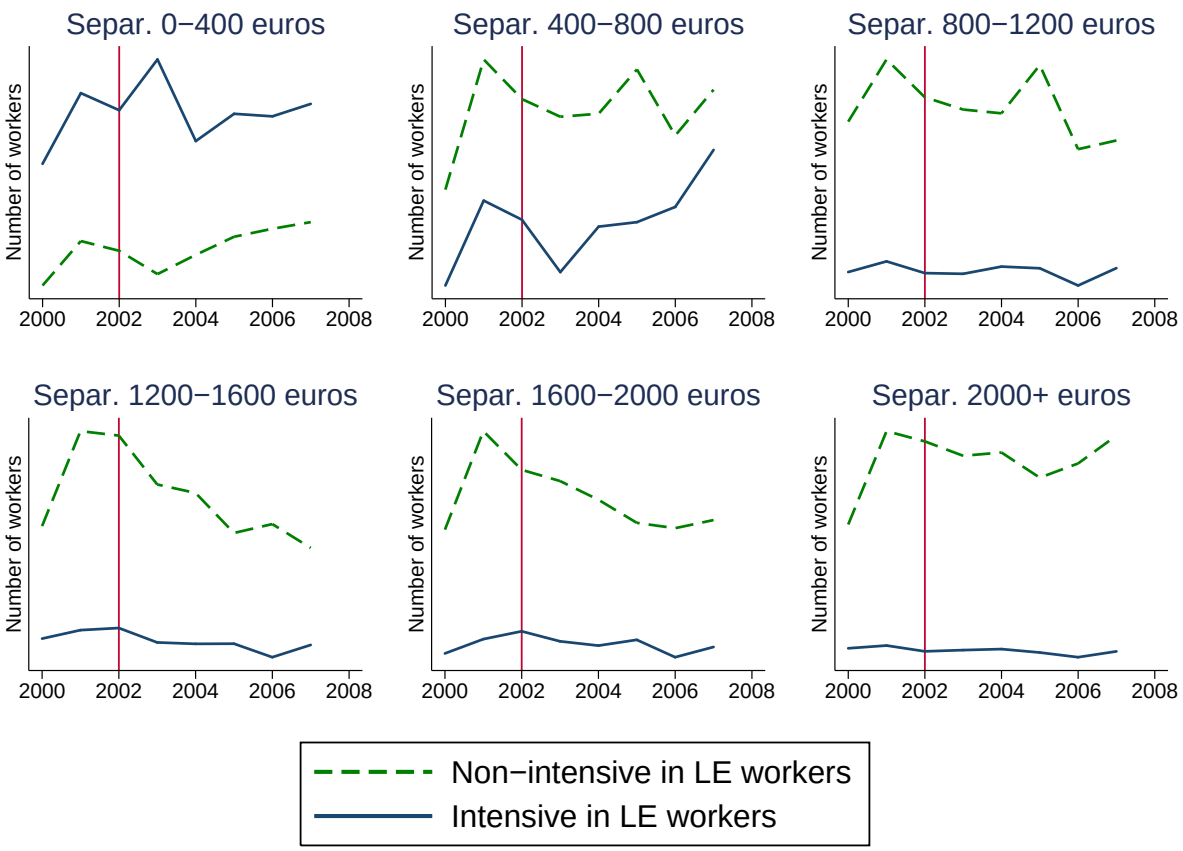
Note: Panel 2000-2007. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B19: Evolution of hirings by gross monthly earnings



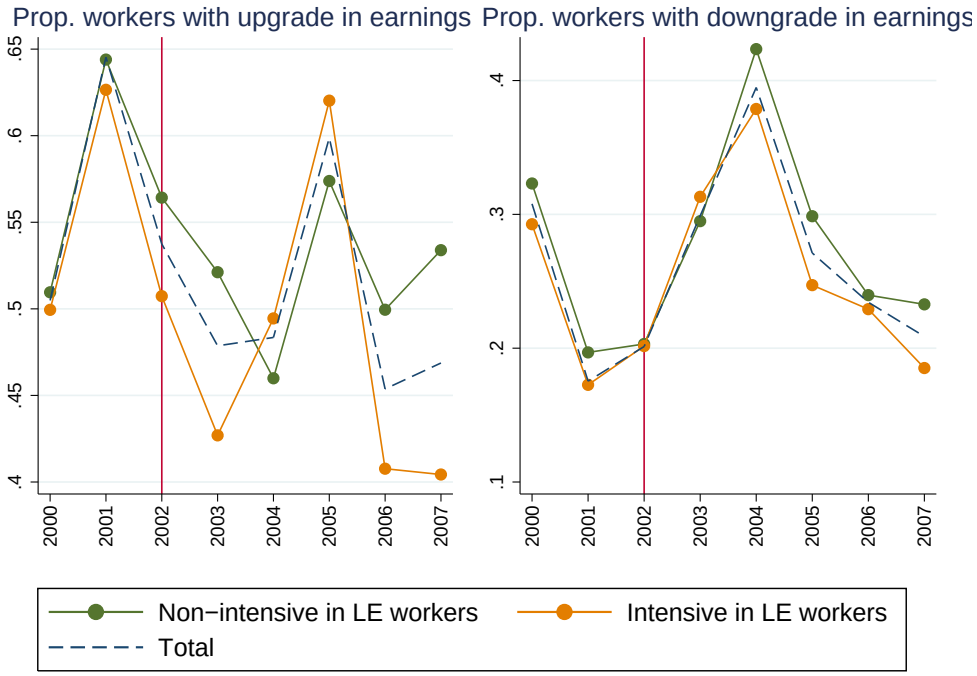
Note: Panel 2000-2002. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B20: Evolution of separations by gross monthly earnings



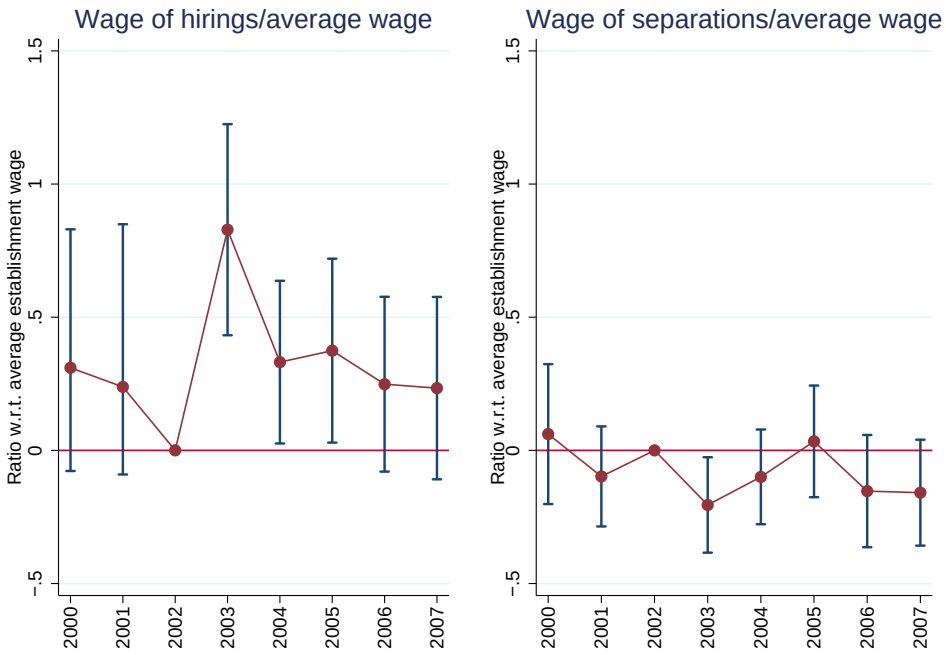
Note: Panel 2000-2002. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B21: Evolution of wage changes for workers within establishments



Note: Panel 2000-2002. Intensive and non-intensive establishments in low-earning workers (LE) refer to whether they are above or below the (weighted) median of the proportion of these workers.

Figure 1.B22: Effect on daily wages of workers flows with respect to average wage within the establishment



Note: Confidence intervals correspond to 95% level.

Figure 1.B23: Evolution of occupational structure (proportion of workers in each task, and number of job titles)

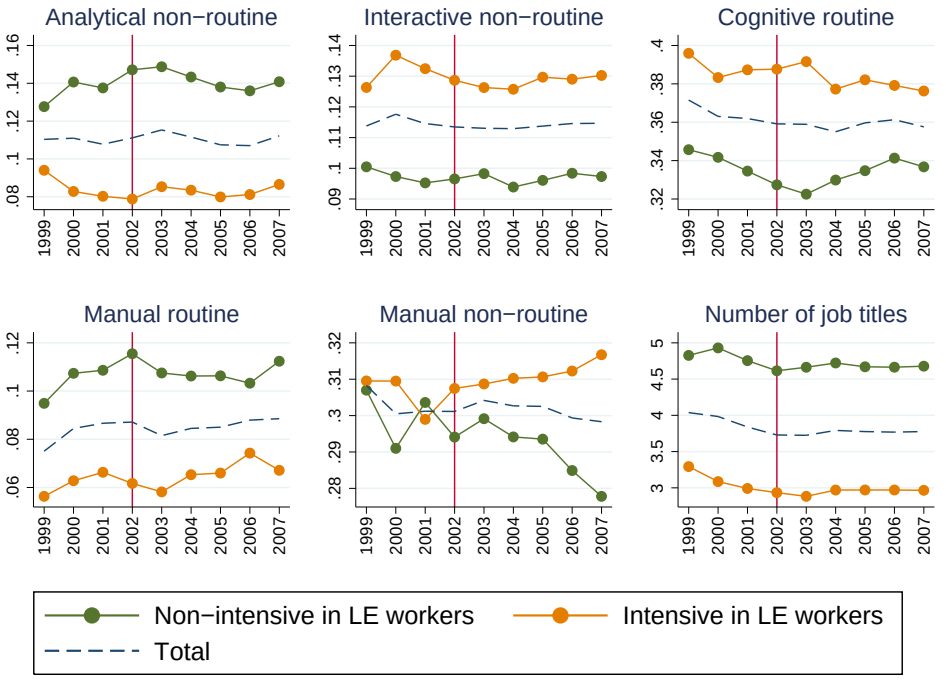
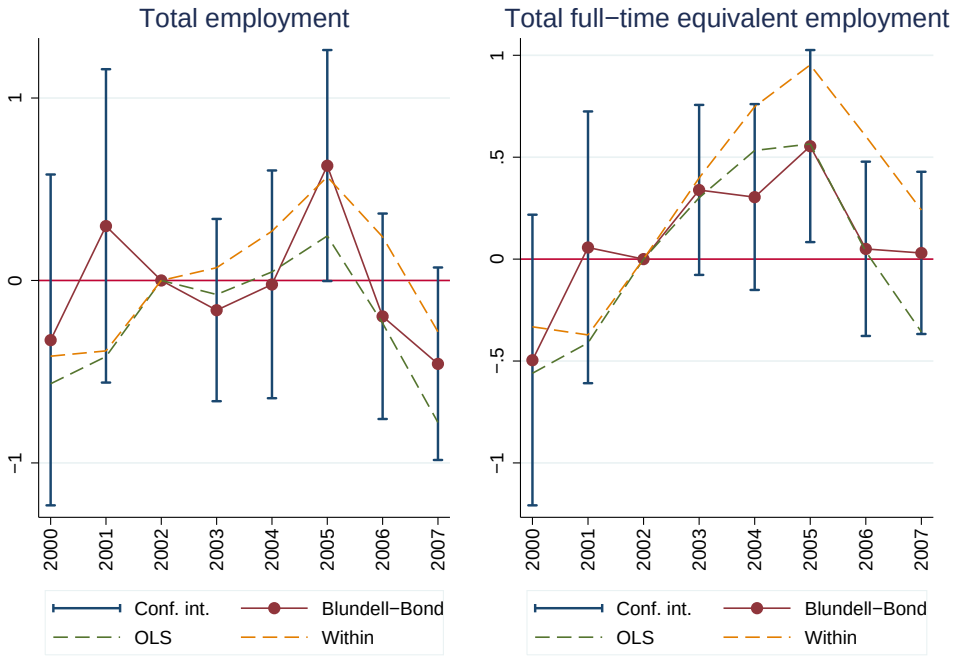


Figure 1.B24: Effects on employment, model with LDV

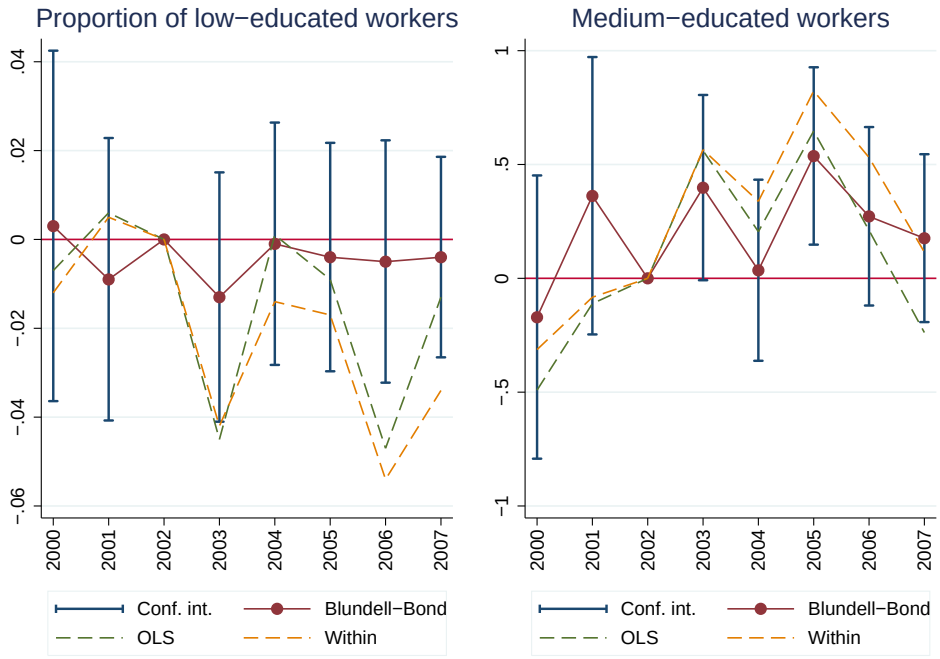


Note: Confidence intervals correspond to 95% level, only reported for Blundell-Bond estimates. Hansen statistic for overidentifying restrictions is not significant for full-time employment (at the 5% level), but it is for employment. Differences-in-Hansen statistics for tests of validity of both GMM and IV instruments are not significant for full-time employment, and only for IV instruments for employment. Hypothesis of autocorrelation of residuals for more than 1 period is rejected (at the 5% level for employment and at any level for full-time equivalent employment).

Figure 1.B25: Effects on part-time and full-time employment, LDV

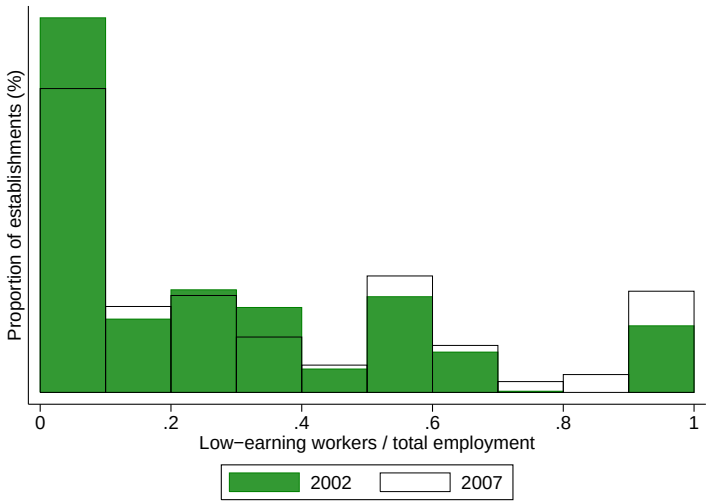
Note: Confidence intervals correspond to 95% level, only reported for Blundell-Bond estimates. Hansen statistic for test of overidentifying restrictions is significant, and differences-in-Hansen statistics for tests of validity of both GMM and IV instruments are not significant for full-time employment, and only for IV instruments for part-time employment. Hypothesis of autocorrelation of residuals for more than 1 period is rejected.

Figure 1.B26: Effects on employment by education level, LDV



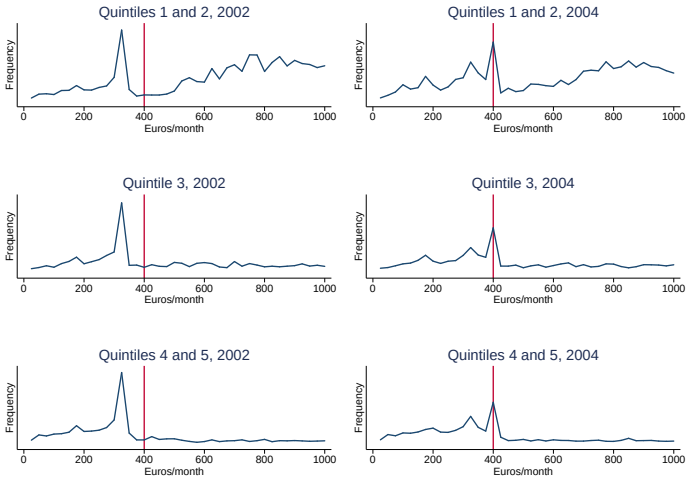
Note: Confidence intervals correspond to 95% level, only reported for Blundell-Bond estimates. Hansen statistic for test of overidentifying restrictions is not significant for medium-educated workers, and it is significant for low-educated workers. Differences-in-Hansen statistics for tests of validity of both GMM and IV instruments are not significant for both. Hypothesis of autocorrelation of residuals for more than 1 period is rejected.

Figure 1.B27: Distribution of establishments according to the proportion of low-earning workers, 2002 vs. 2007



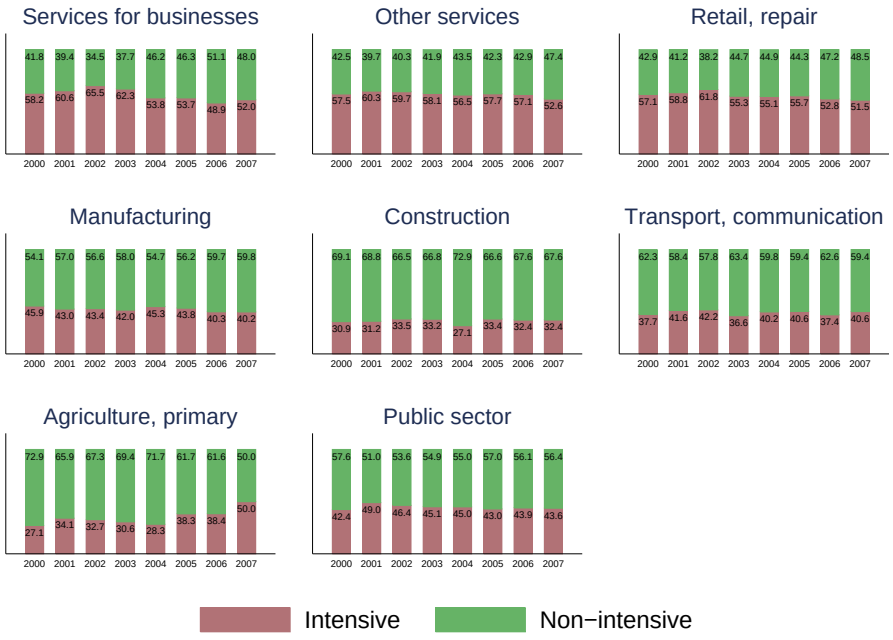
Note: LIAB, panel 2000-2007.

Figure 1.B28: Earnings distribution by establishment pre-reform intensity in low-earning workers, 2002 vs. 2004



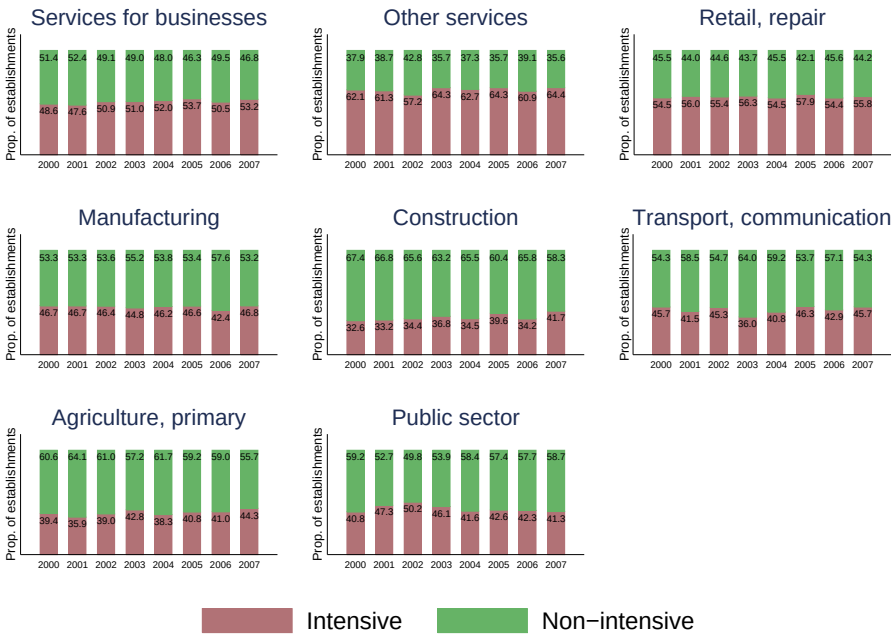
Note: LIAB, panel 2000-2007. Quintiles are defined according to the intensity in 2002, and establishments are followed to 2004

Figure 1.B29: Proportion of establishments by intensity in low-earning workers, panel 2000-2007



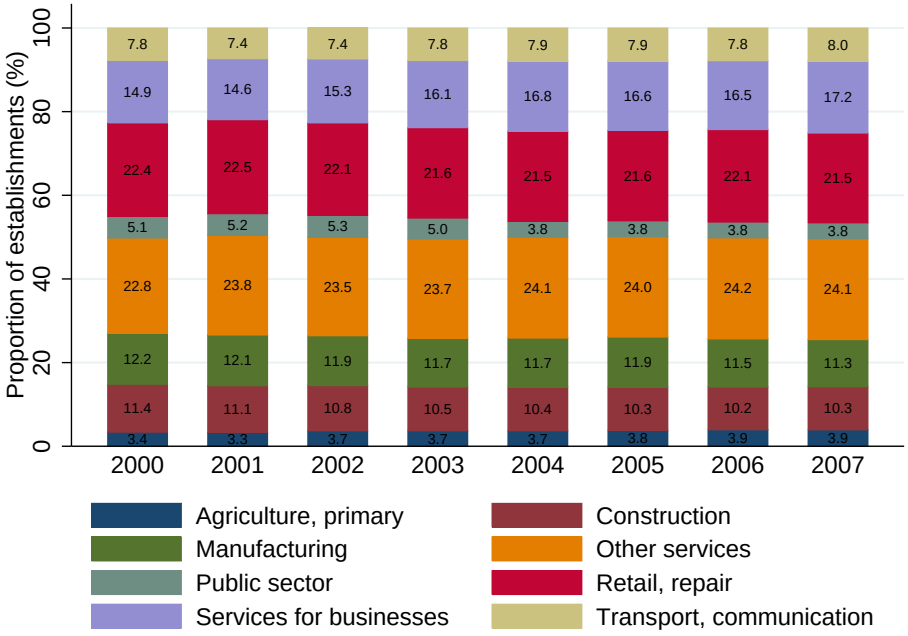
Note: LIAB, panel 2000-2007. Intensive establishments are those with a proportion of low-earning workers above the annual median, and non-intensive as those with proportion of low-earning workers below the annual median. Financial intermediation excluded due to insufficient number of observations.

Figure 1.B30: Proportion of establishments by intensity in low-earning workers, all establishments



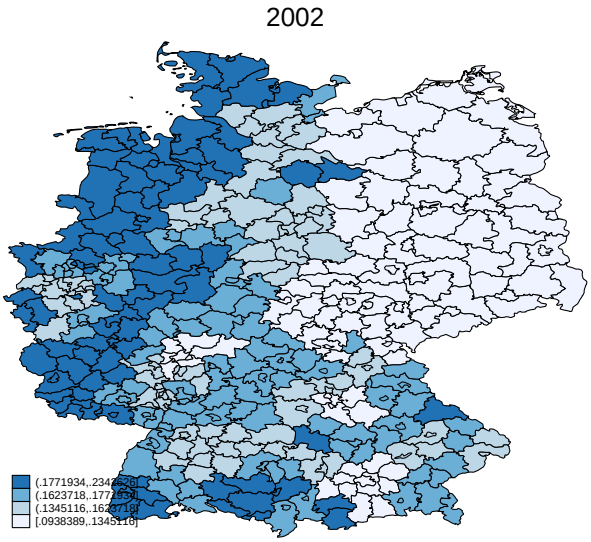
Note: LIAB, cross-sections. Intensive establishments are those with a proportion of low-earning workers above the annual median, and non-intensive as those with proportion of low-earning workers below the annual median. Financial intermediation excluded due to insufficient number of observations.

Figure 1.B31: Industrial composition of establishments, all establishments



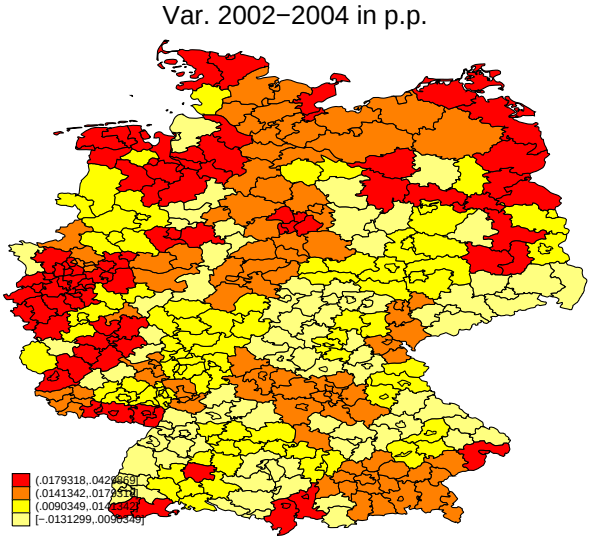
Note: LIAB, cross-sections. Financial intermediation excluded due to insufficient number of observations.

Figure 1.B32: Proportion of low-earning workers by commuting zones in 2002

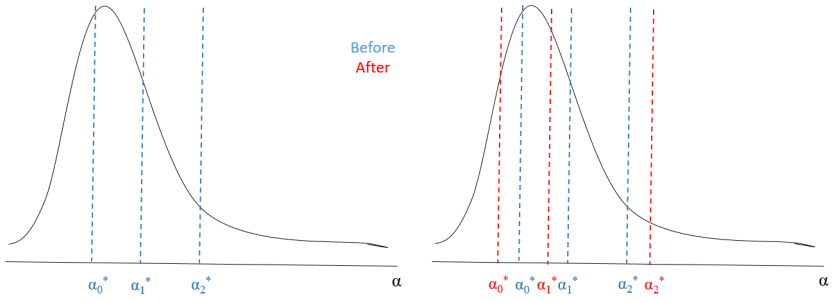


Note: SIAB data. Values for commuting zones of residence.

Figure 1.B33: Variation (in pp.) in the proportion of low-earning workers by commuting zones



Note: SIAB data. Values for commuting zones of residence.



Note: Confidence intervals correspond to 95% level, only reported for Blundell-Bond estimates.

1.C Additional Details on the Data

I perform a set of preparation and cleaning procedures in both the SIAB and the LIAB which follows the recommendations and instructions provided by the IAB. First, I correct for the excess missing values and inconsistencies in the education variables, due to the fact that the reporting of these variables is done by employers but it has not consequences for social security. I follow the criterium "2B" in Fitzenberger et al. (2005), which uses all the information for the same individual (forward and backward extrapolation, assignment of the maximum value for parallel spells), and considers the possibility of both under and over reporting. I adapt the code provided by the IAB, by using information coming from unemployment or training spells as well.

Another important adjustment I perform is imputation of daily earnings when they are right censored (above the social security contribution limit). Right censoring affects fewer than 5% of the observations in my sample and, in particular, it does not affect low-earning workers. The definition of low-earning and high-earning workers, crucial for the firm level analysis, is binary and hence does not incorporate measurement error coming from this limitation. However, to count with a reliable measure of earnings, I impute top coded wages using a series of Tobit models to fit to log-daily earnings by education and age groups following the methodology in Card et al. (2013) (see also Dustmann et al., 2009; Gartner, 2005) adapted to processing constraints imposed by remote and on-site access of the data. The uncensored imputed value is the prediction of the model according to the covariates. I use four groups of education (no degree or primary/lower secondary or intermediate school leaving certificate without vocational training, intermediate school leaving certificate with vocational training -"apprentices"-, upper secondary school certificate - "Abitur" - with or without vocational certificate, and degree from technical school or University) and seven age groups of 10 year-range (in the first I include all people below 20 and in the last, all above 80 years old). The explanatory variables include age in years, an indicator for firms with more than 10 employees, the average proportion of right censored observations and average log daily wage within the establishment, a second degree polynomial of the number of workers at the establishment, an indicator for unipersonal establishments, the average proportion of workers with university degree and the average years of schooling by establishment.

An important feature of the SIAB is that it is spell data, which means that every time there is a notification by the employer (annually, or in the event of changes in contribution group or health insurance company, or changes in the payroll system of the employer), or a change in the status as recipient of unemployment benefits or as job seeker, a new observation is added to the data-set. I use spell data in particular to compute transitions across employment

and unemployment states. In such cases, I consider all the spells during each year of the time series. Some of the descriptives are based on a transformation of the data to annual frequencies, according to the methodology proposed by the IAB. I keep all the spells which contain June 30 each year. I further restrict to one spell per worker-year (I eliminate parallel spells) for some of the descriptives, keeping the observation with highest amount of earnings or benefit reception. I explicit which version of the data I use in each case: "spell data", "annual data", or "annual data, main spell" respectively. Finally, I exclude employment spells with 0 daily earnings.

With respect to the LIAB, I do not impose exclusions of any type on establishments. Typical exclusions in the literature vary according to the topic, and consist of excluding small establishments (17% of the establishments in the Establishment Panel have two employees), establishments in the agricultural sector (6.7%) and in the public administration (9.6%). I avoid restrictions as the sample is meant to be representative of all establishments in Germany. Furthermore, I am agnostic about how establishments typically excluded in the literature affect the results.

Regarding the variables used in the analysis, the data from IEB contains direct report of whether the employment spell comes from regular employment, mini-job ("marginal part-time") or midi-job ("in transition zone"), and I use this definition for the descriptives. I use monthly gross earnings, in particular for the definition of intensity in low-earning workers at the establishment level (proportion of workers in the pre-reform year who were below the after-reform threshold in earnings) and for the analysis of the earnings' distributions. As the data only provides daily (in calendar days) earnings, I generate a monthly conversion following Tazhitdinova (2017). For workers with a single employment spell covering the whole year, I multiply the daily earnings by the average number of days in a month (30.4). For individuals with multiple employment periods in a year, I compute average daily earnings in the year, and I multiply it by the average number of days in a month.

Full-time equivalent employment, as a proxy for hours, is constructed by attributing a weight below 1 to part-time workers. In particular, IEB differentiates between "mini" part-time workers (hours worked below half full-time, corresponding to 18 hours a week), and "midi" part-time workers (hours worked above half full-time and below full-time). I assign a weight of 0.5 to "mini" part-time workers, and 0.75 to "midi" part-time workers. Even though weights are somewhat arbitrary, I confirm that results are the same if I change the weights (for eg., assigning 0.25 to "mini" part-time employment and 0.5 to "midi" part-time workers).

Regarding the classifications used along the analysis, I use the most recent time-consistent industry classification provided by the IAB (Classification of Economic Activities, 1993 version, 3-digits, 224 categories). I perform groupings of this classification for some of the

analysis, where I indicate it. Occupations are categorized according to the German Classification of Occupations (KldB) 1988, comprising 344 categories, and are grouped according to complexity and routinization following Dengler et al. (2014). The classification is based on the BERUFENET data collected by IAB containing expert knowledge about competencies and skills. For the definition of local labor markets, I use the classification of districts ("kreis") in commuting zones in Kosfeld and Werner (2012).

Finally, the response rate in the IAB Establishment Panel is stable over the years and higher than 80%. For longitudinal analysis, the IAB constructs several longitudinal sections, with the corresponding weights. These sections, besides including new establishments and establishments going out of operation, keep the establishments which have continuity in the response to the survey from one year to the next, being then free of survey non-response. I focus on the longitudinal section 2000-2007 which is the most suitable for the period of the reform. I provide some descriptives though using the cross-section of the Establishment Panel, duely clarified in the text. Even though there is no survey non-response in the longitudinal analysis, the survey is subject to item non-response by certain establishments. However, most of the variables in the analysis such as employment, wages, occupations and industries are drawn from the social security records from IEB and BHP linked to the Establishment Panel.[39] I consider therefore that measurement error is not a major issue for the analysis in this paper.

[39] One important exception is investment, which is reported by establishments in the survey and it is subject to non-negligible item non-response.

1.D Additional Derivations

1.D.1 Accounting exercise on the earnings distribution

Figure (1.B8) explains schematically the main ideas for this exercise. Let's denote the change in the mass of workers below the mini-job threshold as follows:

$$\Delta Emp(MJ) \equiv \frac{Emp_1(MJ) - Emp_0(MJ)}{Emp_0(MJ)} \tag{1.14}$$

where $Emp_t(MJ)$ denotes employment below earnings threshold introduced by the reform (€400), and t is 0 for before and 1 for after. The mass is normalized by the employment level below the threshold in case of absence of reform. The mass below the threshold after the reform comprises: (1) workers who retain their job (potentially improving earnings), (2) workers who transit from non-employment to employment, denoted by $Emp_1^+(MJ)$, and (3) workers pulled from above the earnings distribution, $Emp_1^-(MJ)$. Decomposing $Emp_1(MJ)$ into the sum of $Emp_1^+(MJ)$ and $Emp_1^-(MJ)$

$$\Delta Emp(MJ) = \frac{Emp_1^+(MJ) + Emp_1^-(MJ) - Emp_0(MJ)}{Emp_0(MJ)} \tag{1.15}$$

The fraction of entrants from non-employment is then:

$$\Delta Emp_{MJ}^+ \equiv \frac{Emp_1^+(MJ) - Emp_0(MJ)}{Emp_0(MJ)} = \Delta Emp(MJ) - \frac{Emp_1^-(MJ)}{Emp_0(MJ)} \tag{1.16}$$

which is the excess mass of workers below the threshold netted out from the proportion pulled down. The fraction of workers coming from the upper segment of the earnings distribution is proxied by the missing mass close to the threshold:

$$Emp^-(MJ) \equiv emp_0(w > MJ) - emp_1(w > MJ) \tag{1.17}$$

where $emp_t(w > MJ)$ denotes the number of workers with wages above the mini-job threshold. Using annual data (considering individuals only according to the main job), and €1,200 as upper limit (where visually the pre and post reform distributions of earnings converge), the quantities are: $\Delta Emp(MJ)/Emp_0(MJ)$ =7.8% and $Emp^-(MJ)/Emp_0(MJ)$ =-4.1%, which yields ΔEmp_{MJ}^+ =3.6%. This excess mass is even larger when considering only the prime-age population (9.8%), and more so if all spells (secondary jobs included) are considered (41.7%).

1.D.2 Derivations regarding the theoretical framework

Partial equilibrium: Labor supply decision

The first order condition for the solution of the problem (1.10) in the absence of non-linearities is:

$$n = \alpha \hat{w}^{\epsilon} \tag{1.18}$$

Note that $\hat{w} = \alpha^{-\frac{1}{\epsilon}} n^{\frac{1}{\epsilon}}$, is positively related to the disutility of work. Net earnings, $\alpha^{-\frac{1}{\epsilon}} n^{\frac{1+\epsilon}{\epsilon}}$, are a not-linear function of hours.[40] The take-home wage of the worker is below her productivity, $\hat{w} < w$, as a consequence of the tax.

With non-linear taxes, wages, fixed costs of work and non-labor income, there exists α_0^* such that $U(b, 0) = U(c, n)$ (for $n > 0$):

$$\alpha_0^* = \frac{(\epsilon + 1)(b + \beta)}{\hat{w}_1^{\epsilon+1}} \tag{1.19}$$

Let's define α_1^* as the value of α such that workers choose n which yields K before-tax earnings ($\hat{K}$ after taxes):

$$\alpha_1^* \equiv \frac{\hat{K}}{\hat{w}_1^{\epsilon+1}} \tag{1.20}$$

Finally, there exists α_2^* that solves $U(\hat{K}, \hat{K}/\hat{w}_1) = U(\alpha \hat{w}_2^{\epsilon+1}, \alpha \hat{w}_2^{\epsilon})$:

$$(\epsilon + 1)\hat{K} - \epsilon \alpha_2^{*-\frac{1}{\epsilon}} \left(\frac{\hat{K}}{\hat{w}_1} \right)^{1+\frac{1}{\epsilon}} - \alpha_2^* \hat{w}_2^{\epsilon+1} = 0 \tag{1.21}$$

Let us consider the relevant case of $\hat{w}_1 > \hat{w}_2$. For individuals with $\alpha \leq \alpha_0^*$, the fixed cost of working and the loss of non-labor income are sufficiently high that the net earnings in job type 1 cannot compensate for them, if they were to supply their preferred number of hours, and as a consequence they do not work. For $\alpha_0^* < \alpha \leq \alpha_1^*$, individuals optimally choose their number of hours and sort into jobs type 1, with α_1^* corresponding to the individual for which the optimal n is such that gross earnings are exactly K. Individuals with $\alpha_1^* < \alpha < \alpha_2^*$ would like to work more hours at the take-home wage $\hat{w}_1$, but cannot do it because their earnings would surpass K and the wage they receive is $\hat{w}_2 < \hat{w}_1$. These agents bunch at the threshold

[40] The formulation with non-linear earnings in function of hours is typical in the literature dealing with intensive and extensive margins of labor supply (see e.g. Erosa et al., 2016). Note that earnings are increasing in the disutility for labor, to compensate the individual for the utility cost of supplying more hours of work. The non-linear specification penalizes individuals with low number of hours, bounding intensive margin decisions away from zero.

supplying $n = K/w_1$ at w_1 and subject to τ_1. Individuals with $\alpha \geq \alpha_2^*$ supply their optimal number of hours at w_2 and are subject to τ_2.

Comparative statics: change in labor supply when tax benefits change

Given w_1 and w_2, when τ_1 decreases, $(1-\tau_1)$ increases one to one. The change in α_0^* is:

$$\frac{\partial \alpha_0^*}{\partial(1-\tau_1)} = -\frac{(\epsilon+1)^2(b+\beta)}{(1-\tau_1)^{\epsilon+2} w_1^{\epsilon+1}} \tag{1.22}$$

which is negative. For α_1^*:

$$\frac{\partial \alpha_1^*}{\partial(1-\tau_1)} = -\frac{\epsilon K}{\hat{w}_1^{\epsilon+1}} \tag{1.23}$$

is also negative. For α_2^*, renaming equation (1.21) as the implicit function $\tilde{F}(\alpha_2^*, (1-\tau_1))$:

$$\frac{\partial \alpha_2^*}{\partial(1-\tau_1)} = -\frac{\partial \tilde{F}/\partial(1-\tau_1)}{\partial \tilde{F}/\partial \alpha_2^*} \tag{1.24}$$

where:

$$\frac{\partial \tilde{F}}{\partial(1-\tau_1)} = (\epsilon+1)K \tag{1.25}$$

$$\frac{\partial \tilde{F}}{\partial \alpha_2^*} = {\alpha_2^*}^{-\frac{1}{\epsilon}-1} \left(\frac{K}{w_1}\right)^{1+\frac{1}{\epsilon}} - \hat{w}_2^{\epsilon+1} \tag{1.26}$$

Equation (1.25) is positive. To derive the sign of equation (1.26), note that the first term is lower than the second because:

$$\left(\frac{\hat{K}}{\alpha_2^* \hat{w}_1^{\epsilon+1}}\right)^{\frac{1}{\epsilon}} < \frac{\hat{w}_2}{\hat{w}_1} \tag{1.27}$$

$\alpha_2^* \hat{w}_1^{\epsilon+1}$ are the net earnings the individual with the initial α_2^* would have if she could supply the optimal number of hours at $\hat{w}_1$, which are higher than $\hat{K}$ by construction. The factor in the left hand side is hence lower than one, the same as the factor in the right hand side as we are in the case where $\hat{w}_2 < \hat{w}_1$. Besides, the exponent $1/\epsilon > 1$ means that the left hand side is smaller than the right hand side. Hence, expression (1.26) is negative and $\partial \alpha_2^*/\partial(1-\tau_1) > 0$. As a consequence of the expansion of the in-work benefit (modelled as a decrease in τ_1), given the wages, N_1^S increases due to both the inflow of new entrants into employment (α_0^* decreases) and workers previously in jobs type 2 (α_2^* increases), whereas N_2^S decreases, pushing upwards the ratio N_1^S/N_2^S in partial equilibrium.

This parsimonious way of modelling the expansion of an in-work benefit, by a reduction in τ_1, is particularly insightful about the introduction of in-work benefits. However, it does

not reflect exactly the Mini-Job reform case. With the reform, K increased leaving τ_1 virtually unaffected. The result of this modification is also an increase in N_1^S/N_2^S in partial equilibrium, but the channel is different. α_0^* does not change, whereas:

$$\frac{\partial \alpha_1^*}{\partial K} = \frac{1}{w_1^{\epsilon+1}(1-\tau_1)^{\epsilon}} \tag{1.28}$$

is positive, and:

$$\frac{\partial \alpha_2^*}{\partial K} = -\frac{\partial \tilde{F}/\partial K}{\partial \tilde{F}/\partial \alpha_2^*} \tag{1.29}$$

is also positive. Note that in equation (1.29) the denominator is the same as in equation (1.24), and the numerator is:

$$\frac{\partial \tilde{F}}{\partial K} = (\epsilon+1)(1-\tau_1) - \epsilon \alpha_2^{*-\frac{1}{\epsilon}} \left(1+\frac{1}{\epsilon}\right)\left(\frac{K}{w_1}\right)^{\frac{1}{\epsilon}} \tag{1.30}$$

For this expression to be positive, $(1-\tau_1)^{\epsilon} w_1^{\epsilon+1} \alpha_2^* > K$. This is indeed the case because the left hand side is the total before-tax earnings of individual with α_2^* if she were to supply her preferred hours at the take-home wage $\hat{w}_1$. This amount is higher than K by construction. Hence, equation (1.29) is positive. This means that the change in N_1^S/N_2^S with the Mini-Job reform under this framework responds exclusively to a reallocation of workers, both within the low-earning sector (the increase in α_1^* means that workers already in jobs type 1 supply more hours), and coming from the high-earning sector (the increase in α_2^* captures that workers previously in jobs type 2 sort into jobs type 1 by reducing hours). Although these effects are not unreasonable for many workers, there is a dimension the model is missing: the entry from secondary workers who may have higher fixed costs of work and would be induced to enter after the reform given the higher net wage. There is also new low-earning jobs taken up as second job, something also not captured in the model. These caveats are important, as pointed out in section (1.3.2). Although I do not introduce them in the model yet, I consider them when discussing the results from the quantitative exercise.

Equilibrium wages

As previously showed, the expansion of an in-work benefit induces N_1^S/N_2^S to increase. In equilibrium, supply and demand for each of the jobs, and relative wages, need to adjust for the labor market to clear. These changes are simultaneous but I show them sequentially. I first use the fact that N_1^D/N_2^D needs also to increase to match the labor supply, to show the direction of the change in the firm-specific intensities. And then I show that w_1/w_2 will fall to accommodate the changes in quantities.

From the first order condition in equation (1.2), it must hold:

$$\left(\frac{\theta_H}{1-\theta_H}\right)^{-\sigma} \frac{N_{1H}}{N_{2H}} = \left(\frac{\theta_L}{1-\theta_L}\right)^{-\sigma} \frac{N_{1L}}{N_{2L}} \tag{1.31}$$

Taking derivatives in both sides with respect to N_1^D/N_2^D:

$$\left(\frac{\theta_H}{1-\theta_H}\right)^{\sigma} \frac{\partial(N_{1H}/N_{2H})}{\partial(N_1^D/N_2^D)} = \left(\frac{\theta_L}{1-\theta_L}\right)^{\sigma} \frac{\partial N_{1L}/N_{2L}}{\partial N_1^D/N_2^D} \tag{1.32}$$

Equation (1.32) shows that the direction of change in the intensities of each firm is the same as in the aggregate intensity because $\theta_k/(1-\theta_k) > 0$. For a higher N_1^D/N_2^D to match the increase N_1^S/N_2^S due to the expansion of the tax benefit, the firm-specific intensities need to increase.

Knowing that the firm-specific intensity moves in the same direction as the aggregate intensity in labor demand, without loss of generality I can derive the direction of the change in w_1/w_2 in equilibrium, by deriving both sides of the first order condition for the firm H with respect to the change in N_1^S/N_2^S, which in equilibrium is equal to the change in N_1^D/N_2^D:

$$\frac{\partial(w_1/w_2)}{\partial(N_1^D/N_2^D)} = -\frac{1}{\sigma}\left(\frac{\theta_H}{1-\theta_H}\right)\left(\frac{N_{1H}}{N_{2H}}\right)^{-\frac{\sigma+1}{\sigma}} \frac{\partial(N_{1H}/N_{2H})}{\partial(N_1^D/N_2^D)} \tag{1.33}$$

All the factors in the right hand side have a positive sign, except for $-1/\sigma < 0$. Hence, for N_1^D/N_2^D to increase to equate the labor supply, w_1/w_2 needs to fall. Note that the lower is σ (the more complements are low-earning and high-earning workers), the bigger the response on wages due to a change in the relative supply, and the smaller the changes in relative quantities. On the other hand, the only case in which the change in the relative supply does not exert any effect on relative wages is when low-earning and high-earning jobs are perfect substitutes ($\sigma \to \infty$).

Decomposition in scale and substitution effect

The Hicks-Marshall rules of derived demand allow to decompose the change in the labor demand of each task when there is a change in the price of one input, in terms of elasticities and cost factor shares. Let's assume perfect competition and free entry.[41] For simplicity, I skip the index for the firm k, but all derivations need to hold for both $k \in \{H, L\}$.

Let $s_1 \equiv \frac{w_1 N_1}{pY} = \theta\left(\frac{N_1}{Y}\right)^{\frac{\sigma-1}{\sigma}}$ and $s_2 \equiv \frac{w_2 N_2}{pY} = (1-\theta)\left(\frac{N_2}{Y}\right)^{\frac{\sigma-1}{\sigma}}$ be the cost share of labor in

[41] Harasztosi and Lindner (2017) derive an analogous decomposition under imperfect competition.

type-1 and type-2 jobs respectively.

Totally differentiating $Y = F(N_1, N_2)$:

$$\begin{gathered} dY = Y^{\frac{1}{\sigma}}\theta N_1^{-\frac{1}{\sigma}} dN_1 + Y^{\frac{1}{\sigma}}(1-\theta)N_2^{-\frac{1}{\sigma}} dN_2 \\ \frac{dY}{Y} = \frac{Y^{\frac{1}{\sigma}}\theta N_1^{-\frac{1}{\sigma}} N_1}{Y}\frac{dN_1}{N_1} + \frac{Y^{\frac{1}{\sigma}}(1-\theta)N_2^{-\frac{1}{\sigma}} N_2}{Y}\frac{dN_2}{N_2} \\ dlnY = s_1 dlnN_1 + s_2 dlnN_2 \end{gathered} \tag{1.34}$$

Since the production function is constant returns to scale, $s_1 = 1 - s_2$:

$$\begin{gathered} dlnY = s_1 dlnN_1 + (1-s_1) dlnN_2 \\ dlnN_1 = dlnY + (1-s_1)(dlnN_1 - dlnN_2) \end{gathered} \tag{1.35}$$

Dividing by $dlnw_1$:

$$\frac{dlnN_1}{dlnw_1} = \frac{dlnY}{dlnw_1} + (1-s_1)\frac{dlnN_1 - dlnN_2}{dlnw_1} \tag{1.36}$$

A similar expression can be derived for N_2:

$$\frac{dlnN_2}{dlnw_1} = \frac{dlnY}{dlnw_1} - s_1\frac{dlnN_1 - dlnN_2}{dlnw_1} \tag{1.37}$$

These expressions decompose the change in the demand for both factors N_1 and N_2 when the price of one of them changes, w_1, in a scale effect (first term) and a substitution effect (second term). Whereas the scale effect has the same direction in both the demand of N_1 and N_2, the substitution effect acts in opposite direction.

Next, I express equations (1.36) and (1.37) in terms of elasticities. For the scale effect, I use the fact that under perfect competition and free entry, firms make zero-profits: $pY = w_1N_1 + w_2N_2$. Defining as $\eta \equiv -\frac{dlnY}{dlnp}$ the elasticity of demand for output (in absolute value), and plugging $dlnY = -\eta dlnp$ in equation (1.36):

$$\frac{dlnN_1}{dlnw_1} = -\eta\frac{dlnp}{dlnw_1} + s_2\frac{dlnN_1 - dlnN_2}{dlnw_1} \tag{1.38}$$

Differentiating the zero-profit condition, for the case that only w_1 changes, and using equation (1.34):

$$dlnp = s_1 dlnw_1 \tag{1.39}$$

For the substitution effect, using the ratio of first order conditions of the firm's problem:

$$\frac{N_1}{N_2} = \left(\frac{\theta}{1-\theta}\right)^{\sigma} \left(\frac{w_1}{w_2}\right)^{-\sigma} \tag{1.40}$$

Taking logs and differentiating:

$$dlnN_1 - dlnN_2 = -\sigma dlnw_1 \tag{1.41}$$

The elasticities of the demand for labor in each type of jobs when the price of type-1 jobs changes are:

$$\begin{array}{c} \frac{dlnN_1}{dlnw_1} = -[s_1\eta + (1-s_1)\sigma] \\ \frac{dlnN_2}{dlnw_1} = -[s_1\eta - s_1\sigma] \end{array} \tag{1.42}$$

Intensities and cost-shares

From the first order conditions of the firm, $\frac{N_{1H}}{N_{2H}} > \frac{N_{1L}}{N_{2L}}$. From the definition of s_1 omitting the indices k.

$$\begin{aligned} s_1 &= \theta \left(\tfrac{N_1}{Y}\right)^{\frac{\sigma-1}{\sigma}} \\ &= \theta \left\{ A \left[\theta + (1-\theta) \left(\tfrac{N_1}{N_2}\right)^{-\frac{(\sigma-1)}{\sigma}} \right] \right\}^{-1} \end{aligned} \tag{1.43}$$

Deriving with respect to N_1/N_2:

$$\frac{\partial s_1}{\partial (N_1/N_2)} = \theta(1-\theta)\frac{\sigma-1}{\sigma} \left(\frac{N_1}{N_2}\right)^{-\frac{2\sigma-1}{\sigma}} \left\{ \left[\theta + (1-\theta) \left(\frac{N_1}{N_2}\right)^{-\frac{(\sigma-1)}{\sigma}} \right] \right\}^{-2} \tag{1.44}$$

where the right hand side is positive.

Let's define $\phi_k \equiv \frac{N_{1k}}{N_{1k}+N_{2k}}$ as the proportion of hours in the firm by low-earning workers out of total number of hours. I skip the k indices, and express N_1/N_2 in terms of ϕ:

$$\frac{N_1}{N_2} = \frac{\phi}{1-\phi} \tag{1.45}$$

Deriving this expression in terms of ϕ

$$\frac{\partial (N_1/N_2)}{\partial \phi} = \frac{1}{1-\phi} \tag{1.46}$$

which is a positive expression, as $\partial s_1/\partial(N_1/N_2)$ showed before. Hence:

$$\frac{\partial s_1}{\partial \phi} = \frac{\partial s_1}{\partial (N_1/N_2)} \frac{\partial N_1/N_2}{\partial \phi} > 0 \tag{1.47}$$

The insight from this expression is that there is a positive relationship between the cost-share, which is the relevant variable when considering the heterogenous strength of scale and substitution effects, and the fraction of labor in low-earning jobs, closely related to the variable used in the empirical analysis.

Consumption and government budget

Aggregate income is:

$$\begin{aligned} Inc &= (b+tr)F(\alpha_0^*) \\ &+ \textstyle\int_{\alpha_0^*}^{\alpha_1^*} (\alpha \hat{w}_1^{\epsilon+1} + tr) f(\alpha) d\alpha + \int_{\alpha_1^*}^{\alpha_2^*} (\hat{K} + tr) f(\alpha) d\alpha \\ &+ \textstyle\int_{\alpha_2^*}^{\infty} (\alpha \hat{w}_2^{\epsilon+1} + tr) f(\alpha) d\alpha \end{aligned} \tag{1.48}$$

Total income in the economy is exhausted in the demand for goods: $Inc = p_H Y_H + Y_L$. I model the demand for each good using a CES aggregation at the economy-wide level.

$$Y_H = \tfrac{1}{p_H} \tfrac{Inc}{1+p_H^{\kappa-1}} \qquad Y_L = \tfrac{Inc}{1+p_H^{\kappa-1}} \tag{1.49}$$

Balance of the government budget implies $T = G$, where:

$$\begin{aligned} T &= \textstyle\int_{\alpha_0^*}^{\alpha_1^*} \alpha w_1^{\epsilon+1} (1-\tau_1)^{\epsilon} \tau_1 f(\alpha) d\alpha + \int_{\alpha_1^*}^{\alpha_2^*} K \tau_1 f(\alpha) d\alpha \\ &+ \textstyle\int_{\alpha_2^*}^{\infty} \alpha w_2^{\epsilon+1} (1-\tau_2)^{\epsilon} \tau_2 f(\alpha) d\alpha \end{aligned} \tag{1.50}$$

and:

$$G = tr + bF(\alpha_0^*) \tag{1.51}$$

Parameterizations and solution

To solve the model, I start in partial equilibrium (w_1 and w_2 fixed), and I obtain N_1^S and N_2^S, Inc, Y_H, Y_L, N_{1H}, N_{1L}, N_{2H}, and N_{2L}. Using the zero-profit condition of the firm H, I further obtain p_H. Finally, I iterate on w_1 and w_2 until the excess supply for both types of job is zero.

The parameters for the labor demand are selected as follows. I estimate an industry-level

regression using the first order conditions of the firms (in logs):

$$ln\left(\frac{N_{1it}}{N_{2it}}\right) = \lambda_i - \sigma ln\left(\frac{w_{1it}}{w_{2it}}\right) + \pi t + \xi_{it} \tag{1.52}$$

where i is the industry (224 categories). I use data from LIAB, cross-section, for the period 1999-2000. I measure N_{1it} and N_{2it} as the annual average by industry of the total full-time equivalent employment in the low-earning and high-earning segment respectively (as before, I use the post-reform mini-job threshold for this definition). I measure w_{1it} and w_{2it} in a similar way, corresponding to the industry-level average of the full-time equivalent daily wage of workers in each group. I further include a linear trend. Expression (1.52) allows to retrieve an estimation of the parameter σ. In order to address the endogeneity due to the omission of important variables in the production function (such as capital for example, not directly available in the data), I instrument $ln\left(\frac{w_{1kt}}{w_{2kt}}\right)$ with a *Post* indicator, that takes the value 1 for the years after the reform. The estimation suggests $\sigma = 2.462$, higher than for a Cobb-Douglas specification and low enough such that low-earning and high-earning workers are not perfect substitutes.

I retrieve the parameters θ_k using the fixed effects in the regression, and their correspondence with the model specification: $\hat{\lambda}_i = \hat{\sigma} ln\left(\frac{\theta_i}{1-\theta_i}\right)$. I take the average for the industries which were above the median in the proportion of low-earning workers in 2002 to obtain θ_H, and the similarly but for below median industries to obtain θ_L. I further estimate the CES specification of the production function using the parameters retrieved, the sales in real terms as measures for Y_{it}, and the employment measures (all normalized for the year 2002), from which I obtain the relation of magnitudes between A_H and A_L using averages across industries similar as before. This exercise suggests that A_L is 5% higher than A_H. The values obtained in this way imply that $\theta_H > \theta_L$ and $A_H < A_L$, which is sensible since H firms are intensive in low-earning workers and they are likely to have lower total factor productivity.

For the labor supply side of the model, I assume $F(\alpha)$ follows a Weibull distribution, characterized by parameters μ and γ. The parameter ϵ is set to the average of estimates by Tazhitdinova (2017). The rest of the parameters (β, μ, γ, b, κ) are selected such that the model provides reasonable approximations to the employment rate, the proportion of mini-jobbers with respect to the total number of workers, the proportion of workers in the bunching at €400, and the average across highly intensive and low intensity (as of 2002) establishments. Parameters values are shown in table (1.A26) and the comparison of the moments of the model, in table (1.A27).

Chapter 2

The German Mini-Job reform: Intended and unintended consequences for low-earning workers

2.1 Introduction

Welfare-to-work programs have become particularly widespread in developed countries in the last decades. They are intended to help economically poor people while encouraging labor participation and self-sufficiency by providing benefits conditional on employment. One such a program is the Mini-Job Reform which took place in Germany in April 1, 2003. The explicit objectives discussed in the legislation are to (1) reduce unemployment, (2) increase competitivity, and (3) stimulate both labor supply and demand. Exemptions and subsidies of social security contributions (SSC) and income tax paid by workers were expanded in the low-earning segment of the labor market, yielding a considerable expansion of the so-called *mini* and *midi* jobs. These types of employment are defined by a maximum amount of gross monthly earnings (€400 in the mini-jobs and €800 in the midi-jobs), and they are characterized by a lower tax burden.

The existing literature about the reform has focused on its effect on labor supply and employment, as affecting these variables is one of the main objectives of the policy. On the contrary, potential issues such as higher in-work poverty and increase in labor precariousness have been extensively debated in the media and the public discourse, but have received less attention in the academic research.[1] This paper aims at providing empirical evidence

[1]The article "The dark side of Germany's job miracle" (Reuters, 2012) is particularly insightful: *"Economists say it was Schroeder's intention to bring about a rapid expansion of these sectors (mini-jobs*

regarding these side-effects of the expansion of mini and midi-jobs.

The first question this paper addresses is whether the promotion of low-earnning jobs by tax incentives results in improved earnings for workers in the bottom of the distribution, being effective then as an anti-poverty policy. Mechanically, since these workers pay lower taxes after the reform, their take-home wage should improve. However, as predicted by the theory of tax incidence, the lower tax burden is shared by employers and employees depending on the relative elasticities of supply and substitution between workers in low-earning and high-earning employment. Thus, the theoretical prediction regarding the effect on net earnings is ambiguous, and remains an empirical question.

A second question tackled by this paper is whether tax incentives for mini and midi-jobs improve employment prospects of targeted workers. This should be the case if they represent a way for inactive and unemployed workers to accumulate human capital or signal their skills and motivation. If after a spell in these jobs workers have higher chances to transit to employment with higher earnings, mini or midi-jobs constitute a *stepping-stone*. On the contrary, working for reduced hours or low hourly wages may exert a negative signal regarding productivity or motivation. Hence mini or midi-jobs might potentially represent a *dead-end*. Which of these two forces prevail remains an empirical question as well.

The main contribution of this paper is to provide empirical evidence in response to these questions. I use survey data from the German Socio-Economic Panel (SOEP) for 2000-2007 and I estimate fixed effects models to assess the effect of taking up a mini or midi-job on earnings, wages and transition probabilities. I exploit the change in incentives for labor supply and demand induced by the Mini-Job Reform, and compare across groups in a differences-in-differences (DiD) setting to address selection into tax-advantaged jobs.

First, I compare groups typically targeted by similar welfare-to-work policies (e.g. the Earned Income Tax Credit in the US) to non-targeted groups. The findings suggest that after the reform earnings, employment and job stability improves for young people and, to a lesser extent, for women. On the other hand, earnings of single parents do not improve, as an increase in hours worked is offset by a decrease in hourly wages. For low-educated individuals, earnings even decrease after the reform.

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and temporary employment) in order to get the poorly-qualified and long-term unemployed back into the workforce. Critics say Germany's reforms came at a high price as they firmly entrenched the low-wage sector and depressed wages, leading to a two-tier labor market. New categories of low-income, government-subsidized jobs - [...] were created to help those with bad job prospects eventually become reintegrated into the regular labor market, but surveys show that for most people, they lead nowhere. [...] "Regular full-time jobs are being split up into mini-jobs," said Holger Bonin of the Mannheim-based ZEW think tank. And there is little to stop employers paying "mini-jobbers" low hourly wages given they know the government will top them up and there is no legal minimum wage".

I use a second approach comparing workers in tax-advantaged jobs to those in non-tax advantaged jobs with similar observable characteristics. Similar workers are defined by using matching on pre-treatment characteristics. The results suggest that mini and midi-jobbers experience a reduction in net earnings mainly due to a decrease in hours worked. The net hourly wage does not significantly change despite these workers having a lower tax burden. This is consistent with firms benefiting from lower taxes more than workers, and raises doubts about the effectiveness of such an institutional design as an antipoverty instrument. On the other hand, estimates for people out of employment before the reform suggest that low-earning jobs can lead to better future employment possibilities when they are held temporarily.

Related literature

Welfare-to-work policies have attracted a lot of attention in the literature since the introduction of the Earned Income Tax Credit (EITC) in the US in mid 1970's. A big bulk of studies has focused on the effects on participation and employment, exploiting changes in the generosity across time and states and variation in benefits by demographic characteristics. The findings suggest a positive effect on labor participation (mitigated at the family level) and a negative and rather small effect on hours worked, consistent with a theoretical framework of labor supply decision (see e.g. Eissa and Liebman, 1996; Meyer and Rosenbaum, 2001; Eissa and Hoynes, 2004). The Working Families Tax Credit (WFTC) in UK has a design similar to the EITC, and the research has shown comparable results (see e.g. Blundell, 2006; Blundell et al., 2000b). The German mini-job design differs from these tax credits in two main ways: (1) the earnings test for eligibility are at the individual and not the family level, and (2) generosity does not vary with demographic characteristics. These features challenge the analysis of the causal effects of the German Mini-Job Reform.

The effects of welfare-to-work policies have been tested through a few random experiments. One example is the Self Sufficiency Program (SSP) in Canada. Conducted between 1992 and 1995, the experiment consisted in offering a temporary earnings' supplement to a random sample of welfare recipients, conditional on the beneficiaries holding a full-time job. Michalopoulos et al. (2005), Robins et al. (2008), Michalopoulos et al. (2002) find large effects of the policy in employment and earnings, lower welfare receipt, higher family income and lower poverty during the implementation time. The effects vanish shortly after the exhaustion of the benefit. The German mini-job design differs from the SSP as there is no restrictions in hours worked or full-time requirement. As a matter of fact, the vast majority of mini-jobs is part-time employment. Furthermore, the tax benefits in Germany are permanent, favoring a persistence in the effects.[2]

[2]The lack of long-lasting effects and, in general, the timing of the effects in the SSP were explained in a

Recently, few studies have addressed the effect of tax credits on wages, more related to the question in this paper. Leigh (2010) exploits variation in the EITC state supplements, finding that the generosity of the tax credit is positively associated with lower hourly wages of unskilled workers. Similarly, exploiting the expansion of the federal EITC in the middle of the 90s, Rothstein (2010) finds that the wage of single mothers, entitled to higher benefits, has a slower growth rate compared to single women without children. The proposed mechanism behind findings in both studies is an outwards movement in labor supply that shifts the benefit from workers to employers. A similar result but different explanation is provided by Azmat (2014) for the WFTC in UK. The WFTC, differently from the EITC and its predecessor Families Tax Credit, is liquidated in the wage package, giving more information to the employer regarding eligibility and amount received. This salience of the tax benefit for the employer amplifies the shifting of the tax benefit from workers to employers. This paper contributes to this literature by showing that a big part of the German tax benefits for low-earning workers are shifted to the employers, which is consistent with the findings for other in-work benefits and with the fact that the mini-job design has a high salience for employers. Furthermore, I provide evidence of effects on transition probabilities after holding a tax advantaged job, a question for which there is very scarce evidence in the context of in-work benefits.

The German mini-job reform, which does not provide benefits in function of the family structure and applies homogenously nationwide, is particularly challenging for impact evaluation due to the lack of a natural counterfactual. The literature on the effects of the reform on labor market outcomes (see e.g. Akyol et al., 2013; Jacobi and Kluve, 2007; Eichhorst and Zimmermann, 2007) has pointed out this limitation. The reduced form branch relies on difference-in-difference (DID) techniques and propensity score matching to address this problem.

Fertig and Kluve (2006) analyze the impact of the reform on the labor structure by estimating a fixed effects model with administrative data provided by the IAB (the German Employment Agency). They find that the share of atypical employment increases as a consequence of the reform. Caliendo and Wrohlich (2010), using the SOEP, exploit the variation in the months of the interview to analyze the impact of the reform in the probability of having a marginal or secondary job. They define as treatment group people interviewed between April and October 2003, and control between January and March. With the cross section in the same dates for 2002, they perform a DID to control for seasonal variation. They find that the reform increases the propensity of single men who hold secondary jobs, while they do not find an effect on the share of marginal employment.

searching-matching model context by Card and Hyslop (2005).

Another strand of studies uses structural estimations of labor supply and ex-ante micro-simulations of the reform to infer potential effects on participation and employment composition (Bargain et al., 2010; Steiner and Wrohlich, 2005). The simulations predict a moderate positive effect on labor participation, coming mostly from an inflow of secondary workers, and a negative effect on hours, a standard result of the neoclassical labor supply model. Encouraging results regarding the effects on the speed of the matching process are reported by Fahr and Sunde (2009), who structurally estimate the matching function using administrative data on job seekers and vacancies by occupation for 2000-2006. Overall, the literature on the Mini-Job Reform has focused on the changes induced in labor market participation and employment. This paper instead focuses on the consequences on earnings and employment prospects of targeted workers, outcomes for which there is no evidence to the best of my knowledge. The strategy I apply is in line with the techniques used in the existing reduced-form literature.

Related to the question addressed by this paper, there is evidence about the potential of marginal employment in Germany to serve as stepping-stone. However, the analysis is limited to the pre-reform period and to workers already in the social security registers. Caliendo et al. (2012) use a sample of unemployed workers from the IAB data for 2001-2004 and analyze the effect of taking up a mini-job on the unemployment duration and the ex-post job matching quality. They exploit the existence of a disregard level of €165 a month for unemployment benefit claim. They find that holding a mini-job increases the outflow probability of the long-term unemployed and towards more stable jobs. They also document a high correlation between the sector and firm of mini-jobs and subsequent employment, suggesting human capital accumulation. Freier and Steiner (2008) focus on unemployed men, using quarterly administrative data from the Employment Panel of the Federal Employment Agency (EP-FEA) for 1999-2003. Using propensity score matching on recent employment history and duration of the unemployment spell, they find no effect on the probability of regular employment, but a reduction in the likelihood of re-entering unemployment and a slight improvement in earnings. In this paper I analyze instead the changes in the transition probabilities after the reform. Differently from these studies, I use survey data which, despite the smaller sample size, allows to include inactive people in the analysis, an important group given the activation purpose of the in-work benefits.

The question regarding the potential of welfare-to-work policies as stepping-stones or dead-ends is related to the relationship between in-work benefits and human capital accumulation (Blundell et al., 2013; Riddell and Riddell, 2012). The literature documents that higher labor participation induced by tax benefits may increase human capital through on-the-job training. However, since jobs taken are mostly part-time, human capital accumulation is not

as high as in full-time employment. There might also be a negative effect if the incentives to enter the labor market promote withdrawal from formal education.

The rest of the paper is organized as follows. In Section 2 I discuss the details of the institutional background and some relevant facts. Section 3 explains the theoretical background behind the empirical investigation. I describe the data in Section 4 and the the empirical strategy in Section 5. Section 6 presents the results using the strategy of comparison across targeted and non-targeted groups, and Section 7 the findings by applying the matching strategy. Robustness checks and discussion of the results are included in Section 8, and Section 9 concludes.

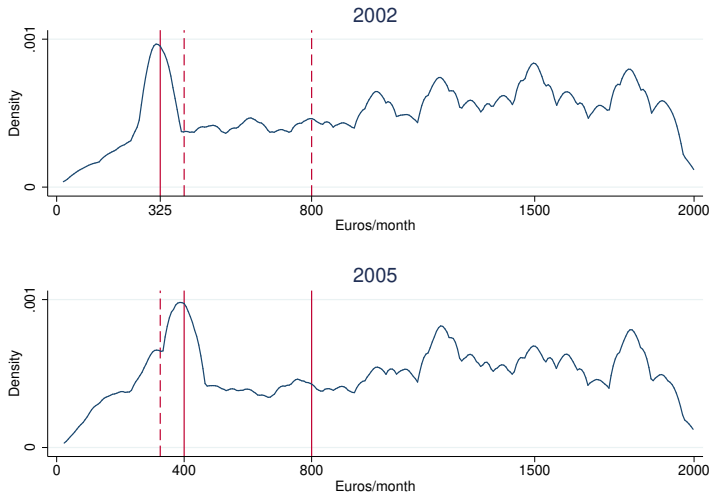
2.2 Institutional Background

The Mini-Job Reform and other details of the institutional context at that time was already discussed in the previous chapter, so I will skip the details here, and I will concentrate in the discussion of descriptive evidence related to this chapter. Using survey data from the G-SOEP (to be detailed later), the pre and post-reform aggregate labor market numbers provide a mixed picture regarding its potential effects, as shown in Table (2.A1) in the Appendix. While both participation and unemployment increased between 2002 and 2005, average hours per worker remained constant and monthly after-tax earnings increased. The number of mini- and midi-jobs in this survey date (different from the previous data, which is administrative) is consistent with the figures reported in Chapter 1 (see Figures (2.A1) and (2.A2) in the Appendix).[3] Earnings distribution look similar as well, as Figures (2.22) and (2.A3) show.

Table (2.21) shows the composition of the working age population in Germany in 2005, after the reform, as well as average hours and earnings of each employment type. Mini-jobs are comparable to regular part-time employment in average hours (14 and 13 a week respectively), though the dispersion is much higher (the standard deviation is 12 compared to 5.7 for regular part-time jobs). However, average hourly earnings of regular part-timers double mini-jobbers' (19 and 10 respectively). For midi-jobs, average hours worked, 26, are below the full-time workers', 41, while double those of part-timers. The dispersion is higher as well (13.9, 9.5 and 6.7 of standard deviation respectively). The hourly net earnings are comparable to full-time workers in terms of mean (8 and 9) while they are more disperse (the standard deviation is 16.4 and 4.2 respectively). Finally, 2% of the working age population

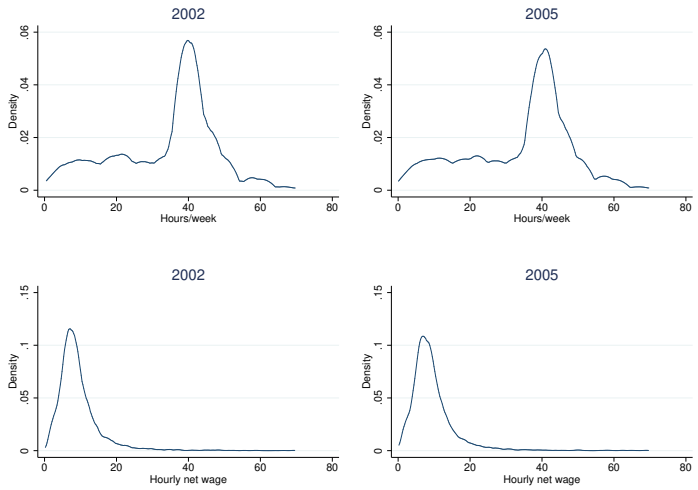
[3]These numbers are not exactly the same as in official statistics due to the survey nature of the data and that I use definitions of mini and midi-jobs. However, they capture the important facts such as the jump in the number of mini-jobs and the share of total private employment.

Figure 2.21: Distribution of gross monthly earnings in main job



Note: Earnings below the median.

Figure 2.22: Distribution of weekly working hours and hourly net earnings in all occupations



Note: Hours below the feasible amount of 70 a week. Hourly earnings excluding top 1 percentile.

holds a mini or midi-job as a secondary employment. This group resembles full-time workers, except for a higher hourly earnings for those whose second job is a midi-job.

Mini and midi-jobs in 2004-2007 absorb two thirds of the people who were inactive or unemployed before the reform (table (2.A2) in the Appendix), while only the remaining one third goes directly to regular employment. Tables (2.22) and (2.23) show the observed probability of transition between states for before the reform (2001/2002) and after (2004/2005) respectively. Outflow from mini-jobs to better-paid employment decreases (33% to 21%),

Table 2.21: Composition of working age population (17-65) in Germany, 2005.

	Prop. (%)	Hours/ week	Hr. wage	Month. gross earn.
Inactive	15.1			
Studying	3.4			
Unemployed	5.0			
Irregularly employed	2.4			
Part-time	6.7	13	19	1,640
		(5.68)	(21.20)	(1114.38)
Full-time	49.1	41	9	2,634
		(9.50)	(4.16)	(1564.93)
Mini-job (main)	10.4	14	10	267
		(12.00)	(25.59)	(161.51)
Mini-job (secondary)	1.9	40	9	2,456
		(13.97)	(6.59)	(1214.64)
Midi-job (main)	5.8	26	8	626
		(13.86)	(16.41)	(166.63)
Midi-job (secondary)	0.3	36	15	3,123
		(16.96)	(12.38)	(1101.77)
Total	100.0	34	10	2,021
		(15.21)	(11.94)	(1625.73)

Note: Hours worked, hourly net earnings and monthly gross earnings are reported only for those who have a positive declaration.

while the persistence in mini-jobs increases (48% to 63%). Mini-jobs display a considerable persistence (45%), being the outflows to better-paid employment 28%. On the other hand, the outflows from full-time employment to inactivity and unemployment decrease slightly (2.6% to 2%). The flow from regular part-timers to mini-jobs decreases (9.4% to 8.4%), not giving signs of precarization of part-time workers.

To sum up, mini and midi-jobs have particular characteristics in terms of hours and hourly earnings compared to regular employment both part-time and full-time. The flows into and out of them suggest that they are a cushion between unemployment and inactivity and regular employment.

Table 2.22: Transition table: Probability (%) of going from state in row to state in column. 2001/2002

2001/2002	Inactive not stud.	Studying	Unempl.	Irregular employm.	Working PT	Working FT	Mini-Job (main)	Total
Inactive not stud.	87.86	0.71	1.83	1.42	3.75	1.46	2.96	100
Studying	4.9	48.4	3.62	6.18	10.02	17.27	9.59	100
Unemployed	19.42	1.94	57.28	2.27	7.77	7.77	3.56	100
Irregular employm.	23.62	19.93	6.64	17.71	9.59	10.7	11.81	100
Working PT	8.75	1.28	4.91	2.85	38.51	34.31	9.4	100
Working FT	1.3	0.37	1.32	0.47	6.85	88.66	1.02	100
Mini-Job (main)	6.86	2.67	1.63	8.14	20.7	12.09	47.91	100
Total	18.16	2.66	4.37	1.91	10.46	56.87	5.57	100

Table 2.23: Transition table: Probability of going from state in row to state in column. 2004/2005

2004/2005	Inactive not stud.	Studying	Unempl.	Irregular employm.	Working PT	Working FT	Mini-Job (main)	Mini-Job (secondary)	Midi-Job (main)	Midi-Job (secondary)	Total
Inactive not stud.	86.08	0.91	2.94	2.58	1.47	0.96	3.95	0.15	0.91	0.05	100
Studying	4.04	54.83	2.46	5.1	3.69	3.87	18.1	0.35	7.56	0	100
Unemployed	21.77	1.09	55.99	2.49	4.67	3.42	7.47	0.47	2.64	0	100
Irregular employm.	23.28	17.24	8.62	18.53	3.45	3.45	17.67	0	7.76	0	100
Working PT	13.46	1.89	6.42	3.14	34.21	27.3	8.43	0.63	4.28	0.25	100
Working FT	0.9	0.07	1.08	0.18	4.74	89.54	0.61	1.41	1.23	0.24	100
Mini-Job (main)	5.17	2.04	2.59	6.5	4.78	4.08	63.48	1.25	10.03	0.08	100
Mini-Job (secondary)	1.01	0	0	0.67	3.7	40.07	4.38	43.77	1.35	5.05	100
Midi-Job (main)	2.09	2.21	3.84	2.56	9.3	18.14	15.47	0.81	45.12	0.47	100
Midi-Job (secondary)	2.08	0	0	0	2.08	39.58	2.08	22.92	0	31.25	100
Total	16.17	3.29	4.77	2.1	6.19	49.67	9.93	2.02	5.45	0.4	100

2.3 Theoretical Discussion

In this section, I discuss the theoretical mechanisms underlying the variation in earnings and employment prospects of workers after to the Mini-Job Reform. For simplicity, let's think in a static partial equilibrium model of the labor market, segmented in a low-earnings' sector, which in the case of interest comprises mini and midi-jobs, and a high-earnings' sector or regular employment.[4] The Mini-Job Reform implies a reduction on the tax (SSC and income tax) paid by workers in the low-earnings' sector and a consequent decrease in the tax wedge on equilibrium.[5] Without any movement in supply or demand (left panel), two effects are in place as shown in the left panel in figure (2.31): (i) the labor cost paid by firms W falls to W', and (ii) the take-home or net wage of workers w increases to w'. The variation depends on the sensitivity of demand and supply.

However, the modification in the tax wedge in the low-earnings' sector induces responses by agents. On the demand side, firms might create more low-paid jobs because now is less expensive, or substitute more costly regular employment with low-earnings' workers. This would imply a shift outwards in the demand for low-earnings' workers and, depending on the substitution with regular employment, a shift in the demand in this sector. The result is an upward pressure on wages and employment level in the low-earnings' sector.

On the other hand, supply of workers is also expected to respond. The left panel of figure (2.32) shows the labor supply decision by an individual with an homogeneous labor tax. The

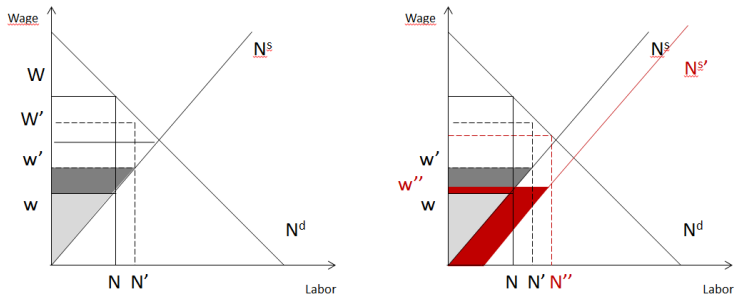
[4]The implicit assumption is that there are two well defined types of labor, each traded in a different sector of the labor market (for example, high skilled and unskilled). Even if in practice there is not a clear cut between low and high-earnings' capacity workers, the simplification is useful for understanding the basic effects.

[5]I mostly abstract from the fact that the tax rate on mini and midi-jobbers, and within the latter group, is heterogeneous, but I simply consider a sector with lower taxes than the other.

upper indifference curve determines the hours worked by an agent who decides to supply labor, while the lower one represents an agent who does not participate in the labor market. The tax reduction represents an increase in the take-home wage and a steeper budget line as shown in the right panel.[6] This change induces some people not participating in the labor market to work a positive amount of hours. However, some agents reduce hours worked to profit from the lower taxes paid by mini and midi-jobbers. Labor supply shifts outwards in the low-earnings' sector, and inwards in the sector of regular employment. This induces a downwards pressure of wages in the first sector, and upwards in the second, and the opposite with respect to the amount of labor.

The right panel in figure (2.31) shows the effect of the shift outwards in the labor supply, while ignoring the movements in demand.[7] In this case, there will be downwards pressures on the take-home wage of the workers in the low-earnings' sector even if they are paying lower taxes. The final direction and magnitude of the variations in labor cost, take-home wage and employment in the low-earnings' sector and regular employment depends on the sensitivity of supply and demand for labor, as well as on the relative magnitudes of the shifts in the curves.

Figure 2.31: Partial equilibrium in the labor market of the low-earnings' sector



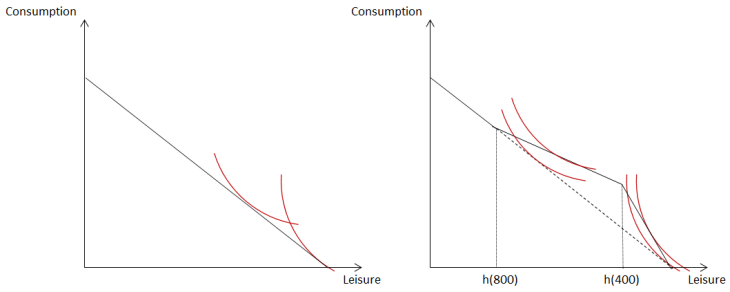
In the formal framework of the theory of tax incidence of Fullerton and Metcalf (2002), let's assume an economy with competitive markets and a single final good produced using labor from two sectors $j = \{1, 2\}$. The Mini-Job Reform implies a reduction in the tax wedge for the sector of low-paid workers, $j = 1$. Let τ_1 be the tax rate paid by employers and employees in mini and midi-jobs, while τ_2 applies for regular employment, such that $\tau_1 < \tau_2$.

The net or take-home wage received by workers is $w_j = W_j(1 - \tau_j)$, where W_j is the labor cost for the firm. The tax wedge τ_j, independent of the statutory incidence (who pays the tax), generates a difference between the net wage and the labor cost. It is possible

[6] I do not consider that the change in the tax rate for single and married people is different due to the joint income taxation of couples.

[7] This is analogous to the case of dominant effect on labor supply, reasonable in the case of in-work benefits, in which the main objective is to increase participation.

Figure 2.32: Labor supply decision



to define an implicit subsidy s derived from the difference between τ_1 and τ_2: $(1+s) \equiv (1-\tau_1)/(1-\tau_2)$. Using this definition, log-linearizing the equation for net wage in sector 1 and totally differentiating (note $d\tau_2/(1-\tau_2) = 0$ because there is no change in taxes in sector 2):

$$\hat{W}_1 = \hat{w}_1 - \hat{s} \tag{2.1}$$

where $\hat{W}_1 \equiv dW_1/W_1$, $\hat{w}_1 \equiv dw_1/w_1$, $\hat{s} \equiv ds/(1+s)$ represent percentage changes of the labor cost, net wage and implicit subsidy respectively. Similar derivations yield:

$$\hat{W}_2 = \hat{w}_2 \tag{2.2}$$

Assume a constant returns to scale production function $X = F(N_1, N_2)$, where X is the single consumption good produced using labor N_j from sectors $j = \{1, 2\}$. Totally differentiating X and expressing the percentage change of X in terms of percentage changes in the labor inputs:

$$\hat{X} = \frac{F_1 N_1}{X}\hat{N}_1 + \frac{F_2 N_2}{X}\hat{N}_2 \tag{2.3}$$

where $F_j \equiv \partial F(N_1, N_2)/\partial N_j$. Under perfect competition, the problem of the firm maximizing benefits yields $W_j = F_j$ for $j = \{1, 2\}$. Let $\theta \equiv (W_1 N_1)/X$ be the share of product corresponding to workers in sector 1, and $(1-\theta) \equiv (W_2 N_2)/X$ the analogous for sector 2:

$$\hat{X} = \theta\hat{N}_1 + (1-\theta)\hat{N}_2 \tag{2.4}$$

The elasticity of substitution is defined as:

$$\begin{aligned} \sigma &= \frac{d(N_1/N_2)/(N_1/N_2)}{d(W_2/W_1)/(W_2/W_1)} \\ &= \frac{\hat{N}_1 - \hat{N}_2}{\hat{W}_2 - \hat{W}_1} \end{aligned} \tag{2.5}$$

Hence:

$$\hat{N}_1 - \hat{N}_2 = \sigma(\hat{W}_2 - \hat{W}_1) \tag{2.6}$$

The labor supply is derived from the individual's static problem, in which we assume a quasi-linear utility over a numeraire consumption good c and hours of work N^s:[8]

$$\begin{aligned} &\max_{c,N^s} c - \alpha^{\frac{1}{\gamma}} \frac{N^{s(1+\frac{1}{\gamma})}}{1+\frac{1}{\gamma}} \\ &s.t. c = wN^s \end{aligned} \tag{2.7}$$

where α denotes the disutility from labor, and γ is the constant elasticity of labor supply. Note that the individual makes the labor supply decision depending on w, which varies according the sector where he supplies labor. For simplicity, I assume each agent supplies labor in a different sector. The first order conditions with respect to labor yield: $N^s = \frac{1}{\alpha} w^{\gamma}$. Log-linearizing and using $\hat{\alpha} = 0$ (it is a parameter) yields:

$$\hat{N}^s = \gamma \hat{w} \tag{2.8}$$

where $\gamma = \hat{N}^s / \hat{w}$ is the labor supply elasticity with respect to net wage, typically assumed not negative. Deriving the labor supply for sector 1 and 2 in terms of the constant elasticity and the respective net wages yields:

$$\begin{aligned} \hat{N}_1 &= \gamma \hat{w}_1 = \gamma(\hat{W}_1 + \hat{s}) \\ \hat{N}_2 &= \gamma \hat{w}_2 = \gamma(\hat{W}_2) \end{aligned} \tag{2.9}$$

Plugging equation (2.9) in (2.5) and deriving the difference in the growth rates of the net wage with respect to the implicit subsidy:

$$\frac{\hat{w}_1 - \hat{w}_2}{\hat{s}} = \frac{\sigma}{\gamma + \sigma} \tag{2.10}$$

Assuming γ is positive, the right hand side of the expression can be either negative or positive depending on the sign and the size of σ relatively to γ. For the case in which labor from both sectors are substitutes in production ($\sigma > 0$), the net wage in sector 1 is expected to grow by more when the subsidy increases, and the magnitude of the variation is increasing in σ and decreasing in γ. If $\sigma < 0$, then the direction of the change is ambiguous. Similarly, the relative growth rate of the amount of labor in both sectors when the subsidy increases

[8] This formulation of the problem is fairly standard in the public finance literature.

is:

$$\frac{\hat{N}_1 - \hat{N}_2}{\hat{s}} = \frac{\sigma + \gamma}{\sigma\gamma} \tag{2.11}$$

The amount of labor in the sector which receives the subsidy is also expected to increase by more when $\sigma > 0$, and is ambiguous if $\sigma < 0$. Using this expression, it is possible to derive the relative growth in the gross wages:

$$\frac{\hat{W}_1 - \hat{W}_2}{\hat{s}} = -\frac{\gamma}{\gamma + \sigma} \tag{2.12}$$

where the right hand side is negative for $\sigma > 0$. Differently from net earnings, the cost paid by firms is expected to fall in the subsidized sector relative to the other when the subsidy increases, reflecting the employer appropriates part of the tax benefit. If $\sigma < 0$ the change is ambiguous.

Within this simplified static framework, it is clear that the effect of reducing the tax rate in the low-earnings' sector on labor cost, wages and employment depends on the sign and the size of the elasticity of substitution and of labor supply. Who is appropriating the tax reduction, the worker or the firm, is an empirical question. Independently of the mechanism, if the tax reduction implies an increase in the workers' take-home wage, the policy is effective as an antipoverty instrument. If, on the contrary, the implicit subsidy allows the firm to reduce the labor cost without improving workers' net earnings, then it is not possible to conclude that workers are better off.

Now I shift attention to the inactive and unemployed workers. As shown in figure (2.32), they face higher incentives to participate in the labor market due to a higher take-home wage implied by the lower tax burden. Let's think in three periods in a very simplified scheme, $t = \{0, 1, 2\}$. In $t = 0$, all workers are unemployed or inactive. Let's assume all workers start with the same reservation wage and they hence accept the first offer they get.[9] Abstracting from labor demand determination, let's assume that the offers include mini or midi-jobs and regular employment. While from the former it is feasible to transit to regular employment, the latter is an absorbing state. Regular employment is more costly for firms (higher tax wedge), hence the probability of receiving such an offer is lower than a mini or midi-job.

In $t = 1$, a randomly selected group obtains an offer for a mini or midi-job, with probability $\alpha_{MJ} = 1$. The remaining workers face a lower probability $\alpha_E < 1$ of receiving an offer of regular employment and $(1 - \alpha_E)$ of not receiving any offer. If they remain unemployed or inactive, in $t = 2$ they face the same lottery. Hence, the probability of obtaining a regular

[9] This is a simplification useful for the analysis. If all unemployed and inactive workers are homogenous ex-ante, the reservation wage is the same and offers below it would not be taken. Hence, all offers are above the reservation wage and are taken by the worker.

employment for this group which do not get a mini or midi-job offer in $t = 1$ is:

$$\alpha_E^{NM} = \alpha_E + (1 - \alpha_E)\alpha_E = \alpha_E(2 - \alpha_E) \tag{2.13}$$

The workers that enter mini or midi-jobs might develop higher labor market attachment through better access to information, working habits or possibilities of promotion, than the unemployed or inactive. On the other hand, they bear costs such as less time for searching for a regular employment, or stigma or bad signal about their productivity or motivation (Moffitt, 1983), which may reduce their possibility to transit into regular employment. These factors determine the probability of transiting to regular employment in $t = 2$, denoted α_E^M. The relevant comparison is then between this probability and expression (2.13). If $\alpha_E^M \geq \alpha_E^{NM}$, then mini or midi-jobs are "stepping-stones", and they are "dead-ends" otherwise. Again, the relative size of these probabilities remains an empirical question.

The implicit assumption in this analysis is that agents prefer regular employment to mini and midi-jobs. As discussed earlier, mini and midi-jobs are not exclusively defined by the amount of hours worked, in this sense a regular employment can entail the same amount of effort with a better hourly wage. Overall, regular jobs by definition imply higher earnings, and the implicit assumption is that workers prefer to earn more. If holding a mini or midi-job improves the future possibilities of transition to regular employment for workers, then there is some evidence that a policy promoting these type of jobs might help workers to improve their employment prospects. In the next sections, I provide some evidence regarding these empirical questions.

2.4 Data and Descriptives

The data used in this paper is the German Socio-Economic Panel (SOEP), a yearly survey covering a wide set of socio-economic and demographic characteristics at the individual and household level, on a representative sample of German population. It has a panel structure and responds to a stratified sampling. I use the balanced panel for 2000-2007.[10]

Table (2.41) shows the main characteristics of mini and midi-jobbers compared to the rest of workers and jobless population according to their labor situation in 2004-2007.[11] Some demographic groups are over-represented among mini and midi-jobbers compared to both

[10]The weights provided by the survey are used throughout the analysis, which adjust for the different probabilities of selection and for the probability of attrition.

[11]Here and in the rest of the analysis self-employed and civil servants are excluded, because their behavior is significantly different compared to wage-workers in private-sector.

workers in regular employment and jobless population: women, single (without a partner), workers who are not head of households, low educated. They are also concentrated in poorer households and with more children. Mini and midi-jobbers have a larger share of previously welfare-state dependent workers, i.e. receiving unemployment insurance or assistance or other public transfers, compared to workers in regular employment, though lower if compared to the group with no employment. Workers starting their first job are more concentrated in mini and midi-jobs.

Considering the recent labor history (2000-2002), mini and midi-jobbers have a longer experience in part-time employment, and shorter in full-time jobs than jobless and rest of working population. They have been unemployed for more time than other workers, though shorter than jobless population. Working hours and gross monthly earnings are in between those of jobless population and rest of the workers, while the hourly net wage is the lowest and the rate of job change the highest among mini and midi-jobbers. The gap between mini and midi-jobbers and regular workers in labor market outcomes increases after the reform.

Given their particular characteristics, mini and midi-jobbers are not a random sample of the population. The probability of taking a mini-job depends on pre-treatment characteristics (see table (2.B1) in the Appendix). The resulting selection bias needs to be addressed to approximate the causal effect of taking up a mini or midi-job.

Exploiting the panel structure of the data, I estimate fixed effects models which allow controlling for unobservable factors constant in time potentially generating differences in levels of outcomes among individuals. In the following section, the identification of an effect by comparing trends in the outcomes of a treatment and comparison group is explained. Regarding the construction of these groups, I explore two different alternatives: (i) using groups which the literature on welfare-to-work policies mention as targets and that are empirically more prone to take up mini and midi-jobs (women, young, single mothers, secondary workers and low educated); (ii) constructing comparable groups by matching in pre-reform characteristics. Both approaches provide different possibilities in terms of the outcomes to be analyzed and the type of treatment effect to be estimated, as will be explained later.

2.5 Fixed effects models and the estimation of the treatment effects

Following the notation in Angrist and Pischke (2009), let D_{it} be a dummy variable representing the treatment for individual i in time t. Y_{it} is the observed outcome, and the potential outcomes are Y_{it}^1 in case of treatment and Y_{it}^0 otherwise.

Suppose:

$$E(Y_{it}^0|U_i, X_{it}, t, D_{it} = 1) = E(Y_{it}^0|U_i, X_{it}, t, D_{it} = 0) \tag{2.14}$$

being X_{it} a vector of observed time-varying characteristics, U_i the unobservable but fixed confounders, and t the chronological time. Equation (2.14) means that the potential outcome in case of no treatment is independent on the treatment status, after controlling for U_i, X_{it} and t. Since the potential outcome in case of no treatment is not observed for treated units after the reform, the only possibility is to test for it in the period before, when all units were not treated (see next subsection).

Assuming further a linear specification for the conditional expectation of the outcome:

$$E(Y_{it}|U_i, X_{it}, t, D_{it} = 0) = \alpha + \lambda_t + U_i'\gamma + X_{it}'\beta \tag{2.15a}$$

$$E(Y_{it}|U_i, X_{it}, t, D_{it} = 1) = E(Y_{it}|U_i, X_{it}, t, D_{it} = 0) + \delta \tag{2.15b}$$

Combining these expressions, yield:

$$\begin{aligned} E(Y_{it}|U_i, X_{it}, t, D_{it}) &= D_{it}E(Y_{it}|U_i, X_{it}, t, D_{it} = 1) + (1 - D_{it})E(Y_{0it}|U_i, X_{it}, t, D_{it} = 0) \\ &= \alpha + \lambda_t + \delta D_{it} + U_i'\gamma + X_{it}'\beta \end{aligned} \tag{2.16}$$

The model to be estimated is hence:

$$Y_{it} = \alpha_i + \lambda_t + \delta D_{it} + X_{it}'\beta + u_{it} \tag{2.17}$$

where $\alpha_i \equiv \alpha + U_i'\gamma$ is the individual fixed effect which captures the time-invariant unobservable confounders, and λ_t is year fixed effects.

Upon verification of the identifying assumption, the resulting estimate for δ from model (2.17) captures the Average Treatment on the Treated (ATT) on the relevant outcome:

$$\begin{aligned} \delta &= E(Y_{it}|U_i, X_{it}, t, D_{it} = 1) - E(Y_{it}|U_i, X_{it}, t, D_{it} = 0) \\ &= E(Y_{it}^1|U_i, X_{it}, t, D_{it} = 1) - E(Y_{it}^0|U_i, X_{it}, t, D_{it} = 0) \\ &= E(Y_{it}^1|U_i, X_{it}, t, D_{it} = 1) - E(Y_{it}^0|U_i, X_{it}, t, D_{it} = 1) \\ &= E(Y_{it}^1 - Y_{it}^0|U_i, X_{it}, t, D_{it} = 1) = ATT \end{aligned} \tag{2.18}$$

where the second line just translates the first in terms of potential outcomes, and the third uses assumption (2.14).[12]

[12] If $E(Y_{it}^1|U_i, X_{it}, t, D_{it}) = E(Y_{it}^1|U_i, X_{it}, t)$ was also assumed, then the Average Treatment Effect (ATE)

2.5.1 Validity of the identifying assumption

The identification of the ATT relies in two assumptions: (i) equation (2.14) and (ii) linearity and additivity of the model. While (ii) responds to the usual parametric specification for the estimation, which is not excessively restrictive, it is possible to exploit the panel structure of the data and the availability of information for a period before the reform to verify (i).

Given two periods, t and t' such that $t < t'$, rewriting the expression (2.18) for t', when both $D_{it'} = 1$ and $D_{it'} = 0$ are observed, yields:

$$\begin{aligned} ATT &= E(Y^1_{it'} - Y^0_{it'} | U_i, X_{it'}, t', D_{it'} = 1) \\ &= E(Y^1_{it'} - Y^0_{it'} + Y^0_{it} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 1) \\ &= \underbrace{E(Y^1_{it'} - Y^0_{it} | U_i, X_{it'}, t, D_{it'} = 1)}_{\text{Before and After (B/A)}} - \underbrace{E(Y^0_{it'} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 1)}_{\text{Trend of } Y^0 \text{ for } D=1} \end{aligned} \tag{2.19}$$

where in the second line Y^0_{it} is added and subtracted, rearranging in the third line. The ATT is the detrended before-and-after estimator for the treated observations. While Y^0_{it} is observable for individuals both in the treatment and comparison groups before the reform, after the reform the only potential outcomes observed are Y^1_{it} for treated individuals and Y^0_{it} for the rest.

However, using assumption (2.14) for both t and t':

$$E(Y^0_{it'} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 1) = E(Y^0_{it'} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 0) \tag{2.20}$$

Plugging in the second term of (2.19):

$$\begin{aligned} ATT &= E(Y^1_{it'} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 1) - E(Y^0_{it'} - Y^0_{it} | U_i, X_{it'}, t', D_{it'} = 0) \\ &= E(Y_{it'} - Y_{it} | U_i, X_{it'}, t', D_{it'} = 1) - E(Y_{it'} - Y_{it} | U_i, X_{it'}, t', D_{it'} = 0) \end{aligned} \tag{2.21}$$

In the last line I used that all the potential outcomes in the first line coincide with the observed outcomes after the substitution. The expression in (2.20) is usually referred as "parallel trends" assumption, necessary for δ to provide an unbiased estimation of the ATT. It is possible to verify this assumption only for the pre-reform periods. Assuming it holds after, the differences in the trends can be attributed to the presence of the treatment.

Let's define the variable D_i individual specific and independent of time, which takes the

would be recovered. However, this is more difficult to argue because there is not possibility of testing as it is the case for assumption (2.14) in the period before the reform.

value 1 if the individual is in the treatment group and 0 if she belongs to the comparison group. Using the period 2000-2002, I run the following regression:

$$Y_{it} = \alpha_i^0 + \lambda_t^0 + \sum_{t=00}^{02} \phi_t^0 Year_t * D_i + X'_{it}\beta^0 + \varepsilon_{it} \tag{2.22}$$

which is similar to equation (2.17) in that it also contains the individual and year fixed effects and time varying characteristics. The key is the set of year dummies $Year_t$ interacted with the D_i. Parallel trends are assumed whenever the hypothesis that $\phi_{00}^0 = \phi_{01}^0 = \phi_{02}^0 = 0$ is not rejected.

2.6 Target groups

The selection bias in the estimation of δ by using (2.17) might persist after controlling for observable and time-invariant unobservable factors, being D_{it} and u_{it} correlated. One way to approach this problem is to define a variable Z_{it} which is exogenous with respect to the treatment (pre-determined) and captures the "assignment to treatment". It takes the value 1 after the reform for a group which has a higher propensity to take up mini or midi-job and 0 otherwise. Treatment and assignment are related as follows:

$$D_{it} = \pi + \eta Z_{it} + v_{it} \tag{2.23}$$

To define Z_{it}, let's consider those groups typically targeted by in-work benefits: women, young (35 years old or younger), single parents, secondary workers (not head of household or spouse) and individuals with low education (high school or less). Even if the legislation on mini and midi-jobs does not include variations for these groups, they have effectively a higher representation, as seen in the last column of table (2.61). The biggest difference in the proportion of mini and midi-jobs is observed among women compared to men and single with children compared to the rest (in couples or single without children).

The equation to be estimated is (2.17), where D_{it} is replaced by Z_{it}. The year 2003 is excluded because the reform was implemented in April. The sample is restricted to prime age population (between 25 to 54) to avoid including the extremes labor market behaviors. As is standard in the literature of treatment effects, δ recovers the "Intention to Treat" (ITT) effect, which is typically lower in absolute magnitude than the ATT. The estimates are interpreted as the effect of the policy on the groups it intends to affect.

The outcome variables are: (1) participation, (2) employment, (3) part-time employment,

(4) regular employment, (5) regular part-time employment, (6) monthly gross earnings, (7) monthly net earnings, (8) weekly working hours, (9) hourly net wage, (10) change of job. Table (2.62) presents the mean and standard deviation of the outcomes before (2002) and after (2005) the reform, and by groups in 2002. The most salient change after the reform is the drop in 9 pp. in the share of regular employment, which includes the mechanical redefinition of jobs between €325 and €800 (regular before the reform and marginal after). It is interesting that despite the share of part-time workers remains constant, the proportion of regular part-time increases from 5.5% to 7.5%, which goes against the suspicion that mini and midi-jobs replace part-time employment. Monthly gross earnings and hourly net wage increase on average, while the working hours remain relatively constant. Finally, the proportion of workers who change job decreases slightly between 2002 and 2005.

In the regressions, outcomes (1) to (5) and (10) are binary variables, and (7)-(9) are in natural logarithm. The first five outcomes are analyzed on the prime age population, and the rest on the population working in all the periods between 2000 and 2007. Control variables X_{it} include time varying relevant characteristics: whether the worker lives in Eastern or Western Germany, if she is single, the number of children, if she is head of household, if she lives in a dual-earner household, and the education level. U_{it} represents unobservables such as motivation, attitudes towards work, reservation wage, etc..

Table (2.63) shows the estimates for δ. In columns, the outcomes are presented, while the rows show the different choices for Z_{it}. The first row presents a before and after replacing the year fixed effects with a linear trend, and the results are consistent with those discussed for table (2.62). In the case of binary outcome variables, a linear probability model is used.[13] Standard errors are clustered at the individual level to account for autocorrelation.

After the reform, female labor participation increases by 4 pp. and employment, 5 pp. relative to men, which represents one third of the preexistent gap. However, the proportion of women in regular jobs decreases by 4 pp. widening the gender gap. There is not significant change in the proportion of part-time employment, which is higher for women (one third of female workers compared to 5% of male), nor in the regular employment among part-timers, higher for women as well (36% of female part-timers and 17.5% of male part-timers). Women do not experience changes in their earnings or working hours, leaving the gap unchanged. A possible underlying mechanism is an increase in labor supply of women. It is interesting that the rate of job change, in which there was no gender difference in 2002, falls 3 pp. relatively for women, potentially due to higher job stability.

Labor participation increases 3 pp. for young workers relatively to older after the reform,

[13]The estimation of $E(Y|X)$, the object of interest, is not sensibly affected by the specification while the linear probability model imposes the least distributional assumptions.

reducing the gap of 5 pp.. There are not significant changes in employment and regular employment, which are lower for youth, and in part-time and regular part-time shares, higher for youth. Monthly earnings increase for them, both in gross and net terms, by 8 pp. and 4 pp. respectively. The preexistent gap of €140 approximately is reduced in €50 on average. The higher earnings come from both a higher number of hours worked and a higher hourly wage: $\hat{\delta}$ for the respective outcomes is positive but imprecisely estimated. This results are consistent with a dominant increase in demand for younger workers, which improves earnings and increases labor participation. The rate of job change decreases by 6 pp. closing the pre-existent gap.

Single individuals with children before the reform display higher participation and lower employment rate, higher share of part-time employment and lower regular employment. In the regressions, the coefficients are not statistically significant suggesting no change. However, this might be partly due the relatively small size of the group (5% compared to approximately 25% to 80% for the other cases, except for secondary workers). The only statistically significant estimate suggests that this group faces a 10% reduction in the hourly wage and a 11% increase in the hours compared to people in other types of families, keeping earnings growing at the same pace as the rest of workers.

There are no differences in participation and employment between primary and secondary workers before the reform. Secondary workers hold less part-time employment, and earnings are lower mainly due to a lower net hourly wage. Even if most estimations are imprecise partly due to the small size of the group, the point estimates suggest that the reform induced higher participation and employment in this group and reduced the proportion of part-timers, against the expectations that mini-jobs are equivalent to part-time employment. In terms of earnings, the group looses relatively to the primary workers, both in gross and net terms. Given there is a relative increase in the number of hours, the main channel of the loss in earnings is a reduction in the hourly net wage compared to primary workers. The results indicate that the gaps between primary and secondary workers both in labor participation and earnings are bigger after the reform.

Participation outcomes do not change for low educated individuals after the reform, except for a mechanical fall in the share of regular employment compared to high educated people. Net and gross monthly earnings of people with low education decrease 5 pp. compared to highly educated workers, and this is mainly due to a fall in the hourly wage.

Overall, the expansion of tax exemptions and subsidies with the reform resulted in an increase in labor participation for female and young people, having the latter improved their earnings as well. For the rest of more affected groups, there is dominant depression in earnings. In line with the theoretical framework presented before, this result is consistent with an outwards

shift of labor supply and demand for women and young workers, groups which consequently achieve higher participation. In the remaining groups, the change in participation is not as pronounced, while there is a depression in earnings particularly for workers with low education level, suggesting appropriation of the tax benefit by firms.

To qualify the validity of the estimations, I test the parallel trends assumption. Table (2.65) shows the statistics corresponding to the test. It is not possible to reject that trends are parallel, except for net monthly earnings for groups by education level, and working hours for groups formed by gender, age and family type. For visual inspection, the graphs of residuals of the regression of the outcomes on the controls and years fixed effects are in figures (2.C1) to (2.C5) in the Appendix.

2.7 Matching strategy

A second approach to address the selection bias is to construct a comparison group to mini and midi-jobbers by using a matching strategy on pre-reform characteristics (Ichino et al., 2014). Matching relies on balance in observables and has the advantage of providing a more homogeneous group for comparisons. To answer the question addressed by this paper, I focus on two groups of outcomes: (1) total and hourly net earnings and working hours of employed population, (2) probability of transiting to regular employment after taking up a mini or midi-job by the jobless population before the reform.

The matching variables are gender, age, immigration condition, number of children in the household, per capita after-tax-and-transfer household income, education level (less, equal or more than high-school), indicator of new entrants in employment who were students in the period before, work experience and monthly gross earnings. Variables refer to the period before the reform.[14] The treatment is considered as taking up either a mini or midi-job after the reform.

I apply coarsened exact matching using the method by Blackwell et al. (2009), which consists on generating cells with combinations of the matching variables, binning the continuous ones. Then the observations are sorted into the strata and those with missing either treatment or comparison observations are discarded. Observations kept are those in the common support, as it is usually referred in the terminology of the matching literature. Matching weights are computed to balance for the heterogeneous composition of the strata within the common support.

[14] Time varying demographics refer to 2002. The indicator for new entrants in employment is measured as being in this condition in any period between 2000 and 2002. Work experience is the maximum declared in this period, and monthly earnings is the average during these years.

In the balanced panel 2000-2007 with working age population (17-65)[15], there are 8,917 individuals, of which 4,518 are working during the whole observation window ("working population") and 1,422 are inactive or unemployed in 2002 ("jobless population"). These are the groups of interest in the present analysis. There are 1,194 and 523 mini and midi-jobs in each of them respectively, which constitute the treatment group. The potential comparison groups are formed by the remaining individuals in each sub-sample. After matching, the resulting sub-samples contain 407 treated and 654 matched controls in the working population (1,061 in total), and 110 treated and 109 controls in the jobless population. For more details on the sample, see table (2.D1) in the Appendix).

The gain of using the matching strategy is to balance the pre-reform observable characteristics. Tables (2.D2) and (2.D3) in the Appendix show the mean, standard deviations and a test for difference in means for matching variables and other pre-treatment characteristics of mini and midi-jobbers compared to the rest of the workers, for the original and matched sub-samples of the working and jobless population respectively.[16] While in the original sample means are statistically different, in the sub-sample in the common support differences disappear or at least become smaller in all variables, even those not included in the matching procedure. Hence, the matching strategy renders gains in terms of comparability of the groups of mini and midi-jobs and the rest of the workers. However, this comes at the cost of a considerable loss of observations, such that the remaining sub-samples represent 23% of the original sample of working population, and 15% for the jobless. Figures (2.E1) and (2.E2) in the Appendix show what is called in the literature as the "propensity score" for the original sample and the sub-sample in the common support.

The outcomes to be analyzed in the working sub-sample are: (1) net monthly earnings, (2) weekly hours worked, (3) net hourly wage, all in natural logarithm. In the sub-sample of jobless individuals, the outcome of interest is the probability of holding a regular employment. The evolution of the outcomes for the original sample as well as the matched sample with and without matching weights is shown in figure (2.F1) in the Appendix. Visual inspection suggests that the take-home earnings, both monthly and hourly, as well as the hours worked decrease for the mini and midi-jobbers once the reform is in place. On the other hand, the probability of holding a regular employment increases for the mini and midi-jobbers right after the reform, and decrease thereafter.

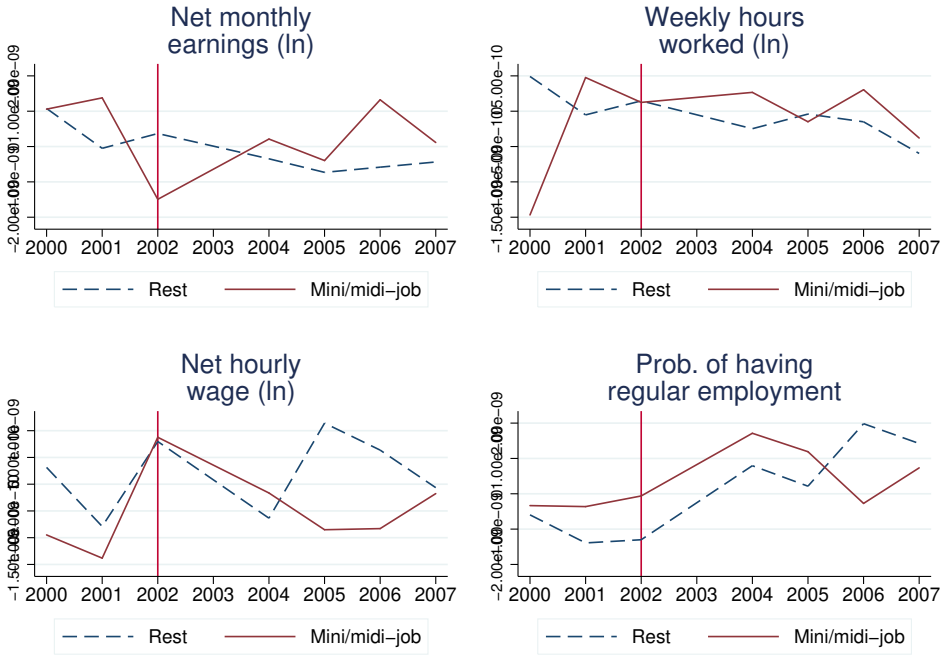
The evolution of the outcomes after accounting for the observable time-varying variables and

[15] I use all ages due to sample size restrictions.

[16] The matching variables are not balanced by construction because the algorithm used allows strata with different number of units in the groups of mini or midi-jobbers and the rest of the workers. The last block of columns shows the same statistics using the weights computed with the matching algorithm to compensate for the differential strata sizes.

year fixed effects on the matched sample is displayed in figure (2.71), where the residuals of the corresponding regressions are plotted. Trends in earnings and hours for mini and midi-jobbers after the reform do not suggest a relative fall compared to the rest of the workers. Regarding the probability of holding a regular employment, it increases soon after the reform and then goes down.

Figure 2.71: Evolution of the outcomes. Residuals from regression on observable time-varying controls and year fixed effects



Note: Net monthly earnings, weekly hours of work and net hourly wage correspond to working population; probability of holding regular employment, to jobless population.

Visually, the parallel trend assumption holds for the hourly net earnings and the probability of being in regular employment, but it is not clear for the rest of the outcomes. Table (2.71) shows the formal test using equation (2.22). Let's define the variable D_i individual specific and independent of time, which takes the value 1 if the individual takes up a mini or midi-job after the reform, and 0 otherwise. The relevant test statistics in table (2.71) for the matched sample (last two columns) do not allow to reject the hypothesis of parallel trends pre-reform in all the outcomes.

Using the matched observations in the balanced panel in 2000-2007, excluding 2003, I estimate the model in equation (2.17), but modified to differentiate mini and midi-jobs in the spirit of heterogeneous effects. The underlying assumption is that after removing differences in observable characteristics, the selection into mini or midi-jobs is determined by

time-invariant unobservables U_i and time-varying observables X_{it} on which I condition. D_{it} equals 1 for all years since the worker's first entrance in a mini or midi-job after 2003.[17]. Under assumption (2.14), δ identifies the ATT and since it is estimated on the matched sample the effect estimated is local to this subgroup of comparable individuals.

Tables (2.72) and (2.73) show the estimation of δ for the corresponding outcomes and subsamples. The first column for each outcome variable shows the estimation by Ordinary Least Squares (OLS), the second, using Fixed Effects (FE), and the third one, using FE in the matched sample.

Estimations using OLS are all significant both statistically and economically. However, the selection bias is apparent when comparing with the lower estimations using FE. The negative sign of OLS estimates in the case of earnings and hours suggests that mini and midi-jobbers work fewer hours and earn less than regular workers. This result is mechanical and potentially due to the definition of mini and midi-jobs based on a maximum of earnings. FE estimates are lower in magnitude, reflecting the differences in trends after controlling for disparities in levels. When restricting to the matched sample with more comparable individuals, estimations became slightly smaller in general, and less precise potentially due to the reduction in the sample size.

Among people working during the whole period 2000-2007, net monthly earnings decrease 7% for mini-jobbers and 2% for midi-jobbers compared to workers in regular employment. These magnitudes are economically significant, equivalent to a lose of €70 and €20 a month respectively, if evaluated at the mean net earnings of €1,000 in the sample. The coefficients are not precisely estimated though.

Decomposing the variation in earnings, hours fall by 10% for the mini-jobbers and 4% for the midi-jobbers compared to the rest of the workers, though the latter is not statistically significant. This magnitude represents 3 and 1 hour a week respectively, given the average is 32 hours in the sample. The net hourly wage, which is on average €7, decreases by 1% (€0.07) for mini-jobbers and 6% (€0.42) for midi-jobbers with respect to the rest, but the coefficients are not statistically different from 0. To sum up, hours worked fall potentially to benefit from the lower tax burden in mini and midi-jobs. However, workers do not receive the benefit because earnings, both monthly and hourly, do not increase. This is consistent with the hypothesis that firms appropriate the benefit of the lower tax burden. It is worth reminding that the lack of growth in net earnings relatively might come from a dominant

[17] The treatment is considered since the first entrance, because starting a mini or midi-job can be attributed to the expansion of this type of employment by the reform, while changing the labor situation afterwards is not exogenous, depends on worker's effort, for example. Since the definition of mini-job changed deeply with the reform, the variable D_{it} does not take the value 1 for mini-jobbers before the reform.

outwards shift in labor supply or from a higher supply elasticity.[18]

Further insight on the mechanism underlying the results is derived from table (2.74), where indicators of job change and reduction in gross monthly earnings are regressed on three lags of the mini and midi-job indicators (maximum length allowed by the sample). The coefficients of interest are on the contemporaneous values. They capture whether there is a higher probability of changing job or suffering a cut on earnings when entering a mini or midi-job. Focusing on the estimation by FE on the matched sample, workers have 25% higher chances of suffering a reduction in the salary when entering a mini-job, and 14% when starting in a midi-job. The coefficients regarding job change are not statistically significant, providing not conclusive evidence regarding workers leaving their jobs to take up a mini or midi-job. Jointly with the previous results, this suggests that firms might directly depress the gross remuneration of workers, by cutting hours or hourly wage, to take advantage of the lower tax wedge. Net earnings by hour do not improve for workers. This is consistent with the findings by Azmat (2006) for the WFTC, which has a similar design to the mini and midi-jobs in the sense that the benefit is part of the payroll.

For the inactive and unemployed individuals before the reform, the estimations regarding mini-jobbers transiting to regular employment one period after on the matched sample even switch sign compared to the OLS estimates. Selection is very strong in this case. Mini-jobbers face a lower probability of holding regular employment due to their observable and unobservable characteristics. Once accounted for this, mini-jobbers have a 12 pp. higher probability (statistically significant) of obtaining a regular employment if they stay one year in the mini-job. In case they stay two years or more, the coefficients become lower and not significantly different from 0. For the midi-jobs, there is the opposite situation: the coefficients increase with the length of the period (for 2 lags, it is 12 pp. higher, though imprecisely estimated). Estimates are high compared to the unconditional probability of being in regular employment of 14% in the whole sample and 18% since 2004.

A possible interpretation of this result is that mini-jobs act as a probation period: workers accept a low pay and hours of work to signal their ability and motivation to work, and firms screen workers by offering these jobs. But if they stay too long in this type of job, it has a lock-in effect where the signal is negative and it is more difficult to find a regular employment. In the case of the midi-jobs, since they are better paid and involve more hours, they might allow to accumulate human capital with time and improve the likelihood of transiting to regular employment.[19]

[18]Bispinck and Schulten (2011) point out that even if unions tried to limit the number of mini and midi-jobs in certain sectors, such as retail, the rules were not enforceable. This together with the low unionization rate in Germany (60%) hints on the low bargaining power or high supply elasticity of low-income earners.

[19]It is difficult to discard that the positive effect does not come from an improvement on the firm's

Tables (2.G1) and (2.G2) in the Appendix present an analysis of heterogeneity of effects for relevant groups. The main findings suggest that the elimination of the hours limit played a role. Previous mini-jobbers increase hours, the same as young people, Eastern Germans, single parents and secondary workers. However, not in all cases earnings improve, because there are downward pressures on the hourly net wages in mini and midi-jobs. This is the case for single parents for example. Young people who hold mini or midi-jobs are the most benefited in terms of earnings.

Estimations regarding stepping-stone effects for inactive and unemployed workers are imprecise potentially due to the reduced sample size. However, it seems that mini-jobs constitute an effective means for unemployed to transit to regular employment. However, there is a lock-in in this type of jobs for women, Eastern Germans and single parents.

2.8 Discussion: Robustness and general equilibrium effects

In this section, I qualify the validity of the results by showing they hold under changes in the specification and I discuss how they are affected by general equilibrium effects. Robustness checks are offered for the results using the combined matching and fixed effects strategy.

First, I redefine D_{it} so as it only refers to mini and midi-jobs as main job. The first four columns of table (2.81) show that the results are qualitatively robust, even if the sample size after matching is smaller for the working population. Most of the estimates do not change sign, though the point estimations are higher in absolute magnitude and more precise. The coefficient regarding the effect of mini-jobs on net monthly earnings is significant and of higher magnitude. For inactive and unemployed people, there is almost no change in the sample and the results, since they mostly take up mini and midi-jobs as main.

A second change in the specification is to consider mini-jobs before the reform as part of the treatment, keeping the original matched samples, as shown in columns 5-8 in table (2.81). While results in terms of earnings are very similar to the previous specification, for the jobless population the estimates decrease in magnitude and become statistically insignificant. However, the temporal pattern of the coefficients remain.

The first four columns in table (2.82) is a "standard DID" exercise, in which I disregard that individuals enter into mini and midi-jobs in different moments after the reform. Results

possibilities to screen workers on the base of unobservables for the econometrician but not for the firm. It would be an unfair comparison if the workers who enter mini-jobs are the most skillfull of the pool of unemployed and inactive.

do not qualitatively change. Finally, in the last columns I restrict attention to those who are part-timers (or inactive and unemployed in the case of the jobless group) during all the observation period, and I present the results on the original sample due to its limited size. The only treatment is to take up a mini-job, and the comparison group is composed by regular part-timers. This exercise potentially abstract from the decision between being full and part-time. Results on earnings remain, though the change in hours become insignificant as it is to be expected. Coefficients related to the probability of transition to regular employment maintain the temporal pattern but are lower and statistically insignificant.

An additional test for the presence of effects on earnings for people working during the whole period of observation, 2000-2007, is performed using the concept of "intensity of treatment". Following Duflo (2001) and Bleakley (2007), workers in sectors with more low-paid jobs before the reform are more affected by the expansion of these type of employment with the reform. I define low-paid jobs as those which comply with the post-reform definition of mini and midi-jobs. The sector in which the worker is before the reform is highly correlated with the sector after: 60% of the workers with valid sector declaration remains in the same sector in between 2002 and 2007. Since it is a pre-determined variable, I consider it exogenous and an indicator of the worker's ability.

The evolution of the outcomes is shown in figure (12) in the Appendix, in which sectors are classified in high and low intensity of treatment according to whether they are above and below the median of low-paid jobs respectively. In a regression framework the specification is:

$$Y_{ijt} = \alpha_i + \lambda_t + \delta(D_j^{pre} * Post_t) + X'_{it}\beta + u_{it} \tag{2.24}$$

where all the variables are as in equation (2.17), D_j^{pre} represents the intensity of low-paid jobs in the sector where the worker was employed before the reform (in 2002) and $Post_t$ is an indicator which takes the value 1 after 2003. The intensity is computed as an average of the proportion of low-paid jobs by sector between 2000-2002. I consider separately a more restrictive concept using only the definition of mini-jobs, and a wider one including midi-jobs as well. As shown in table (2.83), there are not significant coefficients. However, the point estimates suggest that neither the net earnings nor the hours are lower for workers in high-intensity sectors in low-paid jobs compared to the rest. The net hourly wage is between 0.7% and 0.9% lower when the intensity is 10% higher after the reform though. This is consistent with the hypothesis of appropriation of the tax by firms.

A final word is worth regarding the existence of general equilibrium effects. The analysis is based on the comparison of earnings, hours and probabilities of transition to regular employment between mini and midi-jobbers and the remaining workers. However, the comparison

group is potentially affected by the reform as well, and the direction of the effect depends mainly on the degree of substitutability between low and high-earnings' workers.

If they are substitutes, the higher attractiveness of mini and midi-jobs due to their lower tax cost might have led firms to reduce the demand for regular workers, yielding downwards pressures on earnings in this sector. Results hence become a conservative estimation of the effect of the reform in the earnings of mini and midi-jobbers. They would overestimate the real effect if wages of regular employment were increasing driven by complementarity with mini and midi-jobbers. However, the demand for regular employment should increase considerably compared to mini and midi-jobs, which is quite implausible because of the relative sizes of the sector.

Finally, regarding the probability of holding regular employment, the reform mechanically decreased it for both the treatment and comparison group. Even if firms substitute or complement marginal and regular employment, the change in this probability should be homogeneous for both groups not biasing the results.

2.9 Conclusions

The German Mini-job Reform is a controversial policy designed along the lines of the welfare-to-work policies popular in the developed world. It entails tax exemptions and subsidies for workers with gross earnings below a limit, the so-called "mini" and "midi" jobs. While the main goal of this type of interventions is to promote labor participation and improve conditions for workers with low earnings capacity, much of the political debate about the German reform has suggested that it also brought undesired effects related to in-work poverty and lock-in effects in low-quality jobs. In this paper, I provide empirical evidence of the effects of the reform on earnings and employment prospects of targeted workers. I exploit the panel structure of the G-SOEP by estimating fixed effects models, and I provide several alternatives for the construction of comparison groups. On the one hand, I use groups more affected by mini and midi-jobs, i.e. women, young, single parents, secondary and low-educated workers. On the other hand, I construct a comparison group by matching mini and midi-jobs to the rest of the workers on the basis of demographic and socio-economic pre-reform characteristics.

The theoretical framework of tax incidence in the labor market predicts that a reduction of the tax wedge in the low-earning segment as implied by the Mini-Job Reform is shared by employers and employees depending on the elasticities of supply and substitution among mini and midi-jobbers and regular workers, and the inflow of new workers. The latter is

expected to be positive according to the static labor supply model, which on the other hand predicts a reduction in hours of individuals already working. Hence, the expected change in net earnings after the tax reduction is theoretically ambiguous. Empirically, I find that workers in the low-earning segment face downwards pressures on earnings. Using the matched sample, the probability is 25% for mini-jobbers and 14% higher for midi-jobbers to suffer a gross earnings reduction compared to regular workers, while the net monthly and hourly earnings do not increase even if they pay lower taxes. Besides, mini-jobbers reduce hours worked by 10% on average. The findings are consistent with firms appropriating all the economic incidence of the tax reduction.

For inactive and unemployed workers before the reform, mini or midi-job might represent stepping-stones if they yield human capital accumulation or help signalling willingness to work. By these means, jobless workers would transit smoothly to employment with higher earnings. However, it is also possible that working for low wage or hours generates a negative signal regarding the worker type, or detracts time from job search, harming future employment prospects and leading to a dead-end. I find mini-jobbers have 12% higher chances of transition to regular employment after one year, while midi-jobbers increase their chances in a similar magnitude after the third year. At longer horizons for mini-jobs and shorter for midi-jobs, the probabilities are not statistically nor economically significant. This evidence supports mini and midi-jobs potentially serving as stepping-stones.

Encouraging low-earning jobs via tax incentives affects differently groups of the population. In the German experience, younger workers are the winners, increasing labor participation and earnings. The reform seems also effective for activating women. However, some vulnerable groups which are usually targeted by welfare-to-work policies such as single parents and low-educated workers face downward pressures on earnings without improving the chances to be employed.

Even if the Mini-Job Reform took place more than a decade ago, the debate regarding it is ongoing, and many European countries are looking at the German experience to analyze the possibility of adoption of similar policies. Having thorough picture of the consequences of promoting low-earning jobs by tax benefits is hence relevant for policy design. The results in this paper raise questions about the effectiveness of the German design to improve earnings and life quality of workers in the lower tail of the income distribution. On the other hand, they support the hypothesis that jobs with tax subsidies may act as spring board for jobless people to improve their employment prospects.

Table 2.41: Characteristics of jobless, mini and midi-jobbers and regular workers in 2002 (17-65 years old)

	Non-working	Mini/midi-job	Regular job
Demographics			
Female	0.683	0.745	0.423
	(0.466)	(0.436)	(0.494)
Age	49.66	38.71	39.73
	(10.51)	(12.09)	(10.19)
Immigrant	0.162	0.138	0.109
	(0.369)	(0.345)	(0.312)
East	0.211	0.194	0.203
	(0.408)	(0.396)	(0.402)
Single	0.245	0.352	0.322
	(0.430)	(0.478)	(0.467)
Children	0.486	0.816	0.688
	(0.926)	(0.974)	(0.956)
Head of HH	0.521	0.460	0.659
	(0.500)	(0.499)	(0.474)
Dual earner HH	0.131	0.426	0.527
	(0.338)	(0.495)	(0.499)
UB or Assist.	0.219	0.177	0.0596
	(0.414)	(0.382)	(0.237)
Public transfers to HH	10081.7	6198.0	3836.1
	(9283.1)	(6762.3)	(5291.8)
Per capita annual HH income	12049.1	11120.9	14864.2
	(7780.1)	(6920.7)	(7795.2)
Less than HS	0.260	0.205	0.111
	(0.439)	(0.404)	(0.314)
High School	0.611	0.693	0.718
	(0.488)	(0.462)	(0.450)
More than HS	0.129	0.103	0.171
	(0.335)	(0.304)	(0.376)
Work history (2000-2002)			
Working	0.402	0.884	0.988
	(0.490)	(0.320)	(0.108)
Years of FT experience	16.11	10.05	15.51
	(13.02)	(10.79)	(10.80)
Years of PT experience	2.547	3.313	1.681
	(5.883)	(5.723)	(4.243)
Years of unemp. experience	1.893	1.003	0.393
	(3.143)	(2.040)	(1.109)
Weekly working hours	7.589	19.22	37.60
	(12.47)	(14.62)	(12.29)
Hourly net wage	10.82	8.204	9.325
	(14.74)	(7.699)	(5.013)
Gross monthly labor earnings	450.8	783.2	2281.4
	(847.7)	(816.2)	(1280.7)
Change of job	0.119	0.341	0.294
	(0.323)	(0.474)	(0.456)
Labor market outcomes after the reform (2004-2007)			
Weekly working hours		15.61	37.76
		(12.82)	(12.42)
Hourly net wage		8.581	10.35
		(7.940)	(7.063)
Gross monthly labor earnings		636.6	2554.1
		(653.7)	(1387.8)
Change of job		0.432	0.232
		(0.496)	(0.422)
New worker		0.0112	0.00411
		(0.105)	(0.0640)
Student before		0.000240	0.000439
		(0.0155)	(0.0210)

Note: Categorization according to labor situation in 2004-2007: Non-working if did not work in any period, mini or midi-jobbers if such an employment in some period, regular job if employment of other type in some period and not mini or midi-job. Work history: working, new worker, student before and change of job is 1 for an individual who is in this status at least one year in 2000-2002; experience refers to the observation with the maximum, and earnings and weekly hours are the average; same definitions for variables included in outcomes.

Table 2.61: Proportion of people in working age (17-65) not working, in regular jobs and in mini or midi-jobs. 2005

Groups	Not working	Regular job	Mini/midi-job
Female	29%	49%	22%
Male	16%	74%	10%
35 y.o. or younger	19%	60%	21%
More than 35	25%	60%	15%
Single with children	30%	43%	27%
Rest	23%	61%	16%
Secondary worker	19%	57%	23%
Primary worker	23%	60%	16%
Low education	25%	58%	17%
High education	14%	74%	12%

Note: Balanced panel 2000-2007. Mini or midi-jobs held as main or secondary jobs.

Table 2.62: Summary statistics, before (2002) and after (2005), and by groups (2002)

	Before and after		Gender		Age		Family comp.		Type of worker		Education	
	2002	2005	Male	Female	>35	<=35	Rest	Sing. w. chil.	Primary	Secondary	High	Low
Participation	0.886	0.883	0.966	0.819	0.902	0.854	0.883	0.932	0.886	0.887	0.937	0.877
	(0.318)	(0.321)	(0.181)	(0.385)	(0.297)	(0.353)	(0.321)	(0.253)	(0.318)	(0.317)	(0.243)	(0.329)
Employment	0.847	0.837	0.929	0.777	0.861	0.818	0.849	0.813	0.847	0.832	0.926	0.832
	(0.360)	(0.370)	(0.256)	(0.416)	(0.346)	(0.386)	(0.358)	(0.391)	(0.360)	(0.375)	(0.262)	(0.374)
Part-time	0.157	0.158	0.0437	0.253	0.156	0.161	0.151	0.252	0.160	0.0909	0.0884	0.170
	(0.364)	(0.365)	(0.205)	(0.435)	(0.362)	(0.368)	(0.358)	(0.435)	(0.366)	(0.288)	(0.284)	(0.376)
Regular employment	0.793	0.702	0.922	0.683	0.810	0.758	0.798	0.720	0.792	0.808	0.905	0.772
	(0.406)	(0.457)	(0.267)	(0.465)	(0.393)	(0.428)	(0.402)	(0.450)	(0.406)	(0.395)	(0.293)	(0.420)
Regular part-time employm.	0.0542	0.0749	0.00695	0.0939	0.0515	0.0596	0.0515	0.0930	0.0553	0.0234	0.0210	0.0603
	(0.226)	(0.263)	(0.0831)	(0.292)	(0.221)	(0.237)	(0.221)	(0.291)	(0.229)	(0.152)	(0.143)	(0.238)
Gross monthly labor earnings	1857.1	1904.1	2620.0	1216.8	1951.5	1668.6	1898.4	1271.4	1865.1	1626.6	3009.2	1645.3
	(1514.8)	(1751.4)	(1525.8)	(1169.9)	(1574.8)	(1368.3)	(1530.5)	(1118.5)	(1524.4)	(1185.4)	(1941.5)	(1317.3)
Net monthly labor earnings	1403.5	1463.4	1808.5	980.9	1449.1	1307.7	1420.0	1132.9	1409.1	1241.4	1927.3	1292.1
	(813.1)	(914.1)	(798.0)	(580.6)	(867.7)	(675.2)	(824.4)	(531.2)	(819.3)	(585.0)	(997.5)	(720.9)
Weekly working hours	30.38	29.73	39.29	22.90	30.74	29.67	30.71	25.75	30.37	30.68	38.16	28.95
	(18.12)	(18.40)	(14.57)	(17.41)	(17.29)	(19.66)	(18.12)	(17.54)	(18.13)	(17.74)	(16.34)	(18.07)
Hourly net wage	9.110	9.319	10.03	8.139	9.147	9.032	9.128	8.803	9.141	8.202	10.81	8.749
	(5.918)	(5.666)	(4.871)	(6.714)	(5.405)	(6.878)	(5.994)	(4.478)	(5.964)	(4.278)	(4.848)	(6.062)
Change of job	0.103	0.0783	0.0959	0.110	0.0846	0.141	0.105	0.0775	0.104	0.0827	0.112	0.102
	(0.304)	(0.269)	(0.294)	(0.312)	(0.278)	(0.348)	(0.307)	(0.268)	(0.305)	(0.276)	(0.316)	(0.302)

Note: Balanced panel 2000-2007. Prime age population (25-54).

Table 2.63: Intention-to-Treat (ITT) estimates. Balanced panel 2000-2007, prime age population (25-54)

VARIABLES	Partic.	Employm.	Part-time	Regular emp.	Regular PT
After	0.01	0.01	0.01	-0.08***	0.04***
	(0.010)	(0.011)	(0.013)	(0.014)	(0.011)
Female	0.04***	0.05***	0.01	-0.04**	0.01
	(0.012)	(0.014)	(0.012)	(0.018)	(0.010)
35 y.o. or younger	0.03*	0.03	-0.01	0.03	-0.01
	(0.019)	(0.020)	(0.013)	(0.022)	(0.011)
Single with children	0.03	0.04	-0.05	-0.01	-0.01
	(0.024)	(0.033)	(0.039)	(0.030)	(0.036)
Secondary worker	0.02	0.02	-0.02	0.01	-0.02
	(0.027)	(0.028)	(0.023)	(0.028)	(0.015)
Low education	0.02	0.01	0.02	-0.03*	-0.01
	(0.012)	(0.014)	(0.013)	(0.017)	(0.010)
Observations	31,462	31,462	31,462	31,462	31,462
Number of indiv. obs.	4,495	4,495	4,495	4,495	4,495

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.64: Intention-to-Treat (ITT) estimates. Balanced panel 2000-2007, people working all the periods, prime age (25-54)

VARIABLES	Gross m. earn.	Net m. earn.	Hours	Hr. wage	Job change
After	-0.02	0.00	-0.01	0.02	-0.02**
	(0.018)	(0.010)	(0.017)	(0.015)	(0.011)
Female	0.03	0.01	0.01	-0.01	-0.03**
	(0.028)	(0.015)	(0.019)	(0.015)	(0.013)
35 y.o. or younger	0.08***	0.04**	0.02	0.01	-0.06***
	(0.024)	(0.015)	(0.018)	(0.017)	(0.014)
Single with children	0.13	-0.01	0.11**	-0.10***	0.01
	(0.077)	(0.031)	(0.044)	(0.036)	(0.038)
Secondary worker	-0.01	-0.02	0.05	-0.04	0.02
	(0.040)	(0.066)	(0.038)	(0.069)	(0.027)
Low education	-0.05**	-0.05***	-0.02	-0.04***	0.02
	(0.023)	(0.015)	(0.017)	(0.016)	(0.015)
Observations	22,376	21,751	22,350	21,749	22,376
Number of indiv. obs.	3,197	3,197	3,197	3,197	3,197

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.65: Test of parallel trends assumption. Panel 2000-2002, prime age population (25-54)

	Female		Young		Single w. childr.		Secondary		Low educ.	
	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value	F-stat	p-value
					All					
Participation	2.54	0.0790	0.35	0.7069	2.26	0.1043	2.97	0.0516	0.33	0.7172
Employment	2.42	0.0891	0.26	0.7680	1.53	0.2165	1.06	0.3460	0.43	0.6531
Part-time	0.87	0.4200	1.48	0.2269	0.12	0.8841	0.75	0.4710	0.18	0.8328
Regular employment	1.61	0.2003	0.39	0.6776	2.18	0.1132	1.78	0.1691	0.32	0.7261
Regular part-time employment	0.09	0.9156	0.91	0.4013	0.30	0.7444	0.96	0.3841	0.02	0.9846
					Working in all periods					
Gross monthly earnings (ln)	2.02	0.1328	0.93	0.3947	2.55	0.0786	0.53	0.5912	0.45	0.6363
Net monthly earnings (ln)	0.31	0.7344	1.98	0.1384	0.46	0.6288	2.09	0.1232	8.19***	0.0003
Weekly working hours (ln)	4.29*	0.0138	3.83*	0.0218	3.59*	0.0277	0.51	0.5996	2.80	0.0610
Hourly net wage (ln)	2.53	0.0795	0.60	0.5463	2.73	0.0656	1.61	0.2006	0.94	0.3902
Change of job	0.14	0.8714	1.08	0.3410	2.47	0.0849	0.17	0.8437	0.21	0.8131

Table 2.71: Test of parallel trends assumption. Panel: 2000-2002, matched sample

	F-stat	p-value
Working population		
Net monthly earnings (ln)	0.20	0.8193
Log weekly working hours	0.50	0.6089
Hourly net wage (ln)	0.60	0.5489
Jobless population		
Prob. of regular employment	1.08	0.3410

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 2.72: Estimated effects of holding mini and midi-jobs. Panel 2000-2007, working population

	Monthly net earnings (ln)			*Weekly hours worked (ln)*			*Net hourly wage (ln)*		
VARIABLES	OLS	FE	Matching and FE	OLS	FE	Matching and FE	OLS	FE	Matching and FE
Mini-job	-0.75***	-0.10***	-0.07	-0.52***	-0.10***	-0.10*	-0.27***	-0.06**	-0.01
	(0.027)	(0.031)	(0.048)	(0.027)	(0.031)	(0.055)	(0.025)	(0.028)	(0.038)
Midi-job	-0.70***	-0.05	-0.02	-0.41***	-0.06	0.04	-0.31***	0.00	-0.06
	(0.041)	(0.039)	(0.053)	(0.038)	(0.045)	(0.068)	(0.041)	(0.038)	(0.071)
Observations	29,678	29,678	7,018	30,665	30,665	7,223	29,614	29,614	7,001
Adjusted R-squared	0.32	0.10	0.12	0.21	0.03	0.07	0.17	0.03	0.04
Number of indiv.		4,416	1,039		4,417	1,039		4,416	1,039

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.73: Estimated effects of holding mini and midi-jobs. Panel 2000-2007, jobless population

	Probability of regular employment					
VARIABLES	OLS	FE	Matching and FE	OLS	FE	Matching and FE
Mini-job, 1 lag	-0.10***	-0.00	0.06	-0.11***	0.04	0.12*
	(0.027)	(0.032)	(0.056)	(0.035)	(0.031)	(0.062)
Mini-job, 2 lags				0.04	0.07*	0.02
				(0.053)	(0.038)	(0.045)
Mini-job, 3 lags				-0.10*	-0.04	-0.04
				(0.058)	(0.043)	(0.079)
Midi-job, 1 lag	0.12**	0.02	0.06	-0.00	-0.04	0.06
	(0.056)	(0.051)	(0.075)	(0.070)	(0.057)	(0.074)
Midi-job, 2 lags				0.28**	0.25***	0.07
				(0.115)	(0.084)	(0.081)
Midi-job, 3 lags				-0.14	-0.11	0.12
				(0.159)	(0.088)	(0.085)
Observations	8,916	8,916	1,310	7,767	7,767	1,131
Adjusted R-squared	0.18	0.21	0.30	0.16	0.21	0.32
Number of indiv.		1,356	205		1,356	205

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.74: Probability of job change and gross monthly earnings reduction in any activity. Panel 2000-2007, working population

	Prob. of job change			*Prob. of gross monthly earnings reduction*		
VARIABLES	OLS	FE	Matching and FE	OLS	FE	Matching and FE
Mini-job	0.05**	0.02	0.03	0.23***	0.22***	0.25**
	(0.020)	(0.023)	(0.041)	(0.030)	(0.050)	(0.100)
Mini-job, 1 lag	0.02	0.02	0.00	-0.28***	-0.28***	-0.20***
	(0.030)	(0.027)	(0.038)	(0.050)	(0.042)	(0.072)
Mini-job, 2 lags	0.03	0.03	0.04	0.05	0.06	-0.08
	(0.040)	(0.041)	(0.088)	(0.051)	(0.048)	(0.081)
Mini-job, 3 lags	-0.09**	-0.07*	-0.12	-0.04	-0.03	-0.04
	(0.038)	(0.040)	(0.089)	(0.054)	(0.044)	(0.072)
Midi-job	0.09**	0.03	0.13	0.20***	0.14***	0.14**
	(0.036)	(0.050)	(0.100)	(0.042)	(0.046)	(0.058)
Midi-job, 1 lag	0.01	0.01	-0.10	-0.13**	-0.14**	-0.05
	(0.053)	(0.054)	(0.128)	(0.064)	(0.064)	(0.088)
Midi-job, 2 lags	-0.04	-0.06	0.05	-0.13**	-0.12**	-0.18**
	(0.051)	(0.046)	(0.060)	(0.066)	(0.059)	(0.092)
Midi-job, 3 lags	0.10	0.11	-0.13	-0.03	-0.04	-0.19
	(0.086)	(0.098)	(0.137)	(0.061)	(0.063)	(0.127)
Observations	25,266	25,266	5,905	25,266	25,266	5,905
Adjusted R-squared	0.03	0.01	0.03	0.03	0.03	0.04
Number of indiv.		4,417	1,039		4,417	1,039

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.81: Estimated effects of holding mini and midi-jobs. Robustness check. Panel 2000-2007

	Only main job				*Mini-job before*			
VARIABLES	Earnings	Hours	Hr. wage	Pr. reg. emp.	Earnings	Hours	Hr. wage	Pr. reg. emp.
Mini-job, main	-0.18*	-0.27**	-0.03					
	(0.093)	(0.106)	(0.068)					
Midi-job, main	0.04	0.09	-0.03					
	(0.062)	(0.077)	(0.078)					
Mini-job, main, 1 lag				0.12*				
				(0.061)				
Mini-job, main, 2 lags				0.02				
				(0.043)				
Mini-job, main, 3 lags				-0.03				
				(0.079)				
Midi-job, main, 1 lag				0.07				
				(0.076)				
Midi-job, main, 2 lags				0.07				
				(0.081)				
Midi-job, main, 3 lags				0.13				
				(0.087)				
Mini-job*					-0.15**	-0.25***	0.04	
					(0.061)	(0.072)	(0.040)	
Midi-job					-0.02	0.05	-0.06	
					(0.053)	(0.063)	(0.073)	
Mini-job*, 1 lag								0.08
								(0.079)
Mini-job*, 2 lags								0.02
								(0.058)
Mini-job*, 3 lags								0.04
								(0.052)
Midi-job, 1 lag								0.04
								(0.073)
Midi-job, 2 lag								0.07
								(0.078)
Midi-job, 3 lags								0.11
								(0.085)
Observations	3,879	4,054	3,864	1,104	7,018	7,223	7,001	1,131
Number of indiv.	587	587	587	202	1,039	1,039	1,039	205
Adjusted R-squared	0.15	0.11	0.03	0.31	0.13	0.09	0.04	0.32

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.82: Estimated effects of holding mini and midi-jobs. Robustness check. Panel 2000-2007

	Standard DID				*Only part-timers*			
VARIABLES	Earnings	Hours	Hr. wage	Pr. reg. emp.	Earnings	Hours	Hr. wage	Pr. reg. emp.
Mini-job*Post	-0.03	-0.07**	0.03					
	(0.057)	(0.034)	(0.058)					
Midi-job*Post	-0.15***	-0.12**	-0.08					
	(0.050)	(0.060)	(0.053)					
Mini-job*Post, 1 lag				0.06				
				(0.090)				
Mini-job*Post, 2 lags				-0.05				
				(0.060)				
Mini-job*Post, 3 lags				-0.01				
				(0.063)				
Midi-job*Post, 1 lag				0.00				
				(0.084)				
Midi-job*Post, 2 lags				-0.01				
				(0.054)				
Midi-job*Post, 3 lags				0.03				
				(0.050)				
Mini-job					-0.11***	-0.08	-0.09*	
					(0.038)	(0.052)	(0.053)	
Mini-job, 1 lag								0.06
								(0.034)
Mini-job, 2 lags								0.05
								(0.053)
Mini-job, 3 lags								-0.04
								(0.050)
Observations	7,018	7,223	7,001	1,131	3,968	4,172	3,961	6,280
Number of indiv.	1,039	1,039	1,039	205	601	602	601	1,094
Adjusted R-squared	0.13	0.07	0.04	0.31	0.08	0.02	0.02	0.14

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.83: Estimated effects using "intensity of treatment". Panel 2000-2007, working population

	Monthly net earnings (ln)		*Weekly hours worked (ln)*		*Net hourly wage (ln)*	
VARIABLES	Only mini-jobs	Mini or midi-jobs	Only mini-jobs	Mini or midi-jobs	Only mini-jobs	Mini or midi-jobs
Intensity (mini-job)*Post	0.07		0.07		-0.09	
	(0.097)		(0.132)		(0.113)	
Intensity (mini/midi-job)*Post		0.05		0.04		-0.07
		(0.074)		(0.099)		(0.083)
Observations	28,077	28,077	28,722	28,722	28,016	28,016
Number of indiv.	4,131	4,131	4,131	4,131	4,131	4,131
Adjusted R-squared	0.09	0.09	0.03	0.03	0.03	0.03

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: "Intensity (mini-job)": more restrictive definition of low-paid jobs (only mini-jobs). "Intensity (mini/midi-jobs)": wider definition including mini and midi-jobs. Sample of workers with valid sector declaration in 2000-2007.

Appendix

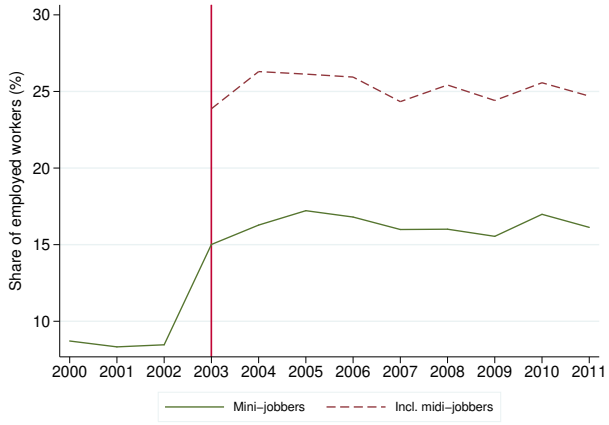
2.A Labor market numbers according to the G-SOEP

Table 2.A1: Labor market indicators in 2002 and 2005

	2002	2005
Labor participation	77.9%	80.0%
Unemployment rate	5.5%	6.0%
Hours a week	34	34
Monthly net earnings	1,332	1,360

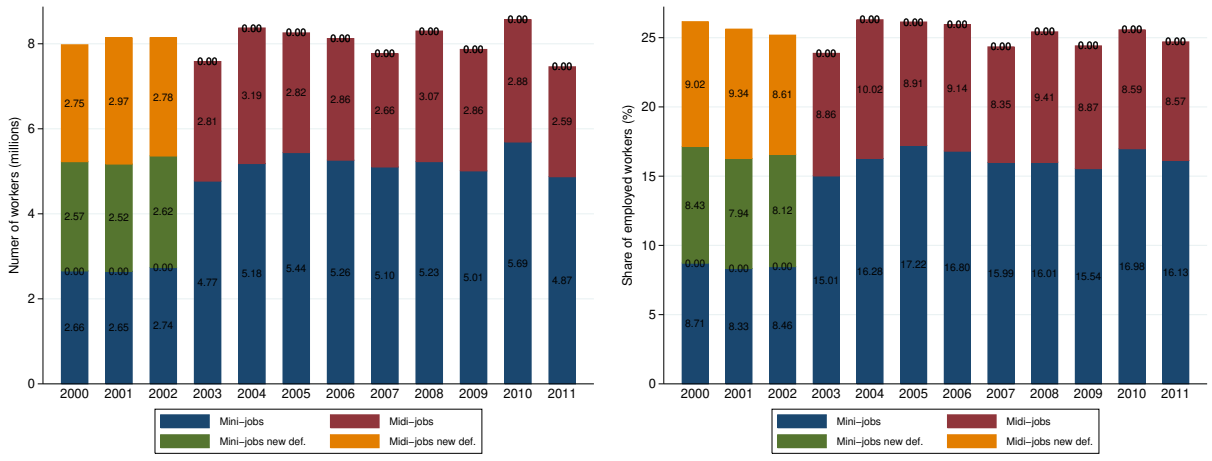
Note: Cross-sectional weights.

Figure 2.A1: Evolution of mini and midi-jobs



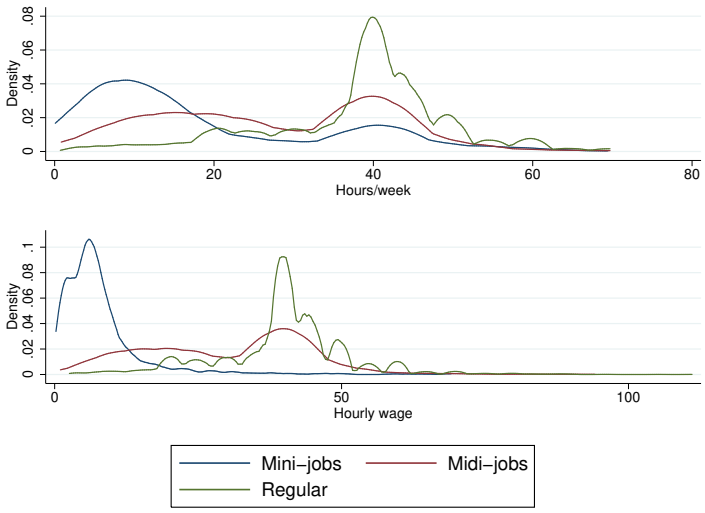
Note: Using the definitions of mini and midi-jobs before and after the reform. Cross-sectional weights.

Figure 2.A2: Evolution of mini and midi-jobs



Note: Using the definitions of mini and midi-jobs before and after the reform. Cross-sectional weights.

Figure 2.A3: Distribution of weekly working hours and hourly net earnings in all occupations, 2005



Note: Hours below the feasible amount of 70 a week. Hourly earnings excluding top 1 percentile.

Table 2.A2: People working at least one period in 2004-2007 (mini and midi-jobs and other employment) by their labor situation in 2002

Labor status 2002	Working age population (17-65)						Prime age population (25-65)					
	ANY JOB			MAIN JOB			ANY JOB			MAIN JOB		
	Mini-job	Midi-job	Other	Mini-job	Midi-job	Other	Mini-job	Midi-job	Other	Mini-job	Midi-job	Other
Inactive	47%	31%	22%	46%	31%	24%	44%	31%	24%	44%	31%	25%
Student	28%	48%	24%	27%	47%	27%	24%	24%	52%	19%	24%	57%
Unemployed	36%	32%	32%	36%	31%	33%	36%	31%	32%	36%	30%	34%
Irregular employment	41%	39%	20%	40%	36%	24%	40%	26%	34%	40%	22%	38%
Working PT	24%	37%	39%	21%	35%	44%	23%	34%	43%	19%	32%	48%
Working FT	13%	12%	76%	7%	9%	84%	11%	10%	79%	5%	7%	88%
Mini Job	54%	38%	8%	54%	36%	10%	58%	35%	8%	57%	34%	9%

Note: Balanced panel 2002-2007.

2.B Selection into mini and midi-jobs

Table 2.B1: Probability of taking up a mini or midi-job as main job in 2004-2007 of working age population (17-65)

VARIABLES	All	Non-working	Working
Female	0.06***	0.09*	0.04*
	(0.021)	(0.048)	(0.023)
Age	-0.00**	-0.02***	0.00
	(0.002)	(0.002)	(0.002)
Immigrant	-0.03	0.09	-0.07**
	(0.027)	(0.058)	(0.030)
East	-0.06***	-0.04	-0.08***
	(0.022)	(0.047)	(0.025)
Single	0.02	0.03	-0.03
	(0.025)	(0.050)	(0.030)
Children	0.04***	0.03	0.03**
	(0.011)	(0.020)	(0.013)
Head of HH	0.00	0.03	-0.00
	(0.021)	(0.047)	(0.023)
Dual earner HH	-0.01	-0.00	-0.06**
	(0.026)	(0.101)	(0.029)
UB or Assist.	0.08**	0.11**	0.06
	(0.031)	(0.054)	(0.040)
Public transfers to HH	-0.00	-0.00	0.00
	(0.000)	(0.000)	(0.000)
Per capita annual HH income	0.00	-0.00	0.00
	(0.000)	(0.000)	(0.000)
High School	-0.00	0.05	-0.01
	(0.026)	(0.048)	(0.031)
More than HS	0.07*	0.02	0.07
	(0.039)	(0.072)	(0.046)
Working	0.29***	0.15**	
	(0.029)	(0.070)	
New worker	0.07	0.27	0.07
	(0.058)	(0.219)	(0.059)
Student before	-0.07		-0.04
	(0.097)		(0.100)
Years of FT experience	0.00	0.00	-0.00
	(0.002)	(0.002)	(0.002)
Years of PT experience	0.00	0.00	-0.00
	(0.002)	(0.005)	(0.003)
Years of unemp. experience	0.00	0.00	0.00
	(0.005)	(0.007)	(0.008)
Weekly working hours	-0.00*	0.01**	-0.00***
	(0.001)	(0.004)	(0.001)
Gross monthly labor earnings	-0.00***	-0.00**	-0.00***
	(0.000)	(0.000)	(0.000)
Observations	7,084	1,336	5,747
Pseudo-R2	0.151	0.192	0.180

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Non-working and working populations refer to those who were in this situation in 2002, i.e. before the reform.

2.C Graphs of parallel trends for analysis by target groups

Figure 2.C1: Trends of outcome variables (residuals). Treatment: Female. Comparison: Male

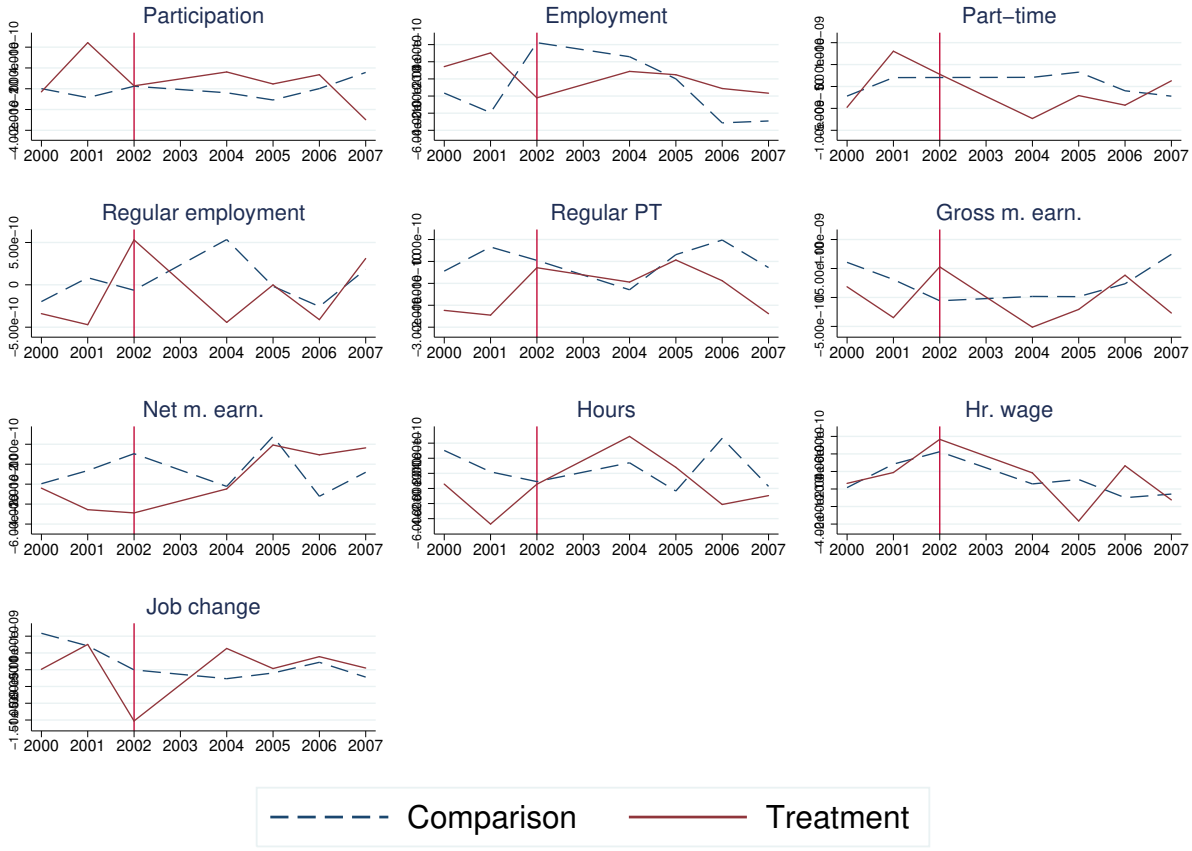


Figure 2.C2: Trends of outcome variables (residuals). Treatment: 35 years old or younger. Comparison: Older than 35

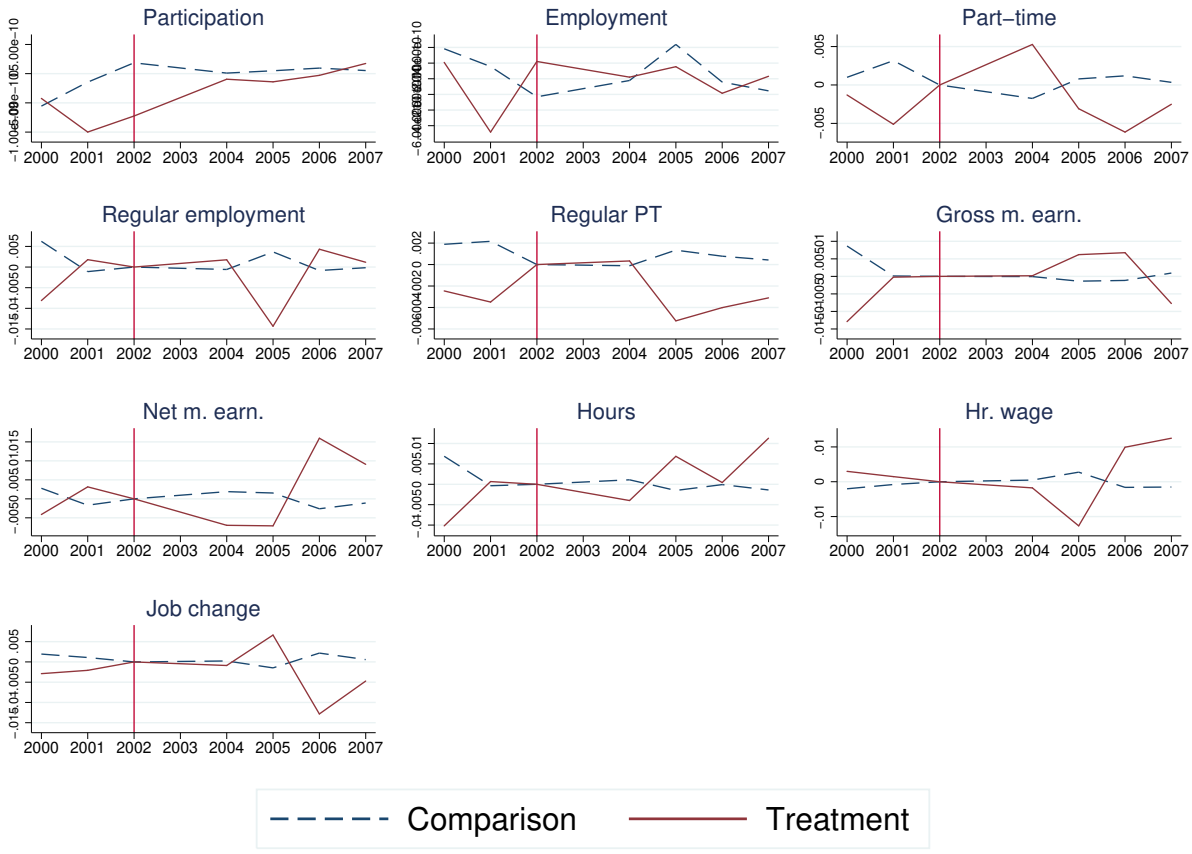


Figure 2.C3: Trends of outcome variables (residuals). Treatment: Single with children. Comparison: Rest

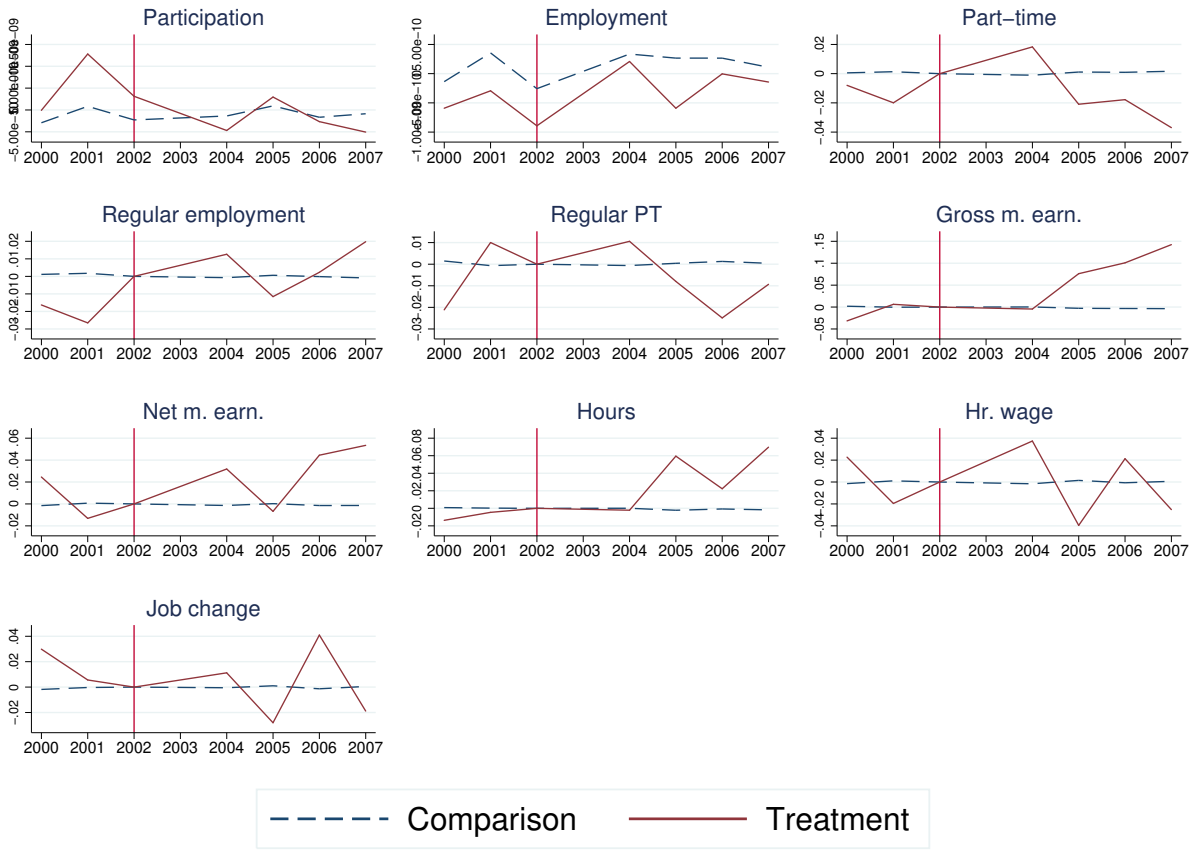


Figure 2.C4: Trends of outcome variables (residuals). Treatment: Secondary worker. Comparison: Primary worker

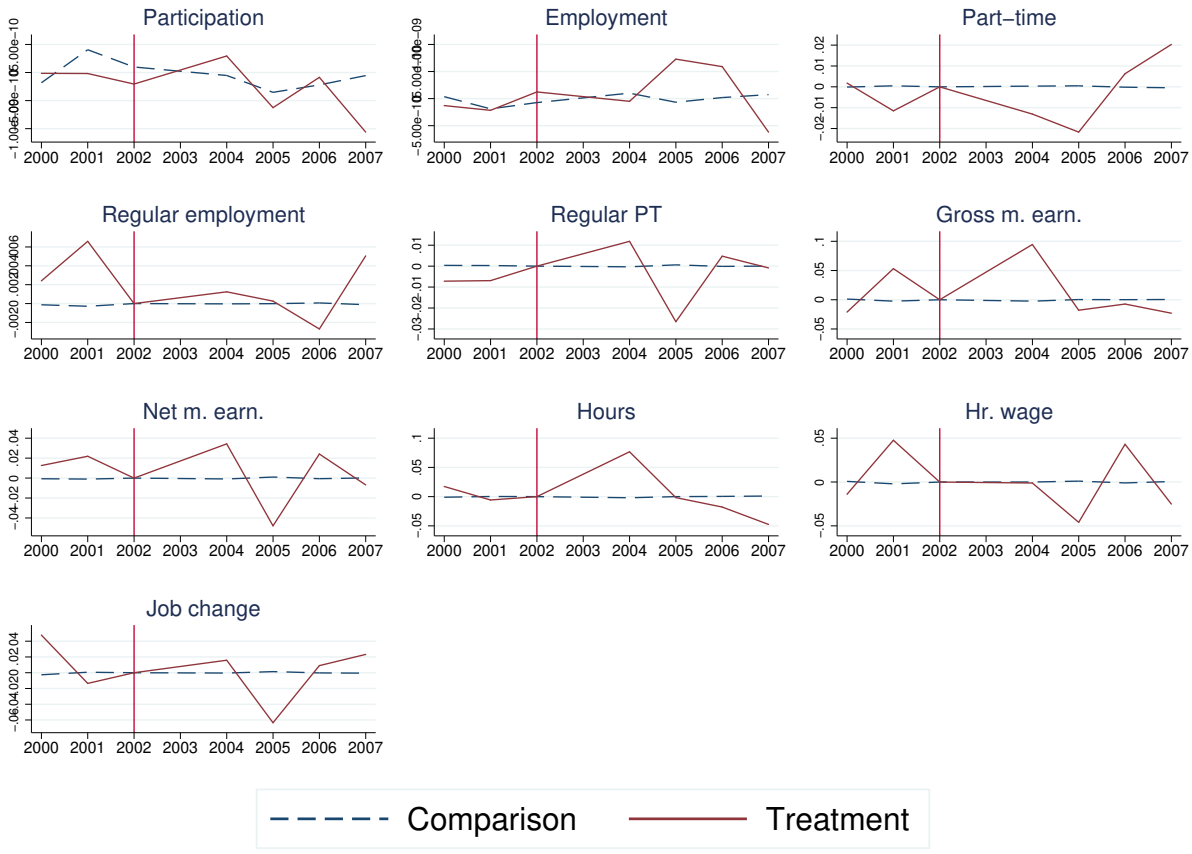
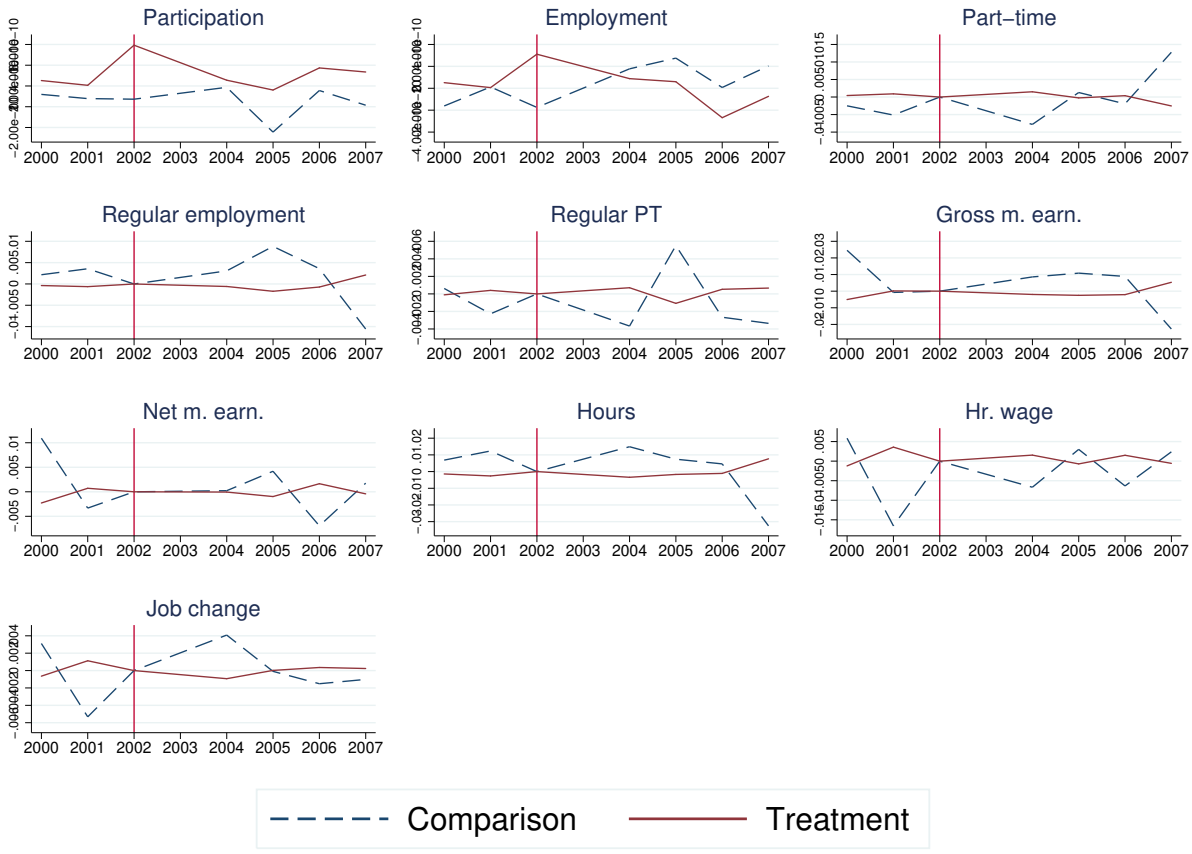


Figure 2.C5: Trends of outcome variables (residuals). Treatment: Low education. Comparison: High education



2.D Sample size and balance tables. Matching strategy

Table 2.D1: Panel 2000-2007

	Working age		Working		Non-working in 2002	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
Mini-job 2004-2007	1,567	18%	626	14%	314	22%
Midi-job 2004-2007	1,326	15%	568	13%	209	15%
Rest	6,024	68%	3,324	74%	899	63%
Total	8,917		4,518		1,422	
Mini-job 2004-2007			224	21%	72	33%
Midi-job 2004-2007			183	17%	38	17%
Rest			654	62%	109	50%
Matched (% of total)			1,061	23%	219	15%

Table 2.D2: Working population (17-65), 2002

	Original sample			Matched sample			Matched weighted sample		
	Rest	Mini/midi-job	Diff.	Rest	Mini/midi-job	Diff.	Rest	Mini/midi-job	Diff.
Female	0.398	0.664	-0.265***	0.444	0.576	-0.132***	0.576	0.576	-0.000
	(0.490)	(0.473)	(0.016)	(0.497)	(0.495)	(0.031)	(0.494)	(0.494)	(0.000)
Age	40.619	39.678	0.941**	39.302	38.128	1.174*	38.147	38.128	0.019
	(8.962)	(10.370)	(0.317)	(9.144)	(9.914)	(0.597)	(9.986)	(9.904)	(0.001)
Immigrant	0.116	0.124	-0.008	0.020	0.030	-0.010	0.030	0.030	-0.000
	(0.320)	(0.330)	(0.011)	(0.140)	(0.170)	(0.010)	(0.169)	(0.169)	(0.000)
East	0.273	0.211	0.062***	0.346	0.286	0.060*	0.332	0.286	0.047
	(0.446)	(0.408)	(0.015)	(0.476)	(0.452)	(0.030)	(0.471)	(0.452)	(1.974)
Single	0.223	0.250	-0.026	0.231	0.246	-0.015	0.253	0.246	0.007
	(0.417)	(0.433)	(0.014)	(0.422)	(0.431)	(0.027)	(0.435)	(0.431)	(0.048)
Children	0.769	0.789	-0.020	0.606	0.665	-0.059	0.665	0.665	-0.000
	(0.977)	(0.947)	(0.033)	(0.771)	(0.832)	(0.050)	(0.832)	(0.831)	(0.000)
Head of HH	0.616	0.477	0.139***	0.590	0.488	0.102**	0.511	0.488	0.023
	(0.486)	(0.500)	(0.017)	(0.492)	(0.500)	(0.031)	(0.500)	(0.500)	(0.390)
Dual earner HH	0.627	0.668	-0.041*	0.677	0.675	0.002	0.691	0.675	0.016
	(0.484)	(0.471)	(0.016)	(0.468)	(0.469)	(0.030)	(0.463)	(0.469)	(0.221)
UB or Assist.	0.035	0.065	-0.030***	0.005	0.005	-0.000	0.005	0.005	-0.000
	(0.183)	(0.246)	(0.007)	(0.068)	(0.070)	(0.004)	(0.070)	(0.070)	(0.000)
Public transfers to HH	3991.765	4675.363	-683.598***	3590.228	3833.995	-243.767	3873.711	3833.995	39.715
	(5036.312)	(5900.921)	(179.044)	(4725.201)	(5410.640)	(315.942)	(4973.423)	(5404.976)	(0.011)
Per capita annual HH income	14503.234	13163.261	1339.973***	13029.961	12889.230	140.730	12918.608	12889.230	29.377
	(7351.921)	(7030.933)	(246.633)	(4685.433)	(5052.361)	(305.221)	(4893.245)	(5047.072)	(0.007)
Less than HS	0.093	0.154	-0.061***	0.018	0.032	-0.014	0.032	0.032	-0.000
	(0.291)	(0.362)	(0.011)	(0.134)	(0.176)	(0.010)	(0.176)	(0.176)	(0.000)
High School	0.706	0.692	0.014	0.914	0.882	0.032	0.882	0.882	0.000
	(0.456)	(0.462)	(0.016)	(0.280)	(0.323)	(0.019)	(0.323)	(0.323)	(0.000)
More than HS	0.201	0.154	0.047***	0.067	0.086	-0.019	0.086	0.086	-0.000
	(0.401)	(0.361)	(0.013)	(0.251)	(0.281)	(0.017)	(0.281)	(0.281)	(0.000)
New worker	0.016	0.039	-0.023***	0.018	0.030	-0.011	0.036	0.030	0.006
	(0.126)	(0.194)	(0.005)	(0.134)	(0.170)	(0.009)	(0.186)	(0.169)	(0.184)
Student before	0.003	0.008	-0.006**	0.000	0.000	0.000	0.000	0.000	0.000
	(0.052)	(0.092)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(.)
Years of FT experience	16.508	11.850	4.658***	15.812	13.363	2.449***	13.314	13.363	-0.049
	(9.862)	(10.304)	(0.339)	(9.827)	(10.332)	(0.634)	(10.202)	(10.322)	(0.004)
Years of PT experience	1.747	4.000	-2.253***	1.941	2.749	-0.808**	2.751	2.749	0.002
	(4.196)	(5.713)	(0.158)	(4.456)	(4.928)	(0.293)	(5.253)	(4.922)	(0.000)
Years of unemp. experience	0.362	0.552	-0.189***	0.265	0.352	-0.087	0.317	0.352	-0.035
	(0.921)	(1.414)	(0.036)	(0.687)	(0.928)	(0.050)	(0.693)	(0.927)	(0.333)
Weekly working hours	40.072	30.583	9.489***	39.323	34.399	4.924***	36.940	34.399	2.541**
	(9.355)	(14.091)	(0.366)	(9.703)	(13.340)	(0.710)	(10.813)	(13.326)	(7.944)
Gross monthly labor earnings	2445.386	1518.220	927.165***	1986.646	1719.183	267.463***	1799.656	1719.183	80.473
	(1236.721)	(1187.915)	(41.533)	(788.589)	(1001.656)	(55.388)	(910.626)	(1000.607)	(1.263)

Note: Balanced panel 2000-2007. In parentheses, standard deviations in each group, standard error for the differences between groups and F-statistics for the difference in the case of the matched weighted sample.

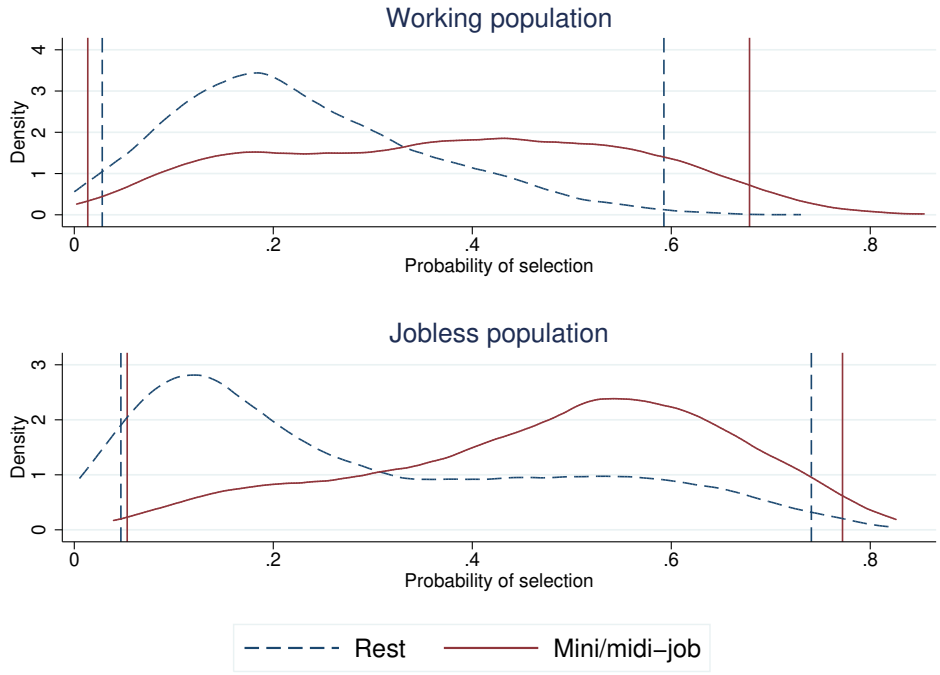
Table 2.D3: Jobless population (17-65), 2002

	Original sample			Matched sample			Matched weighted sample		
	Rest	Mini/midi-job	Diff.	Rest	Mini/midi-job	Diff.	Rest	Mini/midi-job	Diff.
Female	0.718	0.775	-0.057*	0.784	0.734	0.050	0.734	0.734	0.000
	(0.450)	(0.418)	(0.025)	(0.413)	(0.444)	(0.061)	(0.453)	(0.433)	(0.000)
Age	46.930	36.702	10.227***	36.059	34.011	2.048	34.086	34.011	0.075
	(11.402)	(10.260)	(0.623)	(11.224)	(10.417)	(1.550)	(10.686)	(10.150)	(0.002)
Immigrant	0.181	0.180	0.001	0.098	0.085	0.013	0.085	0.085	-0.000
	(0.385)	(0.384)	(0.022)	(0.299)	(0.281)	(0.041)	(0.286)	(0.273)	(0.000)
East	0.263	0.283	-0.021	0.265	0.266	-0.001	0.307	0.266	0.041
	(0.440)	(0.451)	(0.025)	(0.443)	(0.444)	(0.063)	(0.473)	(0.433)	(0.329)
Single	0.200	0.295	-0.095***	0.343	0.362	-0.019	0.367	0.362	0.005
	(0.400)	(0.457)	(0.024)	(0.477)	(0.483)	(0.069)	(0.494)	(0.471)	(0.005)
Children	0.669	1.184	-0.515***	1.020	1.138	-0.119	1.138	1.138	-0.000
	(1.077)	(1.124)	(0.062)	(1.169)	(1.170)	(0.167)	(1.193)	(1.140)	(0.000)
Head of HH	0.428	0.434	-0.005	0.235	0.319	-0.084	0.250	0.319	-0.069
	(0.495)	(0.496)	(0.028)	(0.426)	(0.469)	(0.064)	(0.444)	(0.457)	(1.009)
Dual earner HH	0.027	0.056	-0.029**	0.127	0.117	0.010	0.159	0.117	0.042
	(0.163)	(0.230)	(0.011)	(0.335)	(0.323)	(0.047)	(0.375)	(0.315)	(0.480)
UB or Assist.	0.244	0.322	-0.078**	0.088	0.106	-0.018	0.106	0.106	-0.000
	(0.430)	(0.468)	(0.025)	(0.285)	(0.310)	(0.043)	(0.316)	(0.302)	(0.000)
Public transfers to HH	11531.869	9043.500	2488.369***	7704.892	7574.298	130.594	7719.830	7574.298	145.532
	(9195.811)	(6980.383)	(479.699)	(6555.543)	(7143.280)	(978.472)	(6564.676)	(6960.615)	(0.021)
Per capita annual HH income	11024.918	8874.297	2150.622***	9397.878	8522.738	875.141	8787.246	8522.738	264.508
	(6706.715)	(4622.321)	(342.388)	(3567.812)	(3601.007)	(512.393)	(3541.648)	(3508.923)	(0.262)
Less than HS	0.237	0.236	0.002	0.176	0.170	0.006	0.170	0.170	-0.000
	(0.426)	(0.425)	(0.024)	(0.383)	(0.378)	(0.054)	(0.385)	(0.368)	(0.000)
High School	0.645	0.645	0.001	0.794	0.798	-0.004	0.798	0.798	0.000
	(0.479)	(0.479)	(0.027)	(0.406)	(0.404)	(0.058)	(0.412)	(0.393)	(0.000)
More than HS	0.117	0.120	-0.003	0.029	0.032	-0.003	0.032	0.032	-0.000
	(0.322)	(0.325)	(0.018)	(0.170)	(0.177)	(0.025)	(0.180)	(0.172)	(0.000)
New worker	0.001	0.025	-0.024***	0.000	0.011	-0.011	0.000	0.011	-0.011
	(0.034)	(0.156)	(0.005)	(0.000)	(0.103)	(0.010)	(0.000)	(0.101)	(1.006)
Student before	0.000	0.002	-0.002	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.045)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(.)
Years of FT experience	13.333	8.444	4.889***	5.272	4.738	0.533	5.233	4.738	0.495
	(11.867)	(8.969)	(0.618)	(6.879)	(6.351)	(0.948)	(7.236)	(6.188)	(0.236)
Years of PT experience	2.185	1.428	0.757**	1.336	1.429	-0.092	0.802	1.429	-0.627
	(4.848)	(3.259)	(0.246)	(3.322)	(4.012)	(0.525)	(2.404)	(3.909)	(1.908)
Years of unemp. experience	1.789	1.767	0.022	0.757	1.071	-0.314	0.828	1.071	-0.243
	(2.891)	(2.741)	(0.161)	(1.715)	(2.239)	(0.284)	(1.819)	(2.182)	(0.659)
Weekly working hours	3.692	6.737	-3.045***	1.601	3.811	-2.211*	1.980	3.811	-1.831
	(7.568)	(9.280)	(0.465)	(5.005)	(7.823)	(0.931)	(5.988)	(7.623)	(2.817)
Gross monthly labor earnings	171.733	241.933	-70.200**	54.948	73.851	-18.903	66.029	73.851	-7.822
	(376.217)	(378.960)	(21.345)	(154.590)	(178.233)	(23.783)	(183.447)	(173.675)	(0.073)

Note: Balanced panel 2000-2007. In parentheses, standard deviations in each group, standard error for the differences between groups and F-statistics for the difference in the case of the matched weighted sample.

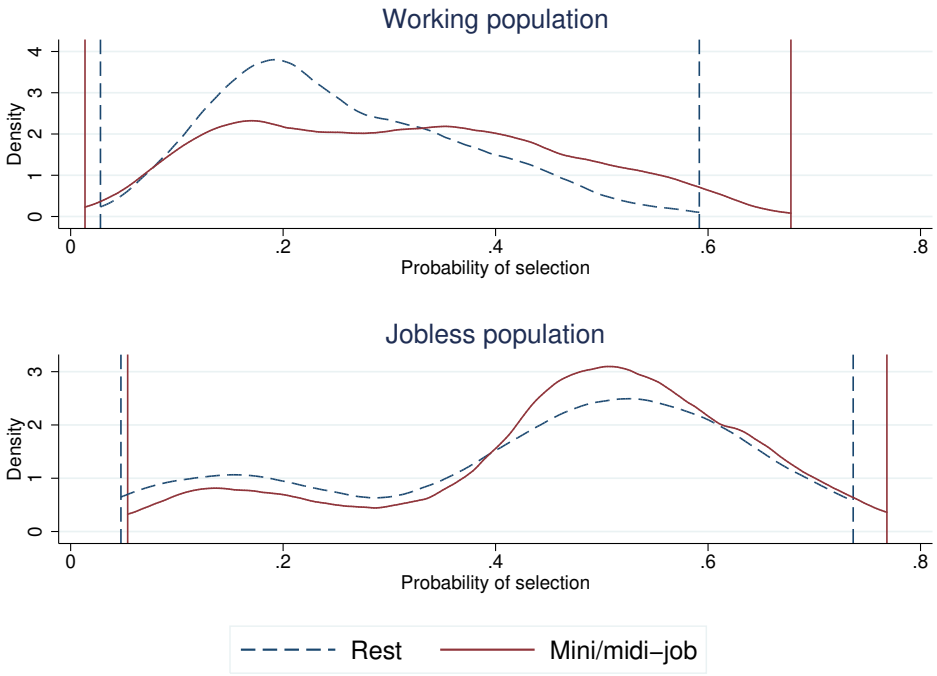
2.E Propensity score for matching

Figure 2.E1: Density of the probability of selection in the original sub-samples



Note: Vertical lines correspond to the limits of predicted probability in the matched sample.

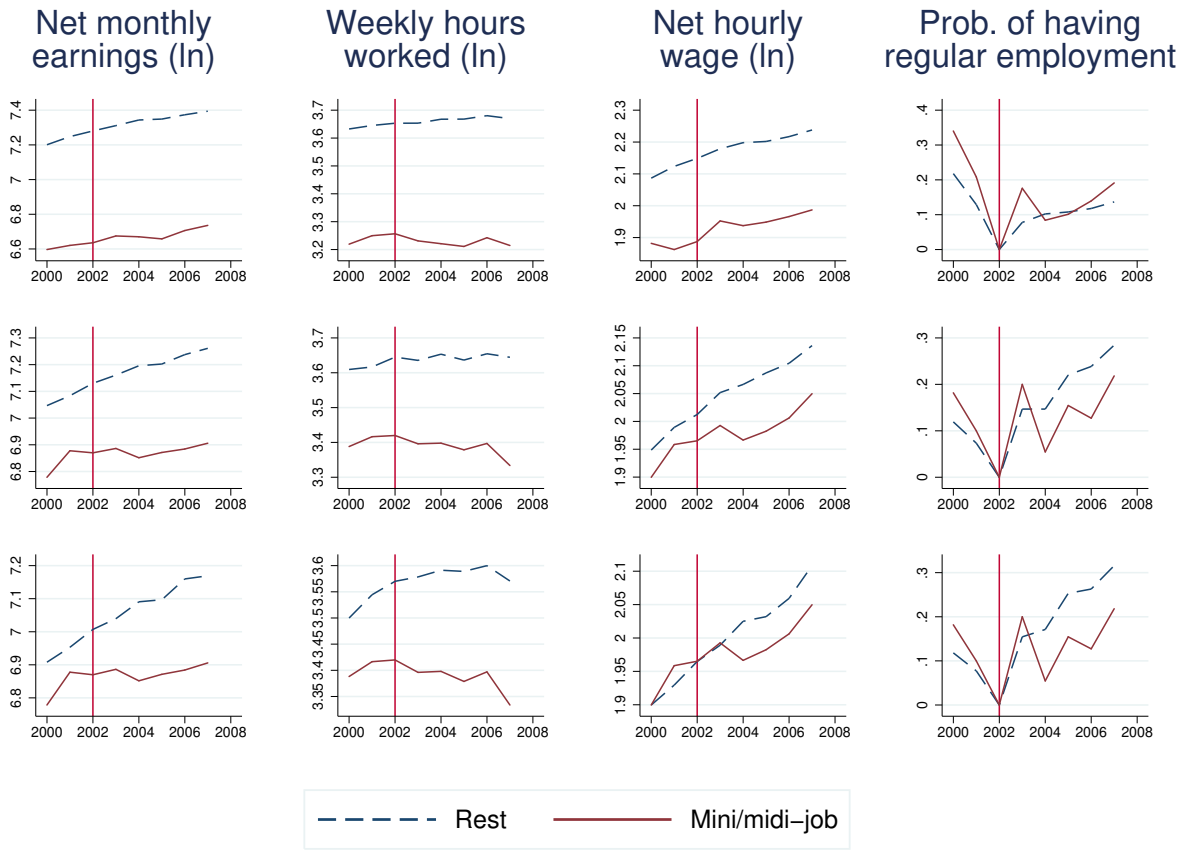
Figure 2.E2: Density of the probability of selection in the matched sub-samples



Note: Vertical lines correspond to the limits of predicted probability in the matched sample.

2.F Evolution of outcomes. Matching strategy

Figure 2.F1: Evolution of the outcomes



Note: Outcomes in columns. Net monthly earnings, weekly hours of work and net hourly wage correspond to working population; probability of holding regular employment, to jobless population. First row: original sample. Second row: matched sample. Third row: matched sample with matching weights.

2.G Heterogeneity of effects. Matched sample

Table 2.G1: Heterogeneity of effects of holding mini and midi-jobs. Panel 2000-2007

VARIABLES	Net monthly earnings (ln)	Weekly hours worked (ln)	Net hourly wage (ln)	Prob. of regular job
Mini-job	-0.10*	-0.13***	0.02	
	(0.056)	(0.045)	(0.040)	
Midi-job	-0.05	0.02	-0.05	
	(0.058)	(0.073)	(0.078)	
Mini-job*MJ before	0.22**	0.14	-0.19**	
	(0.101)	(0.269)	(0.083)	
Midi-job*MJ before	0.22	0.20*	0.01	
	(0.162)	(0.119)	(0.132)	
Adjusted R-squared	0.13	0.08	0.04	
Mini-job	-0.15**	-0.14*	-0.03	
	(0.073)	(0.074)	(0.045)	
Midi-job	0.02	0.12	-0.11	
	(0.106)	(0.111)	(0.091)	
Mini-job*Female	0.13	0.06	0.03	
	(0.095)	(0.103)	(0.073)	
Midi-job*Female	-0.07	-0.11	0.06	
	(0.119)	(0.136)	(0.122)	
Mini-job, lag				0.11
				(0.124)
Midi-job, lag				0.19**
				(0.083)
Mini-job, lag*Female				-0.07
				(0.140)
Midi-job, lag*Female				-0.28***
				(0.106)
Adjusted R-squared	0.12	0.07	0.04	0.30
Mini-job	-0.16**	-0.17**	-0.05	
	(0.063)	(0.074)	(0.045)	
Midi-job	0.01	-0.03	0.02	
	(0.063)	(0.072)	(0.094)	
Mini-job*Under35	0.23**	0.17*	0.12	
	(0.091)	(0.094)	(0.079)	
Midi-job*Under35	-0.07	0.20	-0.18	
	(0.107)	(0.124)	(0.122)	
Mini-job, lag				0.08
				(0.108)
Midi-job, lag				-0.11
				(0.148)
Mini-job, lag*Under35				-0.01
				(0.125)
Midi-job, lag*Under35				0.19
				(0.165)
Adjusted R-squared	0.13	0.08	0.04	0.30
Mini-job	-0.11**	-0.12*	-0.04	
	(0.053)	(0.067)	(0.043)	
Midi-job	0.00	0.06	-0.05	
	(0.056)	(0.077)	(0.078)	
Mini-job*East	0.18*	0.10	0.14	
	(0.102)	(0.082)	(0.091)	
Midi-job*East	-0.10	-0.09	-0.00	
	(0.146)	(0.128)	(0.134)	
Mini-job, lag				0.07
				(0.068)
Midi-job, lag				0.12
				(0.090)
Mini-job, lag*East				-0.01
				(0.080)
Midi-job, lag*East				-0.23**
				(0.113)
Adjusted R-squared	0.12	0.07	0.04	0.30
Observations	7,018	7,223	7,001	1,310
Number of indiv.	1,039	1,039	1,039	205

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

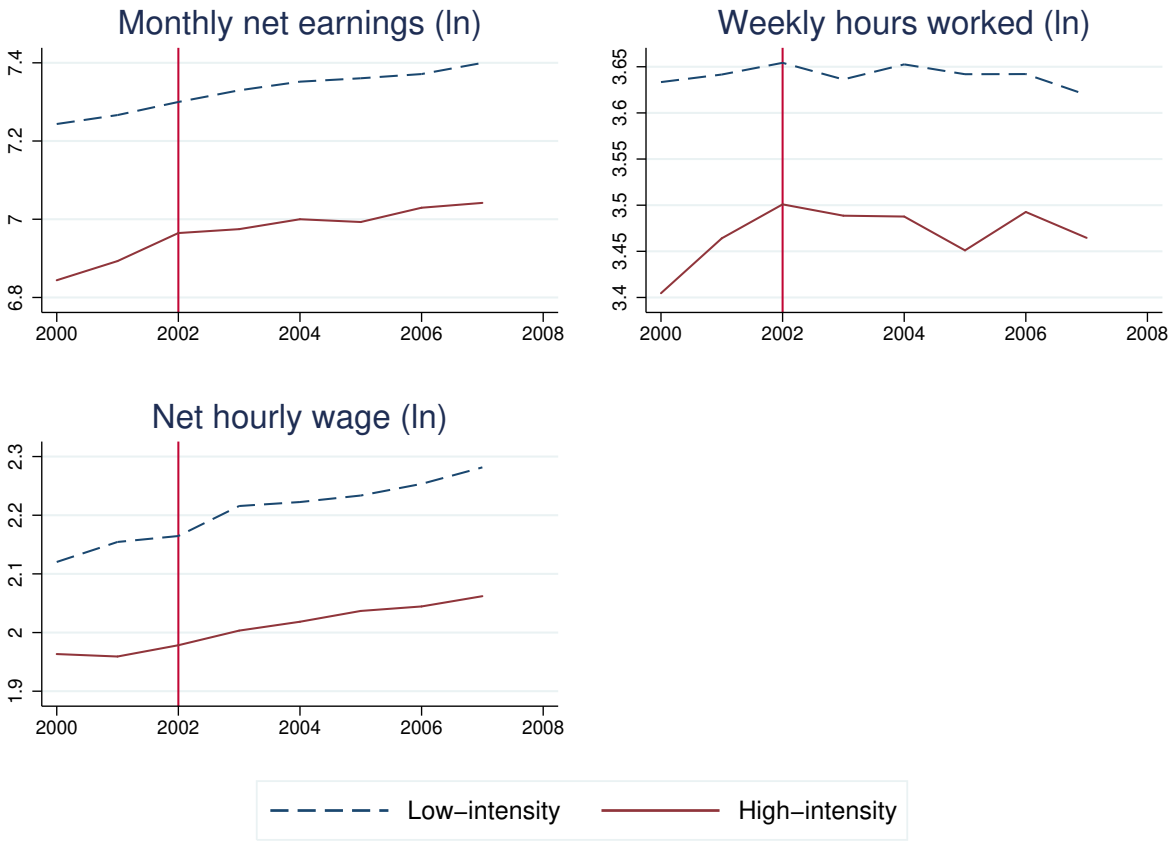
Table 2.G2: Heterogeneity of effects of holding mini and midi-jobs. Panel 2000-2007

VARIABLES	Net monthly earnings (ln)	Weekly hours worked (ln)	Net hourly wage (ln)	Prob. of regular job
Mini-job	-0.06	-0.13**	0.02	
	(0.050)	(0.055)	(0.036)	
Midi-job	-0.02	-0.00	-0.02	
	(0.057)	(0.065)	(0.071)	
Mini-job*Single w. child.	-0.07	0.49**	-0.45***	
	(0.216)	(0.198)	(0.149)	
Midi-job*Single w. child.	0.05	0.36*	-0.23**	
	(0.164)	(0.187)	(0.103)	
Mini-job, lag				0.06
				(0.057)
Midi-job, lag				0.08
				(0.083)
Mini-job, lag*Single w. child.				-0.03
				(0.079)
Midi-job, lag*Single w. child.				-0.14
				(0.121)
Adjusted R-squared	0.12	0.09	0.05	0.30
Mini-job, lag				0.03
				(0.051)
Midi-job, lag				0.08
				(0.073)
Mini-job, lag*Unemployed				0.30*
				(0.182)
Midi-job, lag*Unemployed				-0.54***
				(0.139)
Adjusted R-squared	0.12	0.07	0.04	0.30
Mini-job	-0.07	-0.09	-0.02	
	(0.051)	(0.058)	(0.040)	
Midi-job	-0.04	-0.02	-0.05	
	(0.058)	(0.063)	(0.078)	
Mini-job*Secondary	-0.02	-0.11	0.11	
	(0.161)	(0.148)	(0.171)	
Midi-job*Secondary	0.18	0.49***	-0.06	
	(0.107)	(0.187)	(0.146)	
Mini-job, lag				0.10
				(0.068)
Midi-job, lag				0.02
				(0.091)
Mini-job, lag*Secondary				-0.12
				(0.100)
Midi-job, lag*Secondary				0.14
				(0.160)
Adjusted R-squared	0.12	0.08	0.04	0.30
Mini-job	-0.19	-0.23	0.23	
	(0.334)	(0.380)	(0.199)	
Midi-job	0.03	0.06	0.23	
	(0.635)	(0.523)	(0.158)	
Mini-job*High-school	0.12	0.13	-0.27	
	(0.337)	(0.385)	(0.202)	
Midi-job*High-school	-0.04	-0.01	-0.27	
	(0.637)	(0.528)	(0.173)	
Mini-job*More than HS	0.19	0.12	-0.12	
	(0.393)	(0.388)	(0.242)	
Midi-job*More than HS	-0.14	-0.02	-0.41**	
	(0.642)	(0.525)	(0.193)	
Mini-job, lag				-0.00
				(0.051)
Midi-job, lag				0.11
				(0.158)
Mini-job, lag*High-school				0.09
				(0.077)
Midi-job, lag*High-school				-0.06
				(0.176)
Adjusted R-squared	0.12	0.07	0.04	0.30
Observations	7,018	7,223	7,001	1,310
Number of indiv.	1,039	1,039	1,039	205

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.H Evolution of outcomes. Intensity of treatment

Figure 2.H1: Evolution of the outcomes



Chapter 3

Intergenerational correlation of employment: Is there a role for work culture?

joint with David Koll and Lukas Mayr

3.1 Introduction

The intergenerational correlation of labor market outcomes has been subject of interest among both academics and policy makers for several decades. As a key determinant of socio-economic mobility, the correlations of earnings between subsequent generations has received particular attention. Correlations are typically estimated by regressing the earnings of workers on those of their parents, limiting the sample to individuals and periods for which earnings are observed, i.e. only observations corresponding to employment periods (see e.g. the pioneering studies Solon, 1992; Zimmerman, 1992). This literature typically focuses on the *earnings* of individuals, capturing skills, effort and other dimensions of individual merit once the person is in employment. The present paper focuses instead on a different type of intergenerational correlation: the correlation of the *employment status* between two consecutive generations. We argue that it provides important information for understanding intergenerational links in employment decisions, i.e. the extensive margin of labor supply.

This paper formalizes the intergenerational link of the decisions to work as a combination of factors including productivity (human capital and ability), which is a key determinant of the intergenerational transmission of earnings, and a residual correlation which we interpret as an

intergenerational transmission of preferences for work. Intuitively, more able and educated individuals tend to have stronger incentives to work due to better market wages. They also have more resources to invest in their offspring's education. Their successors will likely be more able due to genetics, and be endowed with a higher human capital, increasing their economic motivation to work. In this paper, we show that there is an additional element generating a positive correlation of employment status across generations. Our evidence suggests that this element may capture what we refer to as *work culture*, understood as the transmission of preferences for work through social interactions across generations (Bisin and Verdier, Palgrave 2008).

We build a theoretical framework of two generations inspired by Solon (1999) in which parents are heterogeneous in productivity and disutility for work. Generations are linked through correlated innate abilities and parental human capital investment for children. We introduce endogenous labor supply decisions and intergenerational transmission of disutility from work. The solution of the model yields an intergenerational equation of employment status that relates labor supply of children and parents. After partialling out ability and human capital, the remaining intergenerational correlation of employment status represents transmission of preferences for work. The transmission of preferences plays a role that goes beyond the human capital and ability mechanisms discussed in the literature on the persistence of earnings.

We obtain evidence in support of this mechanism using data from the NLSY79 and NLSY79 Children and Young Adults and estimate the intergenerational equation derived from the model. We focus on relationships between mothers and children. Since there is more variation in female labor supply than in male labour supply, the focus on mothers is particularly suitable in the context of this study. We construct a representative sample of mothers born in the US between 1957 and 1964, and their children. Exploiting the longitudinal structure of the data, we first estimate the permanent component of employment status along the life-cycle for both, mothers and children. This permanent component measures the fraction of years the individual is employed during her active life. The information comprised in this component is different from the permanent component of earnings, which is only based on periods of employment when earnings are effectively observed. In our approach, we focus on information on the labor supply decisions at the extensive margin.[1]

We find robust support for a statistically significant and positive correlation of employment status. On average, an increase in lifetime employment of mothers by 5 years increases the

[1]Strictly speaking, labor supply corresponds to labor force participation, including both employment and unemployment. However, we do not include unemployment mainly due to the lack of information for the children's cohort. Furthermore, the empirical distinction between unemployment and inactivity is not clear cut.

employment of her child by more than 1 year. After netting out the effect via productivity and other observable factors, the incremental employment for children is two thirds of a year. The residual correlation after partialling out potential labor and non-labor income is consistent with a preference transmission mechanism according to the model.

To rule out alternative explanations for this residual correlation, such as the effect of networks, specific human capital or local labor markets, we look at heterogeneity in the intergenerational correlation of employment across mothers-children pairs that share businesses, occupations or local labor markets. The lack of difference across groups indicates these explanations are unlikely to drive the intergenerational correlation of employment status.

In general, results seem to suggest an intergenerational transmission of work preferences that operates through the parental employment behavior or *role model*. There is a stronger correlation of employment status between mothers and daughters than between mothers and sons. This difference advocates in favor of a role model channel since role models tend to be more pronounced within genders. The channel though appears to exceed a mere transmission of gender roles as the correlation, though lower, is still significant between mothers and sons. Importantly, the correlation is higher for the lower tail of the income distribution, a relevant feature for policy design. We also show that the correlation of employment status is more pronounced during periods in which mothers cohabit with their children. Cohabitation increases the possibility of emulation.

The intergenerational transmission of preferences for work bears important implications for the dynamic effects of economic and social policies that affect labor market participation. The design of programs such as income support and in-work benefits —earnings supplements for low income workers— that affect the labor participation decision of the current generation, should take into account the effects on future generations via changes in preferences for work. This is particularly relevant in the context of US. The Earned Income Tax Credit (EITC) provides incentives for women to work as opposed to depend on welfare benefits. Our paper shows that women have the capability to act as role models by shaping the preferences for work of their children. A fair calculation of the costs-benefits of this particular policy for instance should factor in the effect on the generations to come.

Related literature

Most of the academic discussion around the intergenerational correlation of labor market outcomes has revolved around the intergenerational persistence of earnings (for reviews see Solon, 1999; Black and Devereux, 2011; Björklund and Jäntti, 2011) in an attempt to measure socio-economic mobility. The most widely explored explanations for these intergenerational correlations are correlated abilities and investment in human capital (see e.g. Bowles and

Gintis, 2002).[2] Early work has concentrated on measurement issues of earnings' persistence (see e.g. the seminal studies Solon, 1992; Zimmerman, 1992). By now, the existence of a substantial correlation of earnings has been documented as a robust fact for several countries.[3] Intergenerational correlations of other labor market outcomes typically studied include hours (see e.g. Toledo, 2010; Mulligan, 1997; Couch and Dunn, 1997) and occupations (Lo Bello and Morchio, 2016; Knoll et al., 2017). Our paper contributes to the broad literature on intergenerational correlations by providing evidence on a different labor market outcome, namely the employment status. We argue that this correlation, which remains significantly positive after controlling for the classical transmission channels of productivity, sheds light on preferences for work via the extensive margin of the labor supply decision.

Several recent papers measure the intergenerational correlation of non-employment or unemployment, an outcome closely related to employment status which is the focus of our paper. These studies document positive and causal relationships between unemployment experiences of fathers and children. See e.g. Macmillan (2011) with data for UK,[4], Oureopoulos et al. (2008) for Canada, and Mäder et al. (2015) for Germany. Although our findings are consistent with this general result, our approach differs in several dimensions. Contrary to previous studies, we focus on maternal employment status, which helps to shed light on the transmission of work culture. Since males typically have a lower elasticity of labor supply, labor demand factors are likely to play a relatively larger role in the unemployment experiences of men. Hence children with unemployed fathers are potentially affected by the psychological cost of job loss or stigma rather than the role model channel. Female labor force participation is lower than male participation, suggesting that non-employment spells of females might be more often the result of labor supply decisions. More generally, the focus on labor supply allows to interpret the correlation in employment status as informative about the transmission of preferences for work.

Another related labor market outcome that has been studied in the existing literature of intergenerational transmission is welfare reception. Dahl et al. (2014) show a positive effect of parents' disability insurance reception on children's claim for the same benefit in Norway by

[2]There is a vast literature on the intergenerational correlations of ability and education. See e.g. Black et al. (2009); Anger and Heineck (2010); Björklund et al. (2010); Grönquvist et al. (2017) for ability; Hertz et al. (2008); Heineck and Ripahn (2009); Pronzato (2012) for education. Other channels of intergenerational persistence of earnings include wealth transfers and the family background (Black and Devereux, 2011).

[3]For the US, the intergenerational elasticity of earnings is estimated around 0.5 (Corak, 2016). Using tax records, Mazumder (2005) computes an intergenerational elasticity of 0.6 or higher, and more recently Chetty et al. (2014) provide an estimation of 0.45 (0.34 when using rank-rank regressions), with substantial heterogeneity across geographical areas. Davis and Mazumder (2017) and Blanden et al. (2013) show that the intergenerational mobility declined during the last half century, both in US and UK.

[4]Lo Bello and Morchio (2014) provide evidence of positive correlation between employed fathers and job finding probabilities for sons for UK. The correlation is stronger for those pairs that share the same occupation. They interpret this finding as informational advantages of sons in the labor market.

exploiting random assignment to judges of appeals after rejection. Exploiting a reduction in the coverage of the disability insurance in 1993 in the Netherlands with an age discontinuity, Dahl and Gielen (2018) document similar results. Hartley et al. (2017) report a substantial effect of maternal welfare receipts in the US on their daughters' welfare receipts, attenuated by the mid-nineties' reform which was intended to reduce welfare dependence. Corak et al. (2000) provide evidence of a positive correlation in unemployment insurance claims between fathers and sons both in Canada and Sweden. Although the transmission of preferences for work is an alternative explanation for these results, they can also be attributed to other factors such as the transmission of stigma or information about welfare benefits.[5] Furthermore, welfare dependence is not one-to-one related to non-employment. A jobless individual may receive other sources of non-labor income for her support, such as family transfers.

Another connected strand of literature studies the transmission of cultural traits or preferences across generations. Fernandez (2007) and Fernandez and Fogli (2009) document that the labor force participation of second generation migrant women in the US is related to the female labor force participation in the country of origin of their mothers. She interprets these results as evidence of a causal effect of culture, as second generation migrant women are exposed to the same economic environment but differ in the culture of ancestry. Fernandez (2013) proposes intergenerational learning about the returns to female work as one of the factors driving the pronounced growth in female labor force participation during the second half of the 20^{th} century. She shows that a model in which the current generation learns about the return to working from the average of the previous generation describes well the empirical evolution of the female labor force participation. In a related work, Olivetti et al. (2016) exploit the availability of both intergenerational links and information on peers in adolescence in a data-set for the US to show that women gender norms or work behavior is shaped during adolescence by observing both their mother and their friends' mothers.[6] While these papers also consider the transmission of preferences for work across generations, the level at which preferences are formed are different. Fernandez (2007) and Fernandez and Fogli (2009) deal with social preferences, from the country of origin or the average within one cohort, and Olivetti et al. (2016) do not limit attention to mother-child interactions but include also the interaction of children with mothers of peers. Our paper instead investigates specifically individual preferences that are transmitted from a mother to her offspring. As yet another difference, these papers focus on the formation of *gender roles* by intergenera-

[5] Dahl et al. (2014) document important peer effects within the work place and the family magnifying social programs' participation, which favors the interpretation of the transmission of information underlying the persistence of welfare dependence.

[6] Olivetti et al. (2016) analyze correlations in hours worked either in the current or the most recent job, focusing explicitly on the intensive margin of the labor supply decision. In our paper we are instead interested in the extensive margin.

tional interactions, whereas our paper instead finds that the maternal *employment status* is important both for sons and daughters, even after controlling for the influence of paternal status. We thus study children's imitation of their parents' working behavior.[7]

The studies most closely related to ours are those which infer the presence of transmission of preferences for work from observed labor market outcomes. Toledo (2010) proposes the transmission of preferences for work as an explanation for the intergenerational correlation of working hours. He documents a non-negligible correlation using PSID data,[8] and incorporates this and other intergenerational correlations into a model of intergenerational transmission of leisure preferences, human capital and wealth. Altonji and Dunn (2000) use a similar structural approach to uncover correlations in preferences for work. They estimate a model of earnings determination which decomposes the correlation in observed labor market outcomes in factors related to wages and factors related to preferences. The estimation of the model uses data from the NLS for US. Both Toledo (2010) and Altonji and Dunn (2000) find that transmission of preferences for work are the main drivers of intergenerational correlations in hours worked while the intergenerational persistence of workers' productivity or wages are the main determinants of the earnings correlations. The main difference to our paper is that these studies focus on preferences for hours worked, i.e. the intensive margin of the labor supply. We are interested instead in the participation decision, i.e. the extensive margin of labor supply, and therefore focus on employment status rather than hours worked. Moreover, we introduce a direct measurement of ability and human capital to capture potential wages, whereas these studies proxy potential wages with observed wages that are endogenous to the labor supply decision. Furthermore, we provide a discussion of the role model channel underlying the preference transmission given its relevance for tax and transfer policies.

Addressing the role model channel behind the preference transmission, Mulligan (1997) discusses the presence of work ethic in the US by measuring correlations in unemployment duration, hours, and welfare participation using the PSID. We follow a similar empirical approach in this paper. The main difference is that our study focuses on mother-children pairs, as maternal employment is more likely to be influenced by supply-side factors than paternal employment. Moreover, we do not rely on measures of wage and income to model the human capital and unobserved ability channels. Instead, we control directly for these

[7] Other work dealing with preference transmission is Baron et al. (2009), which correlates declared views and perceptions about welfare benefits and effort in Australia, used as proxies for youth's and mothers' latent attitudes. Although findings are in line with the results in this paper (children seem to favor work culture when mothers work), we consider reported perceptions are not reliable as they often correspond more closely to perceptions about correct answers rather than actual beliefs or behaviors.

[8] Point estimations are similar to the values found here with respect to employment status, however in Toledo (2010) they are imprecise and not statistically significant.

factors taking advantage of our richer data-set.[9] Mulligan (1997)'s evidence for an intergenerational persistence in work attitudes and role model explanation is consistent with our findings.

Finally, the preference transmission mechanism that is the focus of our paper is inspired by the theoretical literature on the intergenerational transmission of cultural traits. Bisin and Verdier (2001) propose a model in which parents transmit preferences to children via socialization decisions, i.e. contacts inside the family (vertical socialization) or with the rest of the society (oblique socialization). Parents make a rational decision on the type of socialization they provide to their children to induce desired preference traits. Doepke and Zillibotti (2008) and Doepke and Zillibotti (2016) also consider preference transmissions across generations. These studies focus on parents' deliberate actions to shape children's preferences, either through specific socialization or investment decisions, or through other types of paternalistic actions. Instead of studying how parents deliberately influence their children's preferences, we study the (potentially) unintended transmission of preferences that arises from the labor supply decisions of parents.

The reminder of the paper is structured as follows. In Section 2 we present a simple model and derive an equation of intergenerational transmission of employment status. Section 3 discusses the methodology and the data used to estimate the intergenerational correlation of employment status. The estimates and discussion of alternative explanations are presented in section 4. Section 5 provides additional evidence for a role model channel. Section 6 presents robustness checks, and section 7 concludes.

3.2 Model

In this section we build a simple two generations model based on the canonical framework by Solon (1999). We introduce endogenous labor supply and a mechanism of transmission of preferences for work. We use the model to derive an equation of intergenerational correlation of labor participation, which we estimate in section 3.3.

[9] Our implementation differs in some other minor aspects from Mulligan (1997). He uses the PSID, which comprises a smaller sample with intergenerational linkages than the NLSY79. Furthermore, he uses four year averages for fathers and children, with potential biases due to transitory fluctuations and life-cycle discrepancies across generations.

3.2.1 The Environment

There is a continuum of families, each consisting of one parent and one child.[10] Generations are indexed by $k \in \{0, 1\}$ for parents and children, respectively. Parents are altruistic but discount their child's expected utility by a factor $\alpha \in [0, 1)$. They decide on consumption c_0, labor supply l_0 and on human capital investment for their child H. Children also decide on consumption c_1 and labor supply l_1, whereas they do not have an offspring and hence do not invest in human capital. Agents are heterogeneous in ability e_k and disutility from labor θ_k.[11] Abilities are correlated across generations accounting for genetic inheritance.

The parents' optimization problem is given by

$$\begin{aligned} V_0(\theta_0, e_0, v_0) = \max_{c_0, l_0, H} & \frac{c_0^{1-\sigma}}{1-\sigma} - \theta_0 \frac{l_0^{1+\chi}}{1+\chi} + \alpha E_0 V_1(\theta_1, w_1) \\ \text{s.t.} \quad & c_0 + pH = w_0 l_0 \\ & \log(w_0) = \log(e_0) + v_0 \\ & \log(\theta_1) = \kappa_0 - \kappa_1 \log(l_0) + \eta_1. \end{aligned} \tag{3.1}$$

We assume that utility is additively separable in consumption and labor. The parameter $\sigma > 0$ is the coefficient of relative risk aversion and $\chi > 0$ is the inverse of the Frisch elasticity of labor supply. Parents finance consumption c_0 and investment in their child's human capital H, a unit of which costs p, by labor earnings $w_0 l_0$.[12] The wage of the parent is determined through ability e_0 and a random term v_0 which captures labor-market luck.

The last equation (3.1) is the process of intergenerational transmission of preferences for work. Children's disutility from labor, θ_1, (potentially) depends on the parental labor supply decision l_0, through a parameter κ_1. A value of κ_1 different from 0 means that parents' labor supply has an effect on children's preferences for work. We do not impose any prior on the direction of the effect. If $\kappa_1 > 0$, the more parents work, the less children dislike working, and the opposite for $\kappa_1 < 0$. If $\kappa_1 = 0$, parental employment does not have any influence on children's preferences for work. The parameter η_1 is an idiosyncratic preference shock. It is worth noting that we do not include a direct effect of θ_0 on θ_1 in this formulation to be able to derive a parsimonious inter-generational equation for employment status. We discuss the

[10] The exposition of the model uses the word parent for the sake of generality, but we use mothers in the empirical implementation due to the higher variation in maternal labor supply.

[11] Whereas differences in productivity among children are captured explicitly by both e_1 (ability) and H (education), e_0 represents for parents a combination of abilities and education, the latter not being modelled.

[12] Savings are not included in the model to ease the derivation of a parsimonious intergenerational equation. Empirically, we control for wealth to mitigate concerns about this exclusion.

implication of this assumption later.

Similarly, the child's optimization problem is given by

$$\begin{aligned} V_1(\theta_1, w_1) = & \max_{c_1, l_1} \frac{c_1^{1-\sigma}}{1-\sigma} - \theta_1 \frac{l_1^{1+\chi}}{1+\chi} \\ \text{s.t.} \quad & c_1 = w_1 l_1 \\ & \log(w_1) = \log(e_1) + \psi \log(H) + v_1 \\ & \log(e_1) = \lambda \log(e_0) + u_1. \end{aligned}$$

Children finance their consumption with labor earnings. Wages w_1 of children depend on their ability e_1, on the acquired human capital H (which has a return ψ), and v_1 which captures labor-market luck. The last equation states that ability is partially inherited. To be specific, parent's and child's ability are linked via an AR(1) process with persistence $\lambda \in (0, 1)$.

3.2.2 The Solution

In order to perform our empirical tests below, it suffices to solve the children's problem. To be specific, we take parental decisions and realizations of shocks as given. The first order condition for labor supply l_1 can then be written as

$$\log(l_1) = -\frac{1}{\sigma + \chi} \log(\theta_1) + \frac{1-\sigma}{\sigma + \chi} \log(w_1).$$

We can substitute for $\log(\theta_1)$ and $\log(w_1)$ and obtain the main equation of this paper,

$$\log(l_1) = \alpha + \beta \log(l_0) + \gamma \log(e_0) + \delta \log(H) + \epsilon. \tag{3.2}$$

This inter-generational equation relates children's and parents' labor supply decision, partialling out parents' ability and human capital investment. The coefficients α, β, γ and δ, which we will estimate in section 3.3, are functions of structural model parameters. Specifically, the intercept α is given by

$$\alpha = \frac{(1-\sigma)\bar{e} - \kappa_0}{\sigma + \chi}$$

Our main coefficient of interest

$$\beta = \frac{\kappa_1}{\sigma + \chi},$$

captures the transmission of preferences across generations. It has the same sign as κ_1, which determines how parent's labor supply translates into children's attitude towards work.

The coefficient on parental ability and human capital investment are given by, respectively,

$$\gamma = \frac{1-\sigma}{\chi + \sigma}\lambda$$

and

$$\delta = \frac{1-\sigma}{\chi + \sigma}\psi.$$

Finally, the error term ϵ depends on the structural shocks of the model,

$$\epsilon = \frac{(1-\sigma)(u_1 + v_1) - \eta_1}{\sigma + \chi}.$$

Equation (3.2) provides an empirical test for the presence of preference transmission. If β is not significantly different from 0, there is no transmission of preferences for work and all the correlation in labor supply decisions is explained by productivity. If β is statistically different from 0, the model suggests a role for work culture or transmission of preferences for work. The sign of β is informative about the type of transmission: $\beta > 0$ suggests child's disutility from work decreases with parental labor supply, and the opposite for $\beta < 0$.

Understanding the source of intergenerational transmission of preferences for work is important for policy implications. If there is a direct effect of l_0 on θ_1, a policy that subsidizes work

(e.g. an in-work benefit) would affect the following generation by reducing the disutility from work and encouraging labor participation. If, on the other hand, β only captures the effect of pure intergenerational correlation of preferences, independent of the labor supply decision of the current generation, such a policy would be ineffective in changing the preferences and work behavior of future generations. While our model does not allow to disentangle the source of intergenerational preference transmission, in the empirical exercise that follows we provide suggestive evidence that there is a direct effect of parents' labor supply on children's preferences for work, i.e. a role model effect.

Note that in the model l_0 and l_1 are continuous variables although we focus on the extensive margin of labor supply. The reason is that l_0 and l_1 describe accumulated employment over the whole life-cycle.

3.3 Data and Empirical Strategy

In this section we describe the data used and the empirical methodology. Furthermore, we discuss the measurement challenges identified by the literature on intergenerational correlations, and how the data helps to overcome these limitations.

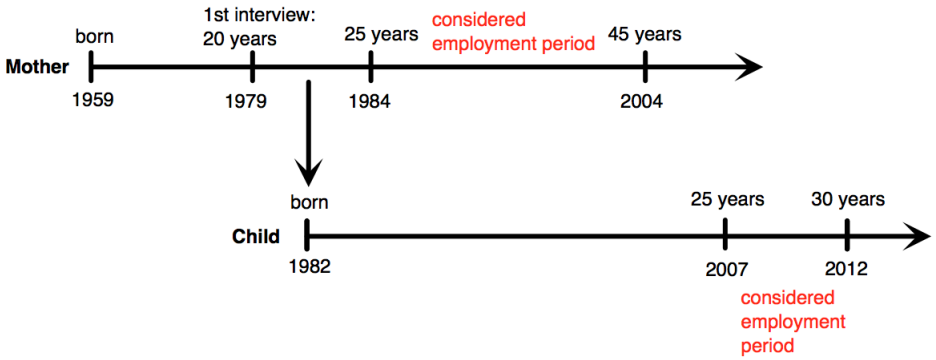
3.3.1 Data

We use the NLSY79 and NLSY79 Children and Young Adults. The NLSY79 surveys a representative sample of 12,686 individuals born in the US between 1957 and 1964. Respondents are 14-22 years old in 1979 and are followed until 2012, when they are 47-56 years old. The frequency is annual between 1979 and 1994, and biannual thereafter. The children of the women in this cohort are followed on a biannual basis since 1986 by the NLSY79 Children and Young Adults, and are linked to the original cohort by a unique identifier provided by the US Bureau of Census. As of 2012, more than 10,000 out of the 11,512 children born from these mothers have been interviewed in at least one survey round. The fact that children are linked to their mothers suits our objective of considering the extensive margin of the labor supply decision since female labor supply is known to be more elastic than male labor supply.

The NLSY79 consists of three sub-samples: (1) the cross-sectional sample (6,111 individuals) is a representative sample of the US population in 1979, (2) the supplemental sample (5,295 individuals) over-samples disadvantaged groups (Hispanic or Latino, black and poor people), and (3) the military sample (1,280 individuals) over-samples the population participating in

the army. We only use the cross-sectional sample to avoid using stratification weights. We further restrict the observation window for employment status to mothers and children of age 25-45 in order to maximize the length of the sample while keeping its representativeness regarding lifetime experience.[13] From the 3,040 women in the cross-sectional sample, we obtain a final sub-sample of 1,373 mothers paired to 2,339 children. Figure 3.31 provides an example for a mother-child pair in the data.

Figure 3.31: Visualization of an exemplary mother-child pair



These data provide a measurement of ability, one important variable in equation (3.2). For the 1979 cohort, the Armed Services Vocational Aptitude Battery (ASVAB) is collected around 1980, when mothers are between 15 and 23 years old. The scores correspond to the Armed Force Qualification Tests (AFQT), which is a composite of test results in arithmetic reasoning, word knowledge, paragraph comprehension and numerical operations.[14] Similar measures of cognitive abilities are collected for the children cohort since 1986. In particular, we use the latest measurement for each child of the Peabody Individual Achievement Test (PIAT) for Math, considered the most appropriate measure of ability among the test-scores available in the data for the younger cohort (Abott et al., 2013)).[15]

Table (3.31) provides descriptive statistics of the data. The last four columns refer to the sample of mothers and their children, and the first shows characteristics of the total sample of women in the NLSY79 cohort for reference. All monetary values are deflated with the Consumer Price Index with basis in 1980.

Mothers are observed an average of 14 waves, and children in 2.5 waves (distributions of number of interviews are in Figure (3.B1) in the Appendix). Average age is 33 years old for

[13] The oldest child in 2012 is 38 years old.

[14] We use the version of the AFQT revised in 2006 to control for differences in cohorts within the NLSY79.

[15] It has been argued that these measures capture not only genetic ability, which is the variable included in the model, but also some components of scholastic skills. As we are interested in the correlation of employment after controlling for productivity derived both from ability and education, this does not affect our analysis.

Table 3.31: Summary statistics for women and mother-children pairs in NLSY79

	Women NLSY79		Mothers		Children	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age	32.9	1.67	33.2	1.01	27.3	1.58
Female					50%	0.500
White	80%	0.403	74%	0.440	73%	0.446
Black	13%	0.337	18%	0.382	19%	0.391
Migrant	5%	0.208	5%	0.209		
Married/cohabiting	67%	0.469	77%	0.419	33%	0.471
Number of children	1.9	1.36	2.6	1.19	1.2	1.32
Northeast	18%	0.383	14%	0.343	12%	0.323
Northcentral	28%	0.451	30%	0.458	29%	0.456
South	37%	0.482	39%	0.489	42%	0.493
West	17%	0.377	17%	0.376	17%	0.376
Urban	80%	0.402	75%	0.433	70%	0.460
Father at home					56%	0.496
Maternal age at birth					21.7	3.39
Years of education	13.7	2.57	12.8	2.24	13.4	2.38
High school drop-out	7%	0.251	10%	0.303	12%	0.320
High school complete	40%	0.491	51%	0.500	36%	0.480
Incomplete college	25%	0.435	26%	0.438	28%	0.451
Complete college	28%	0.447	13%	0.339	24%	0.429
Employed	79%	0.272	73%	0.287	84%	0.323
Labor force participation	97%	0.077	81%	0.245		
Hours/week*	37.8	8.31	36.4	8.81	39.6	11.02
Hourly wage*	8.1	8.23	6.7	9.91	6.3	4.00
Earnings*	12,886	9,076	9,750	6,737	13,316	9,812
Public sector*	10%	0.300	9%	0.289	4%	0.197
Private sector*	87%	0.341	86%	0.345	92%	0.270
Self employed*	3%	0.176	4%	0.199	2%	0.145
Family worker*	0%	0.051	0%	0.066	2%	0.129
Percentile cognitive test*	48.8	28.49	39.6	26.87	49.1	27.77
Age when test	18.0	4.04	18.3	4.20	11.6	4.63
Net worth*	55,894	95,917	43,064	81,629	9,551	31,248
Family income*	33,543	35,636	27,226	24,460	26,029	29,060
Family income (parents)*	31,449	60,082	20,348	30,208	28,918	39,911
Family income (own)*	33,203	35,886	27,190	24,512	19,495	17,348
Earnings spouse*	22,897	17,085	19,387	13,173	13,579	11,953
Number of interviews	13.2	3.05	14.1	1.90	2.5	1.22
Observations	3,040		1,373		2,339	

Note: Cognitive tests are AFQT for parents and PIAT Math for children. *: only observations with positive values

mothers and 27 years old for children.

The sample of mothers is representative of women with children by design. Potentially due to the negative relationship between fertility and income, the sample of mothers is less educated and in poorer households than the total sample of women in the NLSY79. Mothers

are on average 22 years old when children in the sample are born, though the maternal age at birth is quite disperse (see Figure (3.B2) in the Appendix). There is an over-representation of younger children by construction, and observations about older children correspond to younger mothers at the time of birth. These compositional features of the sample may partly explain the lower proportion of children married or cohabiting, and the smaller family income or net worth of children.[16] Three fourth of the sample is white and the same proportion comes from urban areas. As expected, children are slightly more educated than mothers.

The data provides answers to different questions that allow to infer employment status. The choice of the particular question for our analysis follows two criteria. First, we maximize the homogeneity of the measurement for the sample of mothers and children. Second, we consider consistency of the questions along the different waves and minimize the item non-response. We consider mothers as employed if they declare they worked for 10 or more weeks in the year before the interview. We categorize children as employed if earnings in the year before the interview were equivalent to two months or more at a minimum salary.[17] These lower bounds for considering employment intend to exclude odd or itinerant jobs. The employment rate is 73% for mothers and 84% for children (80% for daughters). Although they seem high as compared to official statistics of labor force participation, they are not at odds with the annual window of observation we use. Official statistics refer to one week before the interview.

Employed mothers and children work on average 36 and 40 hours a week at an hourly wage of \$7 and \$6, respectively. Earnings amount to \$9,750 and \$13,316 annually. Almost all the sample of workers comes from the private sector. Net worth (assets minus debts) is \$43,064 for mothers and \$9,551 for children, a difference potentially due to the composition of the children's sample explained before, and because parents are mostly alive when children are surveyed and hence there might not be bequests. Average family income is \$27,226 for mothers and \$26,029 for children. The average percentile of maternal cognitive test scores is 40, and it is 49 for children. Mothers take the test when they are 18 years old and children when they are 9.[18]

[16] The composition of the children's sample is also behind the atypical employment age profile as shown in the right panel of Figure (3.B3) in the Appendix. Employment rates decline and become more volatile with age as older children are fewer and belong to younger mothers at birth. The empirical strategy accommodates for this. Furthermore, the dip in the employment rate at the age of 35-36 for children reflects the 2008 crisis, which affected particularly younger cohorts.

[17] The lower bound for earnings corresponds to 20 hours a week (part-time), 9 weeks (2 months) and \$2.5 the hour, hence \$450. Results do not change qualitatively when we use other measures of employment, as shown in section (3.6).

[18] More descriptives are in the Appendix, in Table (3.A1) and Figures (3.B4) and (3.B5).

3.3.2 Empirical strategy

We estimate the first order condition for children's labor supply which we derived from the model,

$$\log(l_{1i}) = \alpha + \beta \log(l_{0i}) + \gamma \log(e_{0i}) + \delta \log(H_i) + \epsilon_i. \tag{3.3}$$

Our coefficient of interest β describes the intergenerational correlation of employment after controlling for the transmission of "earnings potential". Specifically, we control for the fact that wages, a key determinant of the employment decision, are correlated across generations. This correlation of wages is partially a result of (imperfect) intergenerational transmission of inherent ability (such as IQ), partially due to the fact that higher earning parents can afford to invest more in the child's human capital. As is standard in the literature we use AFQT scores to approximate ability e_0, and we measure education H by the number of years the child went to school.

Our measure for accumulated life-time employment is more involved. In particular, we control for the variation of employment over life- and business-cycles. In our model each generation lives only one period (corresponding to her whole life). Hence, these variations are ruled out by construction. In the data, however, we observe that employment rates vary considerably along the life- and business cycle.[19] Formally, we separate the transitory components due to life- and business-cycle from the permanent component by estimating the model

$$l_{kit} = l_{ki} + \sum_{n=1}^{2} \pi_{nk} A_{kit}^n + \lambda_{kt} + \upsilon_{kit} \tag{3.4}$$

for both generations $k \in \{0, 1\}$. Specifically, we assume that the probability l_{kit} of individual i to be employed in year t is a function of a second order polynomial of her age A_{kit} and a year fixed effect λ_{kt}.[20] The individual fixed effect from this regression l_{ki} represents the permanent component of employment status.[21] This permanent component can be understood as the

[19] For example, Figure 3.B3 in the Appendix shows that on average employment for mothers increases until the age of 39, after which it remains approximately constant. By contrast, we do not observe similar increases in children's employment over their life-cycle, which can be partially attributed to the fact that most of these agents were in their early thirties at the outbreak of the Great Recession in 2008.

[20] We use a linear probability model as it is well known that the conditional expected value of the dependent variable is similar when using this specification than when using a more sophisticated non-linear model for binary dependent variables.

[21] As fixed effects are both positive and negative, we add a constant $a = 0.001 + |\min(l_{ki})|$ to the original variable, in order to be able to take the natural logarithm.

proportion of lifetime each individual is in employment. Under the assumption that the observations for each individual are representative of their life-cycle, this is a good measure of the extensive margin of labor supply.[22]

3.3.3 Methodological challenges in the measurement of intergenerational correlations

The data we use feature desirable characteristics for coping with some estimation issues identified in the literature on the intergenerational correlation of earnings. First, Zimmerman (1992) and Solon (1992) show that early estimations based on single-year measures of parents' and children's outcomes as proxies for lifetime or permanent components are subject to substantial measurement error due to transitory deviations from the long-run means, and yield attenuation bias as a consequence. This problem is particularly relevant for parental outcomes, the explanatory variables in the intergenerational equations. Mazumder (2005) estimates the proportion in which the bias can be reduced by increasing the number of observations. This proportion is higher the less persistent is the process, but it is substantial even when there is high persistency. The longitudinal nature of the NLSY79 allows to use several observations for both generations, particularly in the case of mothers that are observed during 14 periods on average in our sample (only 4% of the sample has fewer than 10 interviews).

Second, the lack of heterogeneity in the samples aggravates the measurement error (Solon, 1992, 1999).[23] We use a representative sample of the US population in 1979, namely the cross-sectional sub-sample of the NLSY79, which is several times bigger than cohorts formed from the Survey Research Center (SRC) component, the analogous of the PSID typically employed in empirical studies of intergenerational earnings' correlations (see e.g. Solon, 1992).

Finally, the literature warns about the life-cycle bias that arises when parents' and children's observations are not representative of their lifetime outcomes due to non-stable trajectories along the life (Haider and Solon, 2006; Grawe, 2006; Nybom and Stuhler, 2016, 2017). Measurement error is not homogenous along the life-cycle, with higher noise for early and late years (Mazumder, 2005). To mitigate this problem, the literature recommends using observations for ages between thirty and fifty (Black and Devereux, 2011). Our sample restriction

[22] If the permanent component was computed by a simple average (controlling for age and year fixed effects) and, for example, out of ten observed years an individual is employed in 5, the permanent component of employment would be 0.5. This measure differs substantially from the analogous corresponding to earnings, which averages earnings for the 5 periods the individual is employed.

[23] The interaction between transitory fluctuations and measurement error, and the homogeneity in the sample is shown in Solon (1989).

to individuals between 25 and 45 years old and the netting out of age effects from the permanent components are aimed at mitigating this bias.

3.4 Results

In this section we present our main results. We measure a significant positive intergenerational correlation of employment status. The correlation remains significant after controlling for all variables that are usually used in the literature to explain the intergenerational correlation in earnings. According to our model, this is a consequence of the transmission of "work culture". We then put the correlation of employment status into perspective by comparing it to other intergenerational correlations in the literature. Further, we show that it is the extensive margin of labor supply, rather than the intensive margin that drives our result. Finally, we rule out potential other, alternative, explanations that would in principle be consistent with this positive correlation.

3.4.1 Main Results

Table (3.41) shows the intergenerational correlations of employment status. Standard errors are clustered at the mother level to account for possible auto-correlation in siblings' error term. The first column shows the unconditional correlation of employment status, which is the coefficient of the regression of $\log(l_{1i})$ on $\log(l_{0i})$ without controls. This correlation is 0.21 and statistically significant: a child whose mother is employed one year longer, is on average employed by around 11 weeks longer.

Specification 1 shows the results of estimating equation (3.3) derived from the model. When introducing ability of mothers and education of children, the correlation of employment status decreases to 0.15 but remains statistically significant. The mother's ability and the child's education have predictive power and signs as suggested by the theoretical framework. Through the lenses of the model, a positive correlation in employment status across generations conditional on education and ability is evidence of intergenerational transmission of preferences for work.

In specifications 2 and 3 we evaluate whether this transmission mechanism remains once we include other potentially relevant controls. In specification 2, we estimate the following equation resulting from substituting out e_0 in equation (3.3):

Table 3.41: Intergenerational correlations of employment status

VARIABLES	Unconditional	Specification 1	Specification 2	Specification 3
Employment (ln) Mother	0.21***	0.15***	0.16***	0.13***
	(0.034)	(0.036)	(0.033)	(0.034)
Ability (ln) Mother		0.07***		-0.01
		(0.022)		(0.021)
Ability (ln) Child			0.14***	0.10***
			(0.028)	(0.032)
Yrs. schooling (ln) Mother				0.07
				(0.069)
Yrs. schooling (ln) Child		0.62***	0.52***	0.24***
		(0.099)	(0.098)	(0.090)
Net worth (ln) Mother				-0.02
				(0.025)
Net worth (ln) Child				-0.06*
				(0.032)
Number of children Mother				0.00
				(0.013)
Number of children Child				-0.06***
				(0.013)
Control mother's age at birth	NO	NO	NO	YES
Observations	2,339	2,237	2,339	1,969
Adjusted R-squared	0.040	0.074	0.086	0.079
R-squared	0.041	0.075	0.087	0.091

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: The dependent variable is the permanent component of the natural logarithm of employment status of children.

$$\log(l_{1i}) = \alpha + \beta \log(l_{0i}) + \frac{\gamma}{\lambda} \log(e_{1i}) + \delta \log(H) + \tilde{\epsilon}_i, \tag{3.5}$$

where $\tilde{\epsilon}_i = \epsilon_i - u_i/\lambda$. Since the coefficient on the child's ability of 0.14 is higher than that on the mother's ability in specification 1 (0.07) this is consistent with partial transmission of ability, i.e. $\lambda \in (0, 1)$. Finally, our model predicts that the coefficient β should be unaffected. Although it slightly increases from 0.15 to 0.16, this difference is not statistically significant, nor is the difference between the estimated coefficients of the years of schooling of children.

In Specification 3, we further introduce a set of controls not included in the model but potential confounders in this context: wealth measured by net worth (assets minus debts), number of children of both generations, and dummies for the age of the mother at birth. Wealth is intended to control for non-labor income and the number of children, for correlated

fertility attitudes. We also introduce all the ability and human capital information for both generations. The correlation of employment remains almost unchanged after these inclusions (it slightly decreases to 0.13). The interpretation is that employment of a child whose mother works 10% of her active life longer, increases by about 1.3% of his active life. Alternatively, the employment of a child whose mother works one additional year, increases by about 7 weeks. Consistent with wealth effects on labour supply, wealthier individuals work slightly less, although the coefficient of -0.06 is significant only at the 10% level. Furthermore, as expected, the number of (the child's) children affects employment of the child negatively. The coefficient of -0.06 is significant at the 1% level. However, we want to emphasize that also the results of specification 3 are consistent with the model. In particular, there are no significant changes in the coefficients on mother's employment β, child's ability γ/λ and child's education δ. In terms of our the regression model (3.5), the effects of children's net worth and children on employment are captured by the error term $\tilde{\epsilon}_i$. The assumption that $\log(l_{0i})$, $\log(e_{1i})$ and $\log(H)$ are all uncorrelated with this error term can not be rejected.

These results are robust to different specifications and to the inclusion of several control variables, as shown in section 3.6. In the remainder of the paper, we use Specification 3.

Putting the numbers into perspective. As discussed earlier, an extensive literature documents a high persistence of earnings across generations. Recent examples are Chetty et al. (2014) and Corak (2016), who estimate this correlation to be between 0.4 and 0.5 in the United States.[24] Earnings are the product of two components, wages or more broadly "earnings ability", and time devoted to labor, or more generally the "willingness to work". Most of the literature focuses on the first component and intends to identify the channels through which productivity is transmitted.

On the other hand, only a scarce literature focuses on the second component. A notable example is Toledo (2010), who estimates the correlation of working hours, the intensive margin of labor supply.[25] Using PSID data, he finds that working hours feature an intergenerational correlation of 0.21. This number is similar to what we find using the NLSY.

Extensive vs. Intensive Margin of Labor Supply. However, the data suggests that it is the extensive margin of labor supply rather than the intensive one, which drives the transmission of preferences for work. This can be seen in Table (3.42), which compares the correlation of employment status (first two columns) and hours worked (last two columns) with and without controls.[26] The unconditional intergenerational correlations are not sig-

[24] Note that the samples over which the earnings correlation is estimated are different, as only employment spells are considered.

[25] Another example is Macmillan (2011), who estimates a correlation of "worklessness" in the UK of 0.1.

[26] We include the periods of non-employment with 0 hours worked.

nificantly different from each other. However, once we introduce the relevant controls, the correlation in hours vanishes, while the one for employment status remains significant at 0.13. Whereas productivity (proxied by AFQT test scores), education, wealth and other observables explain completely the correlation in hours worked, they do not fully explain the correlation in employment status.

Table 3.42: Intergenerational correlations in several employment margins

	Employment		Hours worked	
Employment (ln) Mother	0.21***	0.13***		
	(0.034)	(0.034)		
Weekly hours (ln) Mother			0.17***	0.05
			(0.031)	(0.030)
Controls	NO	YES	NO	YES
Observations	2,339	1,969	2,433	2,034
Adjusted R-squared	0.04	0.08	0.02	0.07

Standard errors clustered by mother ID in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Fathers. It would be interesting to also observe the correlation between the employment status of fathers with the one of their children. Unfortunately, the NLSY79 data are not designed to match fathers to children as only 157 fathers of the children in our sample are respondents.[27] However, the data provides employment status of mothers' spouses, whom in many cases are the children's fathers.

Table 3.43: Effect of Spouses.

	Children's Employment		
Employment (ln) Spouse	-0.01	-0.02	0.02
	(0.032)	(0.033)	(0.050)
Employment (ln) Mother		0.14***	0.14***
		(0.040)	(0.040)
Emp. Mother (ln) x ...			0.06*
... Emp. Spouse			(0.034)
Controls	YES	YES	YES
Observations	2,086	2,086	2,086
Adjusted R-squared	0.06	0.08	0.08

Standard errors clustered by mother ID in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[27] Furthermore, these 157 are not a representative sample. Table 3.A4 shows the results for the few fathers present in the sample. There is a negative but not significant correlation.

The first column of Table (3.43) represents the same regression as above, just that the mother's employment status is replaced by their spouses' employment status. We observe that spouses do not significantly affect the children's labor supply. Furthermore, when we also include the employment status of the mother (second column) the coefficient on mother's is not significantly different from the same regression without spouses. Finally, when we also introduce an interaction term between mothers' and spouses' employment status (third column), this coefficient is statistically significant at the 10% level suggesting a magnification effect of the spouse's employment status. This maybe a result of assortative mating.[28]

Understanding whether the mother or the father drives the intergenerational link in employment status is important for the design of in-work benefits that encourage labor participation. For instance, the EITC in the US targets women.

3.4.2 Assessing alternative explanations

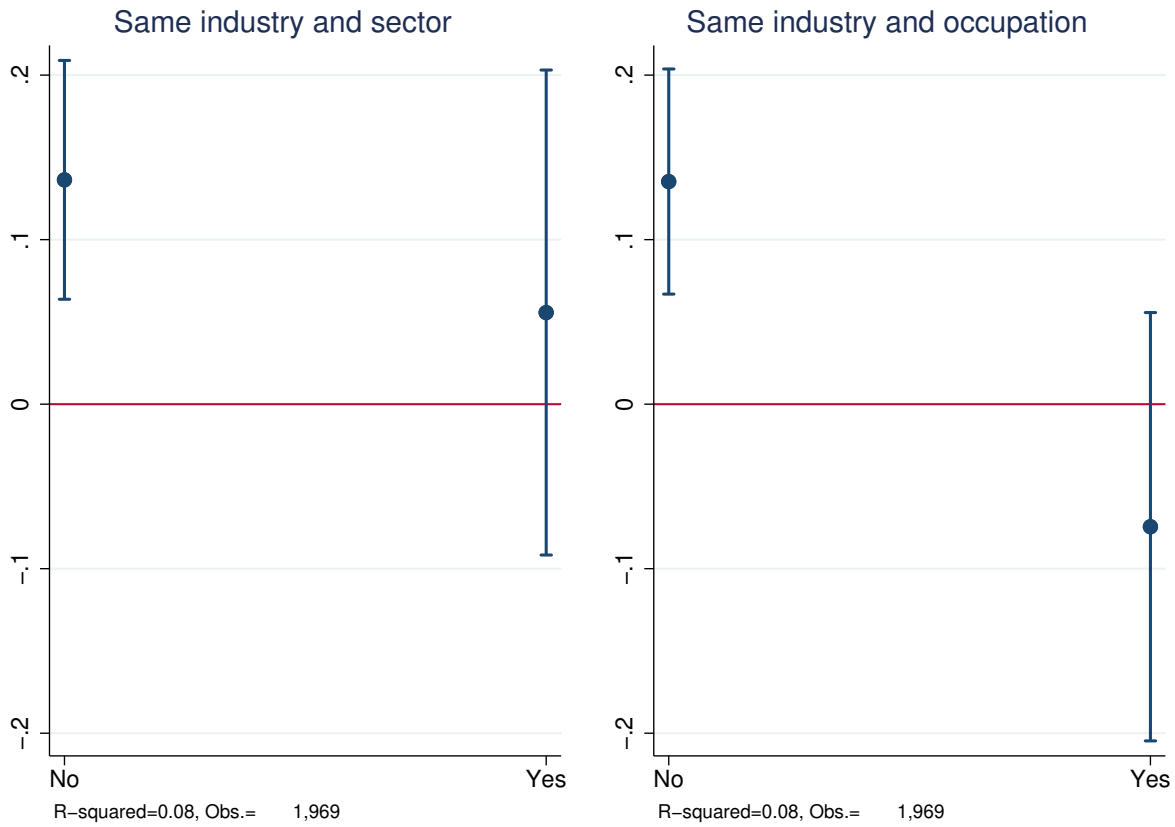
The residual intergenerational correlation of employment status, or *work culture* as we call it, can be interpreted as transmission of preferences for work according to the theoretical framework. However, it is also compatible with other explanations. In this section, we show that these alternative interpretations are not likely to be driving the correlation.

Second, we explore the possibility that the intergenerational correlation of employment status is driven by transmission of networks or specific human capital. It is possible that parents help children to find a job through their network. Alternatively, parents might transmit specific human capital or preferences for occupations in which the job finding rate is higher. The role of nepotism and preferences for occupations in the intergenerational correlation of earnings has been documented in Corak and Piraino (2011) and Lo Bello and Morchio (2016). The data do not support these explanations for employment status instead. Figure 3.41 shows that the correlation of employment status is not statistically different when considering same business or occupation, proxied by industry and sector, and industry and occupation respectively. Moreover, the point estimate of the correlation is higher for the cases when mother and child work in different businesses or occupations. A similar picture emerges when considering the spousal occupation (Figure 3.B6 in the Appendix).

Finally, possibly local conditions of the labor market induce a correlation. If mothers and children live in a place where the labor market is more dynamic, it is more probable that both generations have better chances of being employed, and the job finding probability

[28]Not all the mothers report having spouses in all the waves, nor they are the same spouse. The regressions correspond to the triples spouse-mother-child for which there is a spouse reported. As we are excluding single mothers, this sample is not representative.

Figure 3.41: Intergenerational correlations of employment status by same and different industry, sector and location

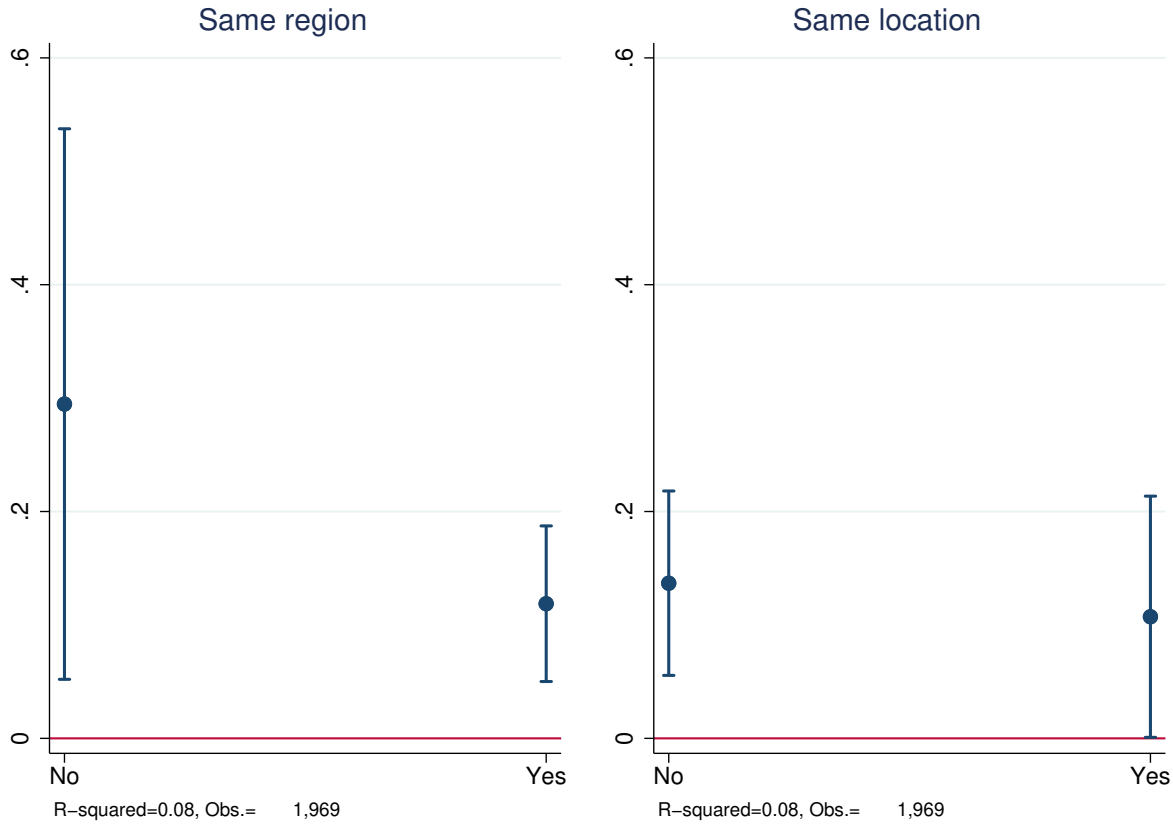


Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The industry, sector and occupation for each individual correspond to the value observed in the maximum number of waves. We only use individuals for which industry, sector and occupation have valid declaration.

could be lower if the labor market is more sclerotic. However, Figure (3.42) shows that whether mother-child pairs live in the same region (location) or not does not affect the intergenerational correlation of employment significantly. If anything, the point estimates are higher for mother-child pairs who live in different regions.

To sum up, the evidence presented in this section suggests that the persistence of employment status between mothers and children documented in our paper is not likely to be driven by assortative mating, networks, occupation-specific human capital or preferences and local labor market conditions. Hence, the explanation proposed in the theoretical framework that preferences for work are transmitted through generations seems the most promising.

Figure 3.42: Intergenerational correlations of employment status by region and location



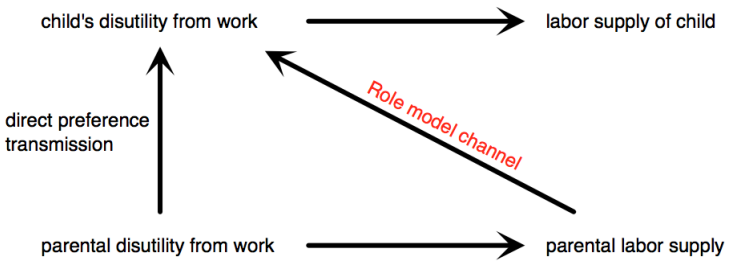
Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The region and location (combination of region, SMSA and urban/rural) for each individual correspond to the value observed in the maximum number of waves. We only use individuals for which region and location have valid declaration.

3.5 Preference versus role model channel

Although we already established that the intergenerational correlation of employment status likely captures transmission of preferences for work from mothers to children, this transmission potentially includes both a direct preference transmission and a role model channel. Figure (3.51) is a schematic presentation of this idea. The distinction between the channels has important policy implications, as policies which provide incentives to work would have intergenerational consequences more likely if there is a role model channel than if there is only a direct preference transmission. In this Section, we present evidence discussing this matter.

First, we present an heterogeneity analysis of the correlation of employment status. Estimates are not precise and differences are not statistically significant because the number of

Figure 3.51: Direct preference channel versus role model channel



observations within groups is reduced and of variable size. Interpretation is based on point estimates in consequence, and refer to the statistical significance of the differences when it is pertinent.

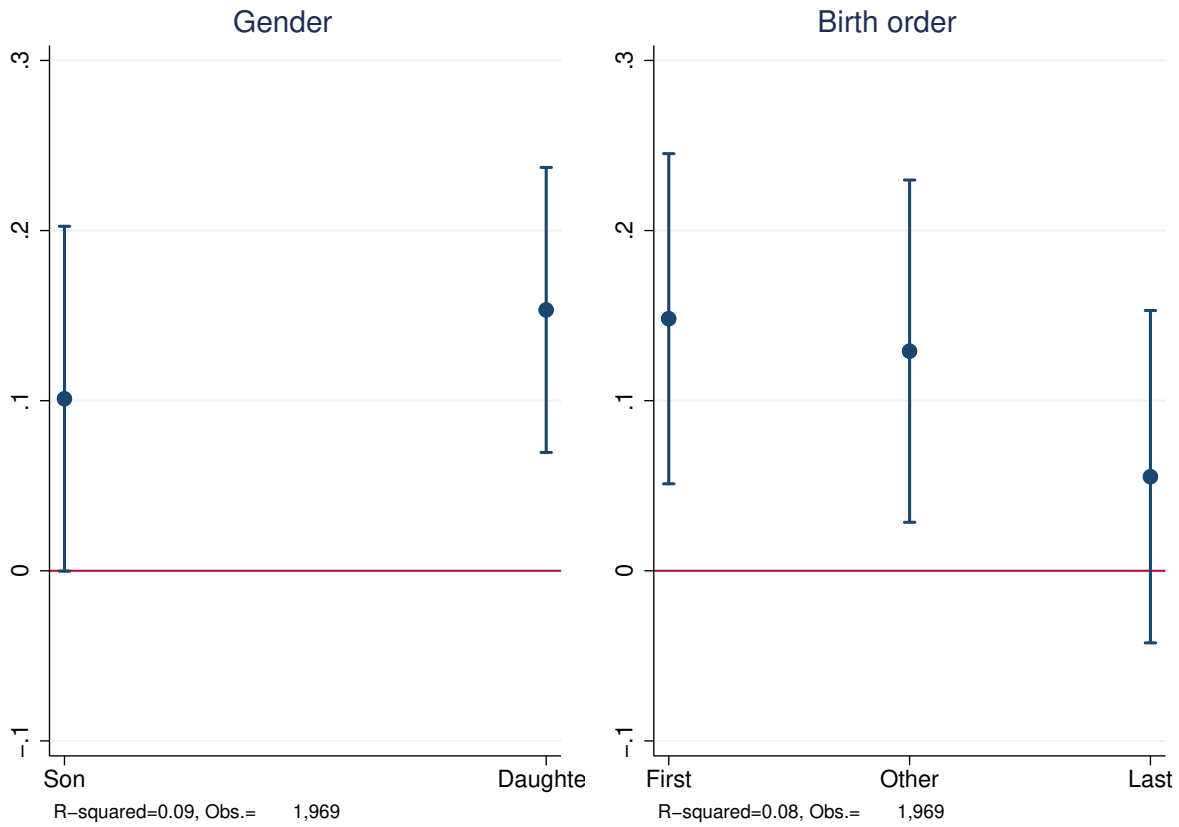
The left panel of Figure (3.52) shows that the correlation is stronger for mother-daughter pairs than for mother-son pairs, but the later is still important (0.15 and 0.1 respectively). This complements the findings in the literature of intergenerational correlations of earnings that report lower associations between fathers and daughters than between fathers and sons (see e.g. Chadwick and Solon, 2002). The stronger link for mothers and daughters in employment status seems to favor the explanation of a role model underlying the correlation of employment status, as role models are intuitively more likely to be gender-specific. However, the fact that the correlation with respect to sons is also present points importantly in the direction of transmission of preferences for work and not only gender roles.

The right panel of Figure (3.52) shows a decreasing correlation of employment status for higher birth order, although there is not statistical difference among the coefficients. This negative relationship with birth order leads to the hypothesis that the longer the time during the active life spent by mothers with children, the stronger the transmission of preferences. This is also suggesting that role models play a role for the intergenerational transmission of preferences for work.

Figure (3.53) shows that the intergenerational correlation of employment status is slightly lower (though not statistically different) when both spouses cohabit with the children. We interpret this as evidence that when two adults conform the reference group of children, this mitigates the transmission of preferences for work from only the mother.

Furthermore, the intergenerational correlation of employment status is stronger when the background of the mother is more disadvantaged. The left panel of Figure (3.54) shows that the correlation coefficient is higher for the first three quintiles of family income, and drops to close to zero for the top 40% in the income distribution. The right panel of Figure (3.54) yields similar conclusions when considering the maternal education background. The

Figure 3.52: Intergenerational correlation of employment status by gender (left) and birth order (right)

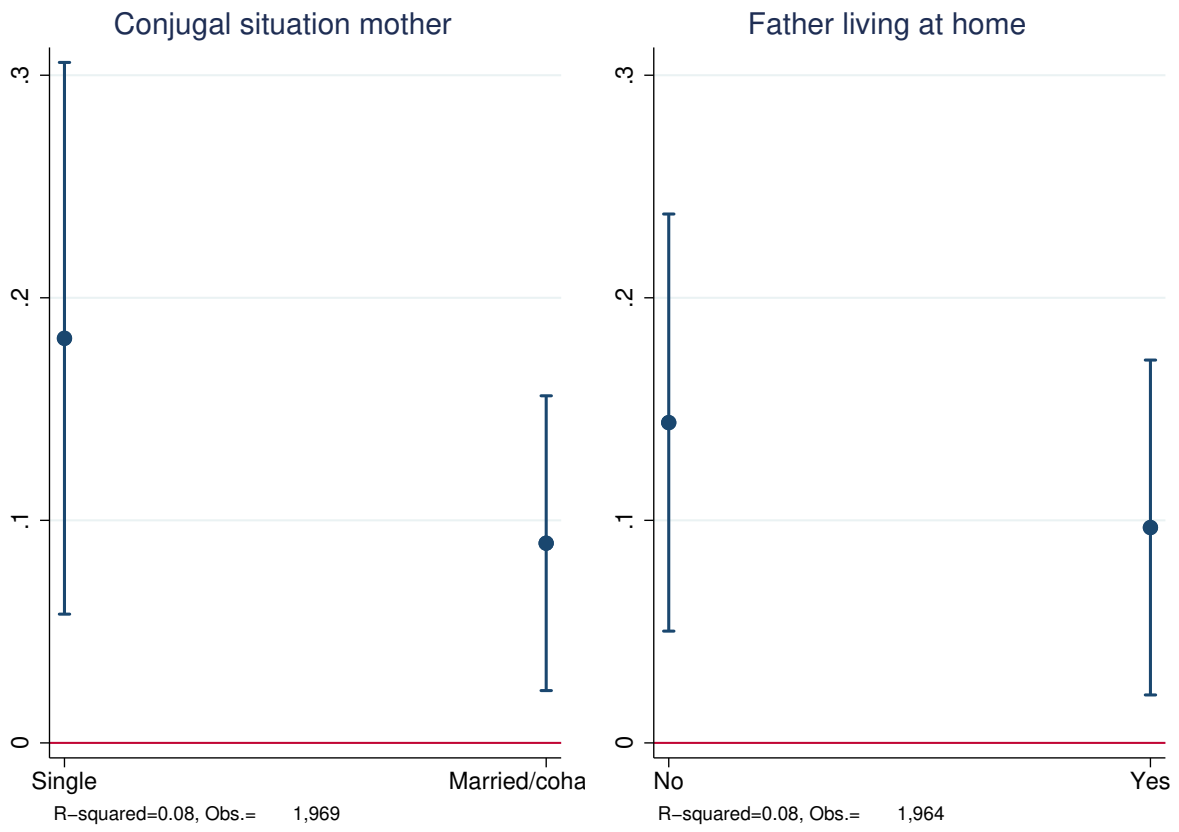


Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID.

intergenerational correlation is higher for mothers who did not complete high-school or only completed this level, and it is close to zero for mothers with some or complete college. Employment status of parents is hence more important for the more disadvantaged households. This is the case for both sons and daughters, as shown in Figure (3.B7) in the Appendix. This result contrasts to the findings in Olivetti et al. (2016), who document stronger transmission of (gender) roles for the top of the income distribution. We find instead that transmission of preferences for work is stronger at the bottom of the distribution. This discrepancy reinforces our claim that the preference transmission we document is different from gender roles.

The left panel of Figure (3.55) shows that the correlation coefficient does not appear substantially different by race. Although it is well known that there is a correlation between race and economic disadvantage, the type of disadvantage involved in our results does not seem associated to race.

Figure 3.53: Intergenerational correlation of employment status by conjugal situation of the mother (left) and by whether there is cohabitation of the father (right)

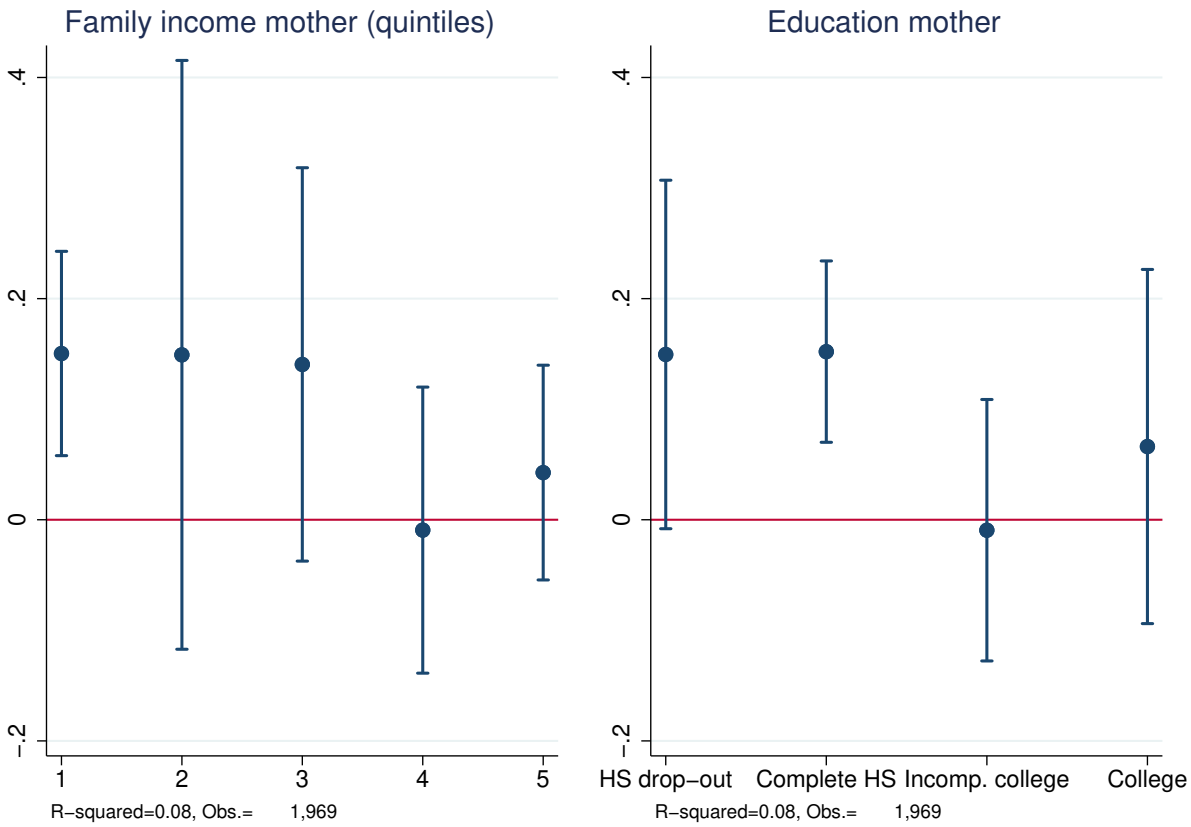


Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The conjugal situation of the mother and the presence of the father are considered according to the category which is observed during the maximum number of waves.

The right panel of Figure 3.55 suggests that children married or cohabiting denote employment status less correlated with their mother's than single ones. This is suggestive that joint labor supply decisions may play a role and impose restrictions to individual decisions.

Ideally, the coefficient $\hat{\beta}$ would estimate the role model channel if we could control for the mothers' preferences for work. Our data does not provide a good measure for this. Instead, we propose a proxy for this variable: mothers' employment status when children do not live with them. If the role model can only be transmitted when children observe their mothers, we can arguably use the maternal employment history in periods without cohabitation as a proxy for preferences for work, where there is no room for a role model. Work behavior in periods of cohabitation then captures the role model channel. The main assumptions behind this exercise are that the work behavior of an individual is a good proxy for her preferences

Figure 3.54: Intergenerational correlation of employment status by mother's income (left) and education (right)

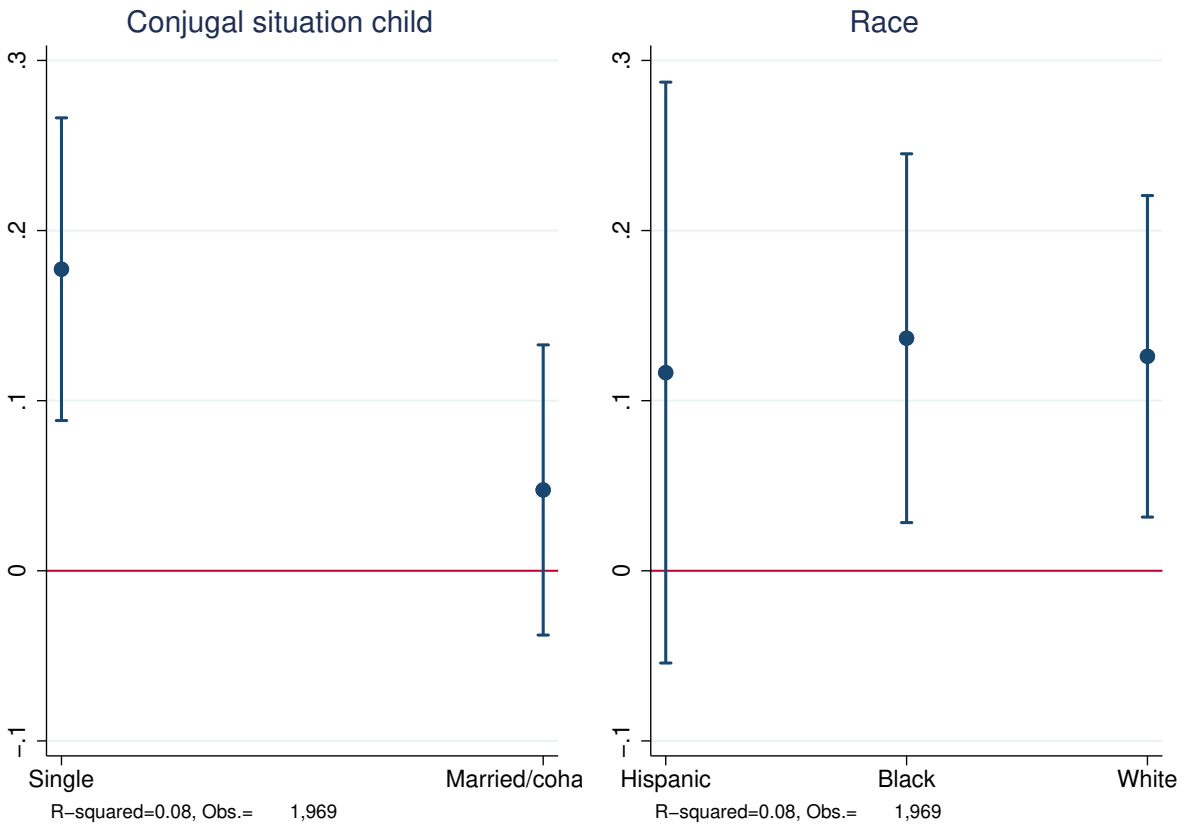


Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. Mother's position in the income distribution is attributed according to the quintile observed during the maximum number of waves. The education level of mothers is the maximum attained.

for work, and that the distribution of ages does not differ substantially between periods of cohabitation and non-cohabitation.

We split the mothers' observations in those in which she is living with the child and those in which she is not, either before the child's birth or after the child leaves home. We estimate the permanent component for mothers only using this period, and estimate the model introducing this variable to control for mothers' preferences for work. Table (3.51) summarizes the results. The first column shows the baseline regression without the new variable in the sub-sample for which we observe both cohabitation and not-cohabitation periods. The second column presents the estimates only including the permanent component of mothers' employment status for periods without cohabitation. The corresponding coefficient (0.04, statistically significant) is significantly lower than when considering all the periods (0.12). This suggests

Figure 3.55: Intergenerational correlation of employment status by race (left) and conjugal situation of the child (right)



Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The conjugal situation of the child is considered according to the category which is observed during the maximum number of waves.

that preferences for work of mothers have an effect on children's employment status, either by themselves or through mothers' work behavior. The third column presents the results of including both maternal employment status variables. The coefficient corresponding to the periods without cohabitation drops and becomes statistically insignificant, and the coefficient of mothers' employment status is almost the same as without the additional variable, 0.10. We interpret this result as evidence that the intergenerational correlation of employment status is mainly driven by a role model.

Table (3.A5) in the Appendix shows a similar exercise, considering that grandmothers' employment status affect the preferences for work of the mother (by either channel, role model or direct preference transmission), and mothers are acting as role model on top of transmitting their preferences directly. Conclusions are the same.

Table 3.51: Intergenerational correlations of employment status, separating periods not cohabitation

	Baseline	Pref.	Pref.+Role model
Employment (ln) Mother	0.12***		0.10**
	(0.041)		(0.044)
Emp. (ln) Mother child not at home		0.04**	0.01
		(0.017)	(0.017)
Controls	YES	YES	YES
Observations	1,123	1,123	1,123
Adjusted R-squared	0.09	0.08	0.09

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of the permanent component of employment status of the children. The observations corresponds to children for whom periods of both cohabitation and non-cohabitation are observed. Cohabitation and non-cohabitation periods are classified for each child.

3.6 Robustness checks

In this section we show that the results are robust to different definitions of the variables regarding employment status and to several specifications.

First, we repeat the estimation of the empirical model in the last column of Table (3.41) changing the method for computing the permanent components. The first two columns of Table (3.61) show these results. In column 1, we estimate the model without taking logs of the variables. In column 2, the permanent components are the simple average of the employment status, without controls for life-cycle or business-cycle fluctuations. The correlation of employment is virtually the same as in our main estimation.

Second, we use two alternative measures of employment status, which are less comparable across generations or available only for fewer periods. These results are presented in the last two columns of Table (3.61). The first definition uses mothers' answers to the CPS (Current Population Survey) employment status question, which is not asked all the years. For children, we observe if they declare to have any employer at the time of the survey. For the second alternative, mothers and children are considered employed if they declare a positive number of hours and earnings, during the past calendar year for mothers and the currently for children. Results do not change.

Third, we estimate rank-rank regressions for average employment status of mothers and children, as this is a common practice in the literature of intergenerational correlations. We rank parents and children according to the proportion of employment periods, and we

Table 3.61: Intergenerational correlations in employment: alternative definitions of the permanent component employment status

	No logs	Averages	Altern. Emp. 1	Altern. Emp. 2
Employment Mother	0.12***	0.14***	0.13***	0.12**
	(0.027)	(0.053)	(0.035)	(0.054)
Controls	YES	YES	YES	YES
Observations	1,969	1,969	1,969	1,996
Adjusted R-squared	0.09	0.08	0.08	0.08

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the permanent component of the employment status of children, and the independent variable is the permanent component of employment status of the mother. The first two columns contain different estimation strategies for the permanent components, referred to in the title of the column. The last two columns correspond to natural logarithm of the permanent component using variables in the survey different from those used in the main estimation. The different number of observations across columns is a consequence of missing values.

compute percentile ranks. We estimate the intergenerational equation with all the controls using percentile ranks instead of the logarithm of the permanent components of employment status. Table (3.62) is the analogous of Table (3.41) for the rank-rank regressions. The slope of the rank-rank regressions follows the same pattern previously documented: it decreases when controlling for observables and statistically significant. The intergenerational correlation of the percentile ranks once accounting for observables is around one half of the unconditional correlation. Differences in the magnitudes of rank-rank and log-log slopes are mainly explained by the linearity of the former and non-linearity of the latter (see Chetty et al., 2014, for details on how the two measures differ). Table (3.A6) in the Appendix shows the transition matrix for employment status, which makes apparent the non-linearities in the relationship.

Finally, we consider that additional controls to age and year fixed effects in the computation of the permanent components. The reason is that the labor supply decision can be affected by demographic events, particularly in the case of women. By controlling for them we attempt that our differences in employment status across individuals do not capture only disparities in demographic events.

We slightly change the computation of the permanent components in the following way:

$$l_{kit} = l_{ki} + \sum_{n=1}^{2} \pi_{nk} A_{kit}^{n} + \lambda_{kt} + XDemo'_{kit}\varsigma + \upsilon_{kit} \tag{3.6}$$

Table 3.62: Rank-rank slopes for employment status

	Unconditional	Specification 1	Specification 2	Specification 3
Rank employment mother	0.12***	0.08***	0.07***	0.05***
	(0.018)	(0.017)	(0.017)	(0.017)
Ability (ln) Mother		0.03***	0.02***	0.00
		(0.006)	(0.007)	(0.006)
Ability (ln) Child			0.04***	0.03***
			(0.009)	(0.009)
Yrs. schooling (ln) Mother			0.02	0.02
			(0.018)	(0.017)
Yrs. schooling (ln) Child		0.21***	0.16***	0.08***
		(0.027)	(0.028)	(0.028)
Net worth (ln) Mother				-0.01
				(0.008)
Net worth (ln) Child				-0.04***
				(0.014)
Number of children Mother				0.00
				(0.004)
Number of children Child				-0.03***
				(0.004)
Control for mother's age at birth	NO	NO	NO	YES
Observations	2,339	2,237	2,237	1,969
Adjusted R-squared	0.03	0.07	0.08	0.10

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the rank of children's average employment. The different number of observations across columns is a consequence of missing values in the variables introduced sequentially.

where $XDemo_{kit}$ are controls for demographic events such as births, couple formation and dissolution, job loss and finding by partner, presence of children 0-3 with/without child-care, older children, moving out from parental home. Although these events are not entirely exogenous with respect to the labor supply decision, the exercise shows (Table (3.63)) that results are qualitatively the same, and coefficients are higher in magnitude.

Other robustness checks not included to economize space are: controlling for education levels instead of years of schooling, including interactions between ability, education and wealth, using labor force participation instead of employment of mothers.[29] Results of these robustness checks are available upon request.

[29]Labor force participation is only available for mothers. There is no information about job search activities of children during their jobless spells.

Table 3.63: Intergenerational correlations of employment status netting out demographic events from the permanent components

	Unconditional	Specification 1	Specification 2	Specification 3
Employment (ln) Mother	0.30***	0.20***	0.18***	0.16***
	(0.041)	(0.041)	(0.040)	(0.041)
Ability (ln) Mother		0.05***	0.02	-0.01
		(0.019)	(0.020)	(0.018)
Ability (ln) Child			0.12***	0.10***
			(0.028)	(0.029)
Yrs. schooling (ln) Mother			0.05	0.05
			(0.050)	(0.052)
Yrs. schooling (ln) Child		0.49***	0.34***	0.17**
		(0.093)	(0.097)	(0.084)
Net worth (ln) Mother				-0.02
				(0.022)
Net worth (ln) Child				-0.06**
				(0.029)
Number of children Mother				0.01
				(0.009)
Number of children Child				-0.04***
				(0.012)
Control mother's age at birth	NO	NO	NO	YES
Observations	2,245	2,153	2,153	1,877
Adjusted R-squared	0.03	0.06	0.07	0.05

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.7 Conclusion

This paper contributes to the literature on intergenerational correlation of labor market outcomes. Differently from the existing literature, we focus on employment status. We argue that the correlation of employment status from mothers to children captures the persistence of the labor supply decision at the extensive margin, and hence is a good candidate to shed some light on the transmission of preferences for work.

In a simple model of intergenerational transmission, altruistic parents decide on their own labor supply and human capital investment for their children, whose abilities are linked to their parents'. We start from formulating the effect of the parental labor supply on children's preferences, and derive an intergenerational equation that links parents and children's employment status. This equation is estimated using the NLSY79 and NLSY79 Children and Youth Adults and allows to test the mechanism embedded in the model.

We first document the existence of a significant correlation in employment status, which is a novel fact to the best of our knowledge. We observe that the correlation is statistically and economically significant after controlling for the channels suggested by the theoretical framework and also those proposed as drivers of the intergenerational correlation of earnings, importantly productivity (ability and human capital). This is consistent with our model and, hence, we interpret it as evidence of intergenerational transmission of preferences for work. Furthermore, we show that other candidate explanations, such as networks, transmission of specific human capital or conditions within local labor markets are not likely driving the correlation of employment status.

Heterogeneity in this correlation across groups suggests that a role model channel plays an important part of the story. In particular, the correlation is stronger between mothers and daughters than mothers and sons, which is reasonable as role models are likely to be gender specific. However, employment of mothers and sons is still significantly connected, suggesting the transmission of preferences for work exceeds a gender role transmission. We also show a stronger correlation when mothers are in direct contact with children by cohabitation, an intuitive result if role models run through imitation of observed behaviors.

The transmission of preferences for work in general, and the presence of a role model channel in particular, bear important policy implications. This is especially the case if these mechanisms are stronger at the bottom of the income distribution, where redistributive policies affect incentives to work. Tax and transfer policies should take into account the effects not only on current generations, but also on generations to come.

Appendix

3.A Tables

Table 3.A1: Summary statistics for women and mother-children pairs in NLSY79

	Women NLSY79		**Mothers**		**Children**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Mother migrant	7%	0.252	5%	0.231		
Father migrant	16%	0.370	14%	0.342		
Second generation of migrants	18%	0.383	15%	0.354		
Both parents migrants	5%	0.221	4%	0.203		
Living with mother (when child)					98%	0.147
Living in own dwelling	92%	0.164	94%	0.119	74%	0.370
Partner works	64%	0.353	68%	0.345	51%	0.442
Children 0-3 not in child care	17%	0.192	20%	0.186	23%	0.339
Children 0-3 in child care	9%	0.137	9%	0.133	9%	0.215
Children 4-5	17%	0.147	23%	0.131	19%	0.283
Children 6-12	40%	0.282	61%	0.164	29%	0.392
Children 13-15	15%	0.147	26%	0.126	3%	0.108
Children 16-18	11%	0.121	20%	0.106	1%	0.048
Births	14%	0.139	14%	0.129	18%	0.278
Couple dissolution	4%	0.067	5%	0.062	7%	0.161
Couple formation	6%	0.081	4%	0.059	18%	0.281
Partner job loss	5%	0.064	5%	0.063	6%	0.155
Partner job finding	6%	0.079	5%	0.060	16%	0.270
Observations	3,040		1,373		2,339	

Table 3.A2: Estimation of intergenerational correlations: Other outcomes

	Net worth Child	Ability Child	Yrs. schooling Child	Num. children Child
Net worth Mother	0.19***			
	(0.033)			
Ability Mother		0.40***		
		(0.023)		
Yrs. schooling Mother			0.38***	
			(0.024)	
Number of children Mother				0.20***
				(0.029)
Observations	2,133	2,325	2,433	2,433
Adjusted R-squared	0.04	0.15	0.13	0.04

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the permanent component of each outcome for the children cohort. Hours and earnings are only considered for employed individuals. The different number of observations across columns is a consequence of missing values.

Table 3.A3: Intergenerational correlations of employment status: spouses-children

	Spec. 1	Spec. 2
Employment (ln) Spouse	-0.01	0.00
	(0.032)	(0.050)
Emp. Mother (ln) x Emp. Spouse (ln)		0.02
		(0.031)
Controls	YES	YES
Observations	2,086	2,086
Adjusted R-squared	0.06	0.06

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of the permanent component of employment status of children. The different number of observations across columns is a consequence of missing values.

Table 3.A4: Intergenerational correlations of employment status: fathers-children

	Unconditional	Specification 1	Specification 2	Specification 3
Employment (ln) Father	0.00	-0.04**	-0.01	-0.19
	(0.043)	(0.015)	(0.023)	(0.195)
Ability (ln) Father		0.00	-0.30	-0.25
		(0.057)	(0.220)	(0.229)
Ability (ln) Child			0.14	-0.08
			(0.116)	(0.094)
Yrs. schooling (ln) Father			1.60	1.11
			(1.145)	(1.278)
Yrs. schooling (ln) Child		0.85	0.26	0.47
		(0.527)	(0.400)	(0.433)
Net worth (ln) Father				0.18
				(0.200)
Net worth (ln) Child				-0.04
				(0.041)
Control for mother's age at birth	NO	NO	NO	YES
Observations	157	141	141	131
Adjusted R-squared	-0.01	0.03	0.12	0.00

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of the permanent component of employment status of children. The different number of observations across columns is a consequence of missing values. Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The industry, sector and occupation for each individual correspond to the value observed in the maximum number of waves. We only use individuals for which industry, sector and occupation have valid declaration.

Table 3.A5: Intergenerational correlations of employment status including grandmothers' employment status

	Baseline	Pref.	Pref.+Role model
Employment (ln) Mother	0.13***		0.13***
	(0.047)		(0.047)
Emp. (ln) Grandmother		0.02	0.01
		(0.016)	(0.016)
Controls	YES	YES	YES
Observations	1,109	1,109	1,109
Adjusted R-squared	0.06	0.05	0.06

Standard errors clustered by mother ID in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of the permanent component of employment status of the children. The observations corresponds to children for whom periods of both cohabitation and non-cohabitation are observed. Cohabitation and non-cohabitation periods are classified for each child.

Table 3.A6: Transition matrix for average employment status

Employment mother	Employment children 0-0.25	0.25-0.50	0.5-0.75	0.75-1	Total
0-0.25	49 20%	13 5%	29 12%	150 62%	241
0.25-0.50	53 18%	11 4%	28 9%	208 69%	300
0.5-0.75	45 9%	15 3%	44 9%	383 79%	487
0.75-1	90 7%	26 2%	109 8%	1,086 83%	1,311
Total	237	65	210	1,827	2,339

Note: Number of observations and transition probabilities in percentages.

3.B Figures

Figure 3.B1: Number of interviews of mothers (left) and children (right)

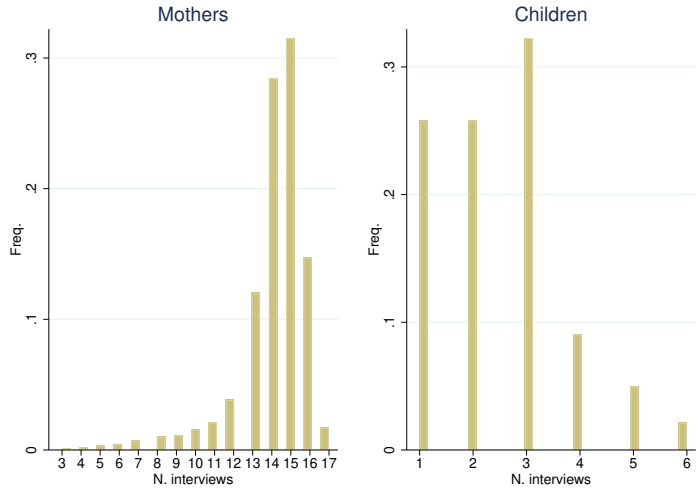


Figure 3.B2: Age of mothers at birth

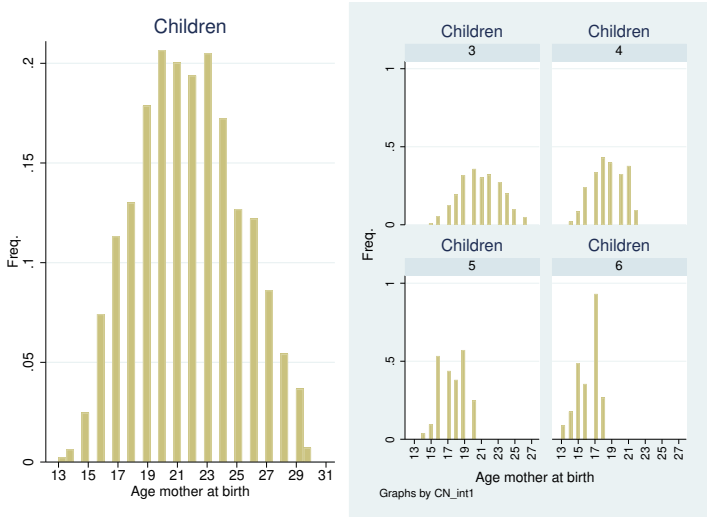


Figure 3.B3: Employment-age profiles of mothers (left) and children (right)

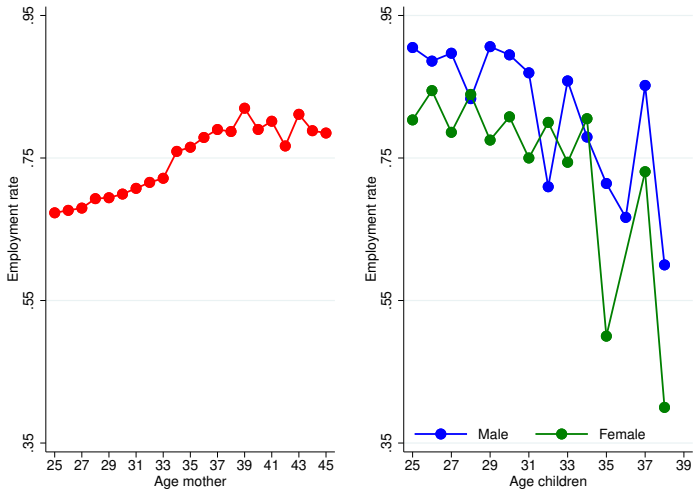


Figure 3.B4: Distributions

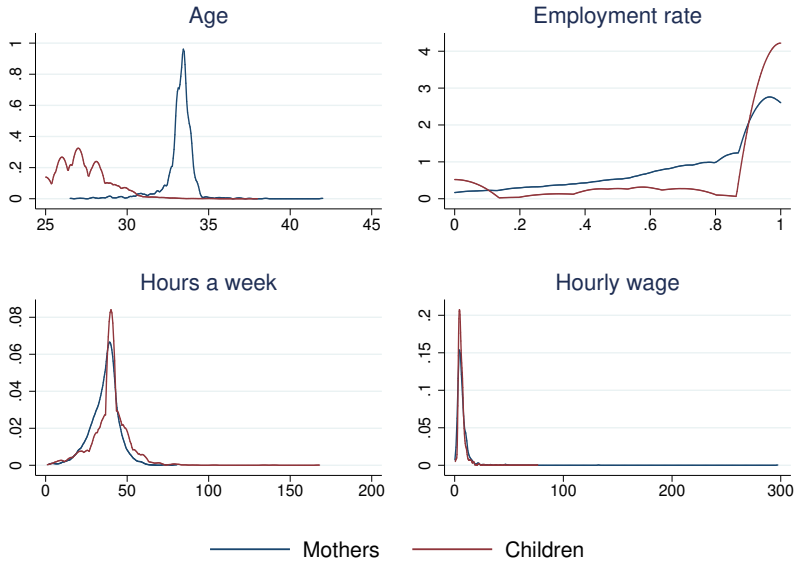


Figure 3.B5: Distributions (cont.)

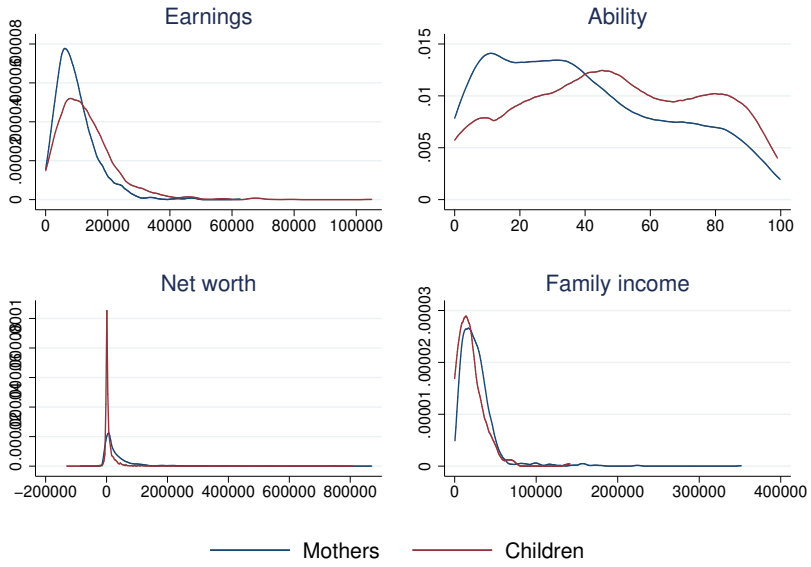
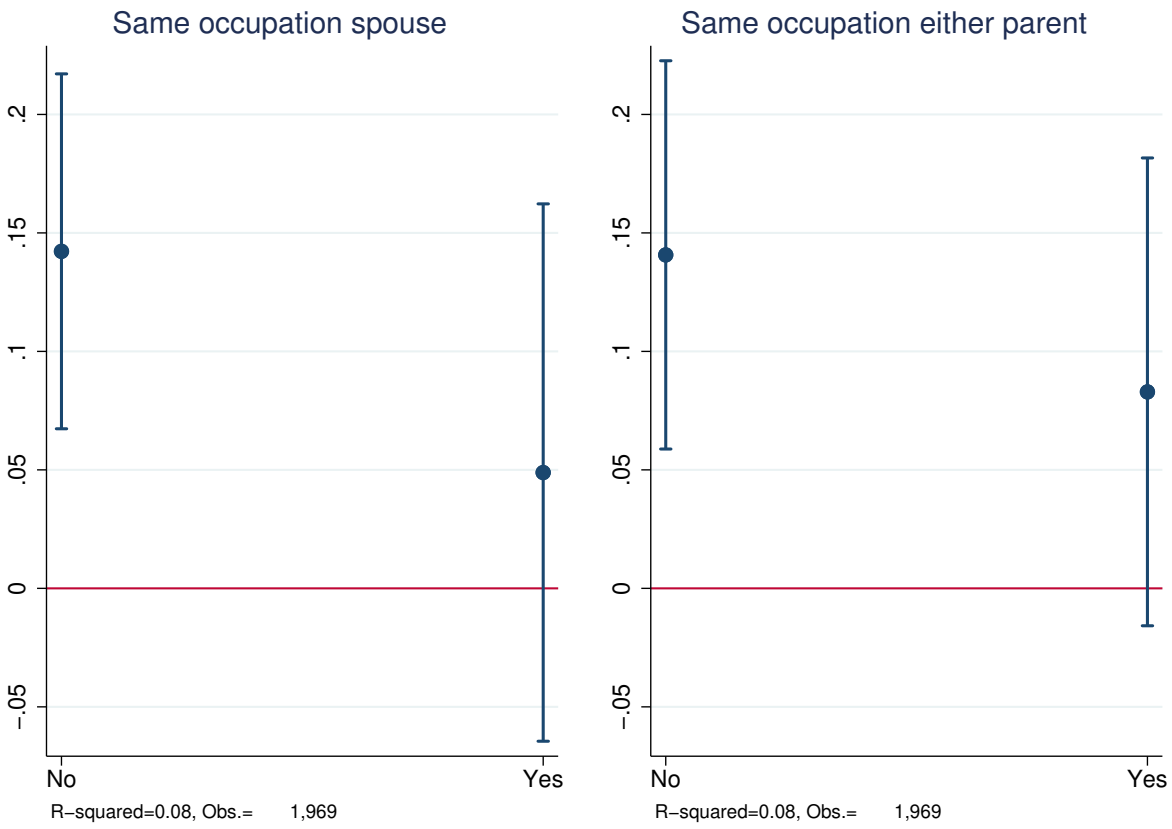
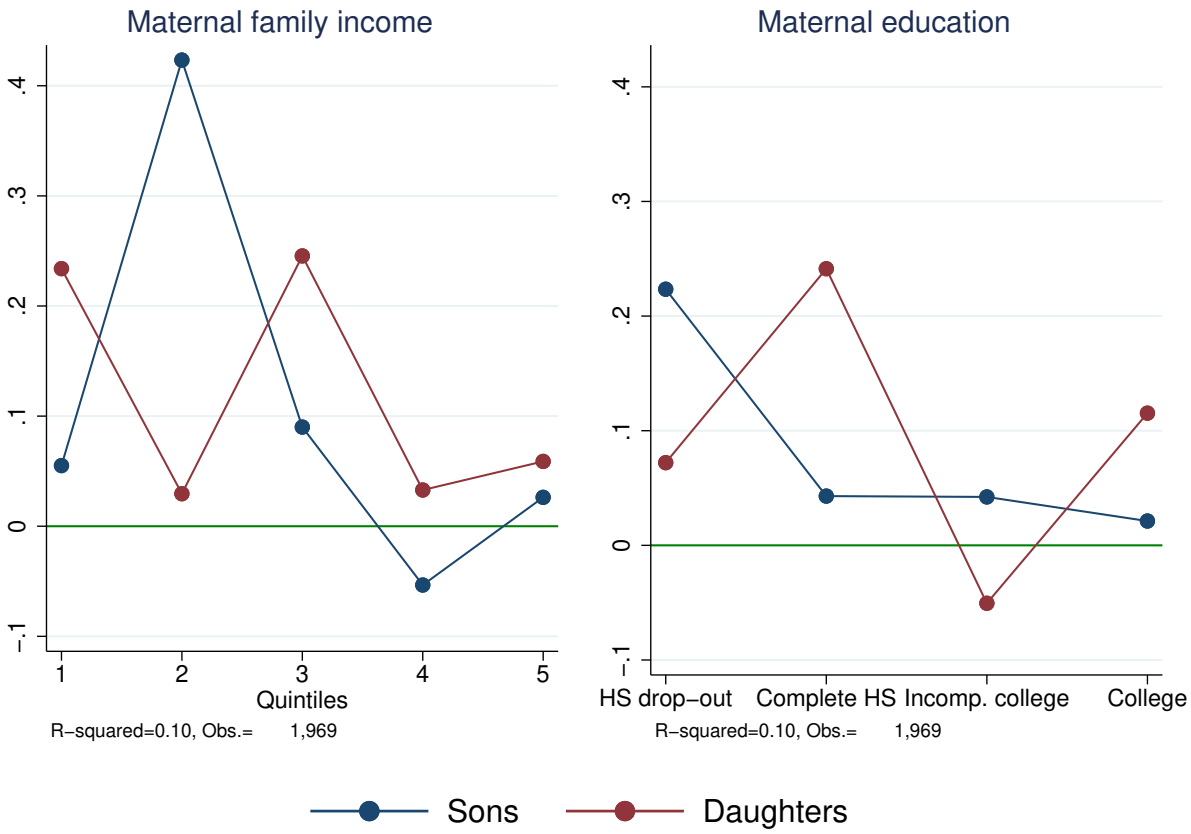


Figure 3.B6: Intergenerational correlations of employment status by same and different occupation of spouse and either parent



Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. The industry, sector and occupation for each individual correspond to the value observed in the maximum number of waves. We only use individuals for which spousal information (either having or not) and occupation of the spouse have valid declaration.

Figure 3.B7: Intergenerational correlation of employment status by mother's income (left) and education (right) for sons and daughters



Note: The dependent variable is the permanent component of the natural logarithm of employment status of the children. Standard errors are clustered by mother ID. Mother's position in the income distribution is attributed according to the quintile observed during the maximum number of waves. The education level of mothers is the maximum attained.

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