

Pauka, Kira

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## How does Part-time Work Affect Firm Performance and Innovation Activity?

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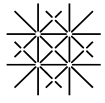
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Kira Pauka

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Universität Basel  
WWZ  
Peter Merian-Weg 6  
4052 Basel, Switzerland  
[wwz.unibas.ch](http://wwz.unibas.ch)

**Corresponding Author:**

Kira Pauka  
T +41 61 267 27 57  
[Kira.pauka@unibas.ch](mailto:Kira.pauka@unibas.ch)

# **How does Part-time Work Affect Firm Performance and Innovation Activity?**

Kira Pauka

*University of Basel, Faculty of Business and Economics, Department of Human Resources and Organization,  
Peter Merian-Weg 6, CH-4002 Basel, Switzerland,  
Phone: +41 (0)61 267 27 57, E-Mail: kira.pauka@unibas.ch*

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## **Abstract**

This paper analyzes how part-time work affects financial and innovative firm performance. Moreover, it provides a detailed examination of part-time work by defining three different forms of part-time work (large, medium and small part-time work) depending on weekly working hours. Considering human capital theory, I expect part-time workers to have lower work experience and to accumulate less human capital. Thus I hypothesize that part-time work affects both, financial and innovative firm performance, negatively. For the empirical investigation I use a large German firm-level data set. The analysis shows that increasing part-time work has a significant negative impact on financial firm performance. Specifically, there are differences with regard to the considered categories of part-time work. Part-time workers having the fewest working hours per week have the strongest negative impact on financial firm performance. However the negative effect of part-time work does not remain for innovative firm performance. The results show no significant difference between part-time and full-time workers in their impact on innovative firm performance.

JEL Classification: J21; L25; M50

Keywords: part-time work, financial firm performance, innovation

## **1 Introduction**

Increasing environmental dynamics force firms to become more flexible, in order to remain competitive. Firms can improve their flexibility by applying flexible work practices, such as part-time work (Valverde et al., 2000). Moreover, firms can adjust to increasing employees' preferences for a better combination of work and family life by offering part-time jobs (Den Dulk et al., 2013). Part-time work is a widespread practice: Every fourth employee in Germany, the United Kingdom or Sweden is working part-time. In the Netherlands even nearly half of the workforce has a part-time job (Fouarge and Baaijens, 2009).

While the influence of part-time work on individual outcomes like hourly wages (e.g. Hardoy and Schøne, 2006) or job satisfaction (e.g. Booth and van Ours, 2008) is well analyzed in the economic literature, less is known about the impact of part-time work on firm performance. Theoretical argumentation on the relationship between part-time work and firm performance is ambiguous. Part-time work is associated with higher job satisfaction (Booth and van Ours, 2008) and hence might have a positive effect on worker's productivity. Consequently part-time work has to be advantageous for firm performance. However part-time workers can accumulate less human capital than their full-time working counterparts, suggesting that part-time can have a negative effect on firm performance. Thus how part-time work influences financial and innovative firm performance remains an open question.

Studies investigate the effect of flexible work practices, including part-time work, on financial firm performance, innovative firm performance or both (e.g. Roux, 2007; Giannetti and Madia, 2013; Arvanitis, 2005). Although researchers investigate the effects of part-time work on firm performance, they do not analyze part-time work in detail by distinguishing between different forms of part-time work. For instance part-time work can differ with respect to weekly working hours, decision competencies or tasks. Studies that analyze the impact of part-time work on firm performance in detail are those of Künn-Nelen et al. (2013) and Garnero et al. (2014). However their focus lies on financial firm performance.

This paper contributes to the literature on part-time work and firm performance by extending the analysis to innovative firm performance. In addition to a good financial performance, firms also

need to generate innovations to be successful in the long run (Michie and Sheehan-Quinn, 2001). Therefore I also investigate how part-time work influences innovations.

Additionally, I provide more detailed analysis of part-time work and firm performance. Thus I use weekly working hours to categorize different forms of part-time work. Precisely, I distinguish between three forms, namely small part-time work (working less than 15 hours per week), medium part-time work (working 15-24 hours per week) and large part-time work (working more than 24 hours, but less than 39 hours per week).<sup>1</sup> By distinguishing different part-time work forms I answer the question whether a favorable form of part-time work exists and derive practical implications how firms could use part-time work more effectively.

To investigate the impact of part-time work on firm performance I follow Künn-Nelen et al. (2013) and use a Cobb-Douglas production function with an extended input factor labor. In their approach Künn-Nelen et al. (2013) assume employees working different hours per week to have different marginal productivities. Differently to their model I analyze the influence of part-time work on financial firm performance and innovative firm performance. In my analysis I use value added as an indicator for financial firm performance. To measure innovative firm performance I use product and process innovations.

For the empirical analysis I use a large German data set, which is provided by the Institute for Employment Research (IAB) of the Federal Employment Agency. The IAB Establishment Panel covers firm-level data of all firm-size classes, industries and of all German regions. As it contains not only detailed information on different forms of part-time work but also different measures for firm performance, the data set fits my research question. I include data from the years 2006, 2008 and 2010 into the analysis.

In order to obtain meaningful estimates, I take observable and unobservable firm characteristics into account. E.g. a firm's long-term strategy or the availability of competent full-time workers on the labor market can influence both firm performance and the extent of using part-time work. Therefore I take potential endogeneity into account by using an instrumental variable (IV) estimation strategy. I use the extent of lagged part-time work as instrument for the extent of current part-time work.

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<sup>1</sup> A similar definition of different part-time work forms is used in Künn-Nelen et al. (2013).

In contrast to the empirical results of Künn-Nelen et al. (2013) and Garnero et al. (2014), my empirical analysis shows that firms employing an increasing number of part-time workers have a lower financial performance than firms that employ mainly full-time workers. Specifically, a difference between distinct forms of part-time work exists, as I find part-time workers with shorter weekly working hours to have larger negative coefficients. Thus financial firm performance depends on weekly working hours of its employees. In Germany part-time work might be less accepted in firms than in the Netherlands or Belgium. Employers therefore may not support part-time and full-time workers equally in terms of training or personal development. Thus part-time workers in Germany have lower individual productivity and hence part-time work influences financial firm performance negatively.

However the negative influence of part-time work does not remain for innovative firm performance. I cannot find differences between full-time and all three defined forms of part-time work in their influence on innovative firm performance.

The paper is organized as follows. In section 2 I present the related literature. A discussion of theoretical considerations follows in section 3. In section 4 I introduce the econometric model. Section 5 shows the data set, the included variables and the descriptive statistics. After the description of my estimation strategy in section 6, I present the results in section 7. In section 8 I compare the human capital investment strategies of firms that employ part-time workers and firms that only employ full-time workers. Doing so I can empirically test my theoretical considerations and explain the empirical results presented in section 7. The paper concludes with a discussion in section 9.

## **2 Related Literature**

Part-time work is well analyzed and discussed in the empirical economic literature. Older studies primarily focus on the reasons firms have to employ part-time workers (e.g. Montgomery, 1988; Zeytinoglu, 1992) and the differences between part-time and full-time workers, which explain the incentives individuals have to supply part-time work (e.g. Miller and Terborg, 1979; McGinnis

and Morrow, 1990).<sup>2</sup> In recent years there is growing interest on the effects part-time work could have on workers and firms. Many empirical studies analyze the impact of part-time work on individual outcomes, e.g. employees' job satisfaction (e.g. Bardasi and Francesconi, 2004; Booth and van Ours, 2008) or individual wages (e.g. Hardoy and Schøne, 2006; Fernández-Kranz and Rodríguez-Planas, 2011). In contrast empirical studies, which focus on firm outcomes, are rare. As well results are mixed.

There are two strands of literature. The first analyzes the relationship between flexible work practices, including part-time work, and firm performance. Here some studies focus on financial firm performance (e.g. Valverde et al., 2000; Roux, 2007), whereas others examine the influence of flexible work practices on innovative firm performance (e.g. Giannetti and Madia, 2013). Though, there are also studies that analyze both, financial and innovative firm performance, respectively (e.g. Michie and Sheehan-Quinn, 2001; Arvanitis, 2005).

Valverde et al. (2000), use a data set that covers 20 European countries. To measure financial firm performance they use firm's profit. However the authors could not find a significant influence of part-time work on firm's profit. Roux (2007) analyzes in his study flexible work practices that comprise employees working part-time, employees with a fixed-term work contract as well as apprentices. For the empirical analysis he uses a French data set. The indicator for financial firm performance is firm's yearly value added. In contrast to Valverde et al. (2000), Roux (2007) finds that part-time work positively affects financial firm performance.

An empirical study that focuses on the effect of flexible work practices on innovations in Italy is the study by Giannetti and Madia (2013). The authors restrict their empirical analysis to product innovations. Giannetti and Madia (2013) quantify product innovations as share of yearly sales caused by new products based on total sales. They find that there is a positive effect of part-time work on innovations.

Michie and Sheehan-Quinn (2001) analyze how flexible work practices affect financial firm performance and innovation activities of firms. They use data from the United Kingdom for their empirical analysis. To measure financial firm performance Michie and Sheehan-Quinn (2001) create an indicator, which captures the relative performance of firms. They ask senior managers to

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<sup>2</sup> Part-time workers are e.g. often females, young persons and workers that have lower qualifications (McGinnis and Morrow, 1990).

compare the firm's profitability to the profitability of competitors in the same industry. For innovation activities they introduce two measures, product innovations and process innovations. Michie and Sheehan-Quinn (2001) find part-time work to have a statistically positive significant impact on financial and a statistically negative significant impact on innovative firm performance. The study by Arvanitis (2005) also investigates the influence of flexible work practices on financial firm performance and innovation activities of a firm. For his empirical analysis Arvanitis (2005) uses a Swiss data set. The sales per employee indicate the firm's financial performance. Like Michie and Sheehan-Quinn (2001), Arvanitis (2005) determines a firm's innovation activities with the two indicators product innovations and process innovations. In this study part-time work is measured by a dummy variable, which becomes 1 if the firm rates part-time work as important. Part-time work is found to have a significant negative effect on the firm's financial performance, which is opposed to the results obtained by Michie and Sheehan-Quinn (2001). However Arvanitis (2005) does not find a significant relationship between part-time work and product innovations or process innovations.

There are some possible explanations for the mixed empirical results. As the studies use data from different countries, distinct results may be caused by country specific institutions. E.g. some countries have laws, which prohibit the discrimination of part-time workers in firms, and others have not. Firms that operate in countries without anti-discrimination laws can accomplish different hourly wages for part-time and full-time workers. This unequal treatment of employees with different working hours directly influences financial firm performance through lower labor costs (Hardoy and Schøne, 2006). Another explanation could be that the authors use different measures for part-time work or firm performance and data sets measuring different periods of time. This also makes a comparison of empirical results more complicated.

The second strand of literature analyzes part-time work more detailed. Studies, which focus on part-time work and how it affects financial firm performance, are those by Künn-Nelen et al. (2013) and Garnero et al. (2014).

Künn-Nelen et al. (2013) examine the influence of part-time work on financial firm performance in the Netherlands. Thereby firm's yearly sales indicate financial firm performance. The authors also want to determine optimal working hours for part-time work by distinguishing between "low", "medium" and "long" part-time work. Künn-Nelen et al. (2013) restrict their empirical



analysis to the pharmacy sector. Thus results only apply to this sector and are not necessarily transferable to other industries. The authors provide Ordinary Least Squares (OLS) estimation results for different specifications. Moreover, to account for unobserved heterogeneity, they conduct Fixed Effects (FE), Random Effects (RE) and Instrumental Variable (IV) estimates in their sensitivity analysis by using information from an additional wave. All used estimation strategies reached similar results. Künn-Nelen et al. (2013) find that part-time work has a statistically positive effect on firm's yearly sales. In addition they find medium part-time work to have the largest positive effect on financial firm performance. The authors explain their result that part-time work positively influences financial firm performance by allocation efficiencies. The pharmacy sector is characterized by high fluctuations in demand. Therefore firms could perform more efficient, if they employ also part-time workers in times of high demand (Künn-Nelen et al., 2013).

Künn-Nelen et al. (2013) argue that firms use part-time work, like fixed-term work, as a buffer to compensate high fluctuations in demand. The possibility to use part-time workers as a buffer in times of high demand can explain why part-time work is found to positively influence firm performance in the Dutch pharmacy sector. However this explanation only applies to the service industry and cannot be transferred to other industries. I suppose part-time workers to be deployed like full-time workers, but to work fewer hours in a week and hence to have lower work experience. Therefore part-time work is expected to negatively influence firm performance.

Garnero et al. (2014) analyze how employing part-time workers has an effect on a firm's financial performance with a Belgian data set. They distinguish between small part-time and large part-time jobs. Additionally, the authors focus on differences between male and female part-time workers. As an indicator for financial firm performance Garnero et al. (2014) use the firm's value added per hour. They conduct Generalized Method of Moments (GMM) estimation. Garnero et al. (2014) find that employees working in a large part-time job have a positive effect on the hourly value added compared to full-time workers. Though, they do not find a difference between the influence of workers with a small part-time job and full-time workers on financial firm performance. Garnero et al. (2014) explain their result by different advantages firms have from employing distinct part-time workers. Female part-time workers generate lower wage costs, whereas male part-time workers provide productivity advantages.

The situation of part-time workers is different in distinct countries. For example the Netherlands have the largest number of part-time workers of all European Union countries. More than forty-five per cent of all workers have a part-time work contract. In contrast, in Germany only about twenty-five per cent of the employees work part-time (Fouarge and Baaijens, 2009). Therefore the acceptance of part-time work in firms may be higher in the Netherlands than in Germany. A higher acceptance of part-time work can lead to more support in terms of further training and personal development of part-time workers in firms. Additionally, part-time workers may have higher commitment at the workplace if they feel to be better supported. Knowledge creation through training and commitment have a high impact on individual productivity and hence on firms' performance. Thus it is interesting to analyze how part-time workers influence firm performance for the German case.

Moreover, both studies focus on financial firm performance. I want to extend my analysis by investigating also the impact of part-time work on innovative firm performance, as it is not only important for firms to have a good financial performance, but also to generate innovations to be successful. This study is, to the best of my knowledge, the first study, which provides a detailed analysis of part-time work and investigates how different forms of part-time work affect financial and innovative firm performance.

### **3 Human Capital Theoretical Considerations**

Firm performance is mostly determined by individual performance of employees. As part-time workers work fewer hours than full-time workers, they have lower work experience and also they can accumulate less human capital (Hirsch, 2005). Thus part-time workers have lower individual productivity, as they have less routine in doing their tasks. Therefore I expect part-time work to have a negative impact on financial firm performance.

Accordingly, the three part-time work forms also differ regarding their impact on financial firm performance. Few weekly working hours are associated with few human capital accumulations. Therefore, the shorter the weekly working hours, the greater has to be the negative influence of part-time work on financial firm performance compared to full-time work. Thus I expect small

part-time work compared to full-time work to have the largest negative impact of all three part-time work forms on financial firm performance. Consequently I derive my first hypothesis:

*H1: Firms having a large share of part-time workers have a lower financial performance than firms with a large share of full-time workers. Specifically, the shorter the weekly working hours, the larger is the negative impact of part-time work on financial firm performance compared to full-time work.*

In the long run firms also need innovations, in addition to a good financial performance, to remain competitive (Hitt et al., 1997). For the occurrence of innovations it is important for firms to generate new knowledge and keeping existing knowledge up to date (Thornhill, 2006). As argued before, considering human capital theory, part-time workers have lower work experience than full-time workers. Additionally, part-time workers are disadvantaged by firms' training policies as the period in which a firm can benefit from its investment is smaller for part-time workers (Nelen and de Grip, 2009). Thus part-time workers have less knowledge and also have problems to keep their knowledge up to date, which results in a lower individual ability to generate innovations.

The argumentation for different forms of part-time work is equivalent. The requirement for employees to influence innovative firm performance positively is that they spent sufficient time in their workplaces to be familiar with products and processes (Garnero et al., 2014). The lower the weekly working hours, the lower is the experience of an employee. Small part-time work is hence expected to have the largest negative influence of all three part-time work forms on innovative firm performance. Therefore I formulate my second hypothesis:

*H2: Firms having a large share of part-time workers have a lower innovative performance than firms with a large share of full-time workers. Specifically, the shorter the weekly working hours, the larger is the negative impact of part-time work on innovative firm performance compared to full-time work.*

#### 4 Econometric Model

To analyze how part-time work influences firm performance I use a Cobb-Douglas production function and extend the input factor “labor” following the approach of Künn-Nelen et al. (2013). The production function is formulated as follows:

$$Y = A K^\beta L^{*\gamma} \quad (1)$$

Thereby  $Y$  denotes firm performance. The input factors “technical progress” and “capital” are described by  $A$  and  $K$ , respectively.  $L^*$  indicates the extended input factor “labor”,  $\beta$  and  $\gamma$  are the corresponding output elasticities.

In their theoretical model Künn-Nelen et al. (2013) assume that employees working different hours per week differ substantially in their marginal productivities. Therefore they divide the group of all employees working in a considered firm into the three subgroups “full-time workers”, “part-time workers” and “other workers”. Differently to Künn-Nelen et al. (2013), I distinguish between full-time workers and three different forms of part-time workers. The extended input factor “labor”  $L^*$  can thus be described as:

$$L^* = FT + \theta_1 PT_L + \theta_2 PT_M + \theta_3 PT_S \quad (2)$$

The number of employees working in a large, medium or small part-time job are represented by  $PT_L$ ,  $PT_M$ ,  $PT_S$ , whereas  $FT$  indicates the number of full-time workers.  $\theta_1$ ,  $\theta_2$  and  $\theta_3$  are the corresponding marginal productivities. For simplicity, the marginal productivity of full-time workers is set to 1. Equation (2) can be rewritten as follows to capture different employment shares:

$$L^* = L \left[ 1 + (\theta_1 - 1) \frac{PT_L}{L} + (\theta_2 - 1) \frac{PT_M}{L} + (\theta_3 - 1) \frac{PT_S}{L} \right] \quad (3)$$

Thereby  $\frac{PT_L}{L}$ ,  $\frac{PT_M}{L}$  and  $\frac{PT_S}{L}$  indicate the share of employees working in a large, medium or small part-time job. Now I insert equation (3) into (1) and take natural log:

$$\ln(Y) = \ln(A) + \beta \ln(K) + \gamma \ln(L) + \gamma \ln \left[ 1 + (\theta_1 - 1) \frac{PT_L}{L} + (\theta_2 - 1) \frac{PT_M}{L} + (\theta_3 - 1) \frac{PT_S}{L} \right] \quad (4)$$

Using first-order Taylor series approximation equation (4) can be simplified to:<sup>3</sup>

$$\ln(Y) = \ln(A) + \beta \ln(K) + \gamma \ln(L) + \gamma(\theta_1 - 1) \frac{PT_L}{L} + \gamma(\theta_2 - 1) \frac{PT_M}{L} + \gamma(\theta_3 - 1) \frac{PT_S}{L} \quad (5)$$

The term  $\gamma(\theta_1 - 1)$  indicates, how employees working in a large part-time job affect the firm performance in comparison to full-time workers. If  $\gamma(\theta_1 - 1) < 0$ , large part-time workers have a smaller influence on firm performance than full-time workers (Künn-Nelen et al., 2013). The same argumentation holds for medium and small part-time jobs, respectively.

Next, I reformulate equation (5) by using full-time equivalents (FTE) in order to compare the three forms of part-time work with the reference category full-time work:

$$\ln(Y) = \ln(A) + \beta \ln(K) + \gamma \ln(FTE) + \gamma(\theta_1 - 1) \frac{PT_L}{FTE} + \gamma(\theta_2 - 1) \frac{PT_M}{FTE} + \gamma(\theta_3 - 1) \frac{PT_S}{FTE} \quad (6)$$

Therefore I determine for each firm three weighting factors for the three part-time work forms to obtain full-time equivalents. A weighting factor is defined as the average weekly working hours of a part-time work form divided by the number of working hours full-time workers have to work in a firm. Hence more weekly working hours are associated with greater weighting factors. I also express the input factor “labor” in terms of full-time equivalents.

## 5 Data, Variables and Descriptive Statistics

For the empirical analysis I use the IAB Establishment Panel, a large data set which is conducted annually since 1993 by the Institute for Employment Research (IAB) of the Federal Employment Agency in Germany. Each year the IAB surveys more than 15,000 firms of all industries, firm sizes and in all federal states. The firms are randomly chosen from a parent sample of all German firms that have at least one employee covered by social security. Thus the data set is representative for Germany. As the IAB surveys firms with face-to-face interviews complemented by written questionnaires, response rates are high (between sixty and seventy percent) (Fischer et al., 2009).

The data set well suits my research question, as it contains information on different variables indicating firm performance. Additionally, it provides data on employees’ weekly working hours,

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<sup>3</sup> The first-order Taylor series approximation states, that  $\ln(1 + x) = x$  (Brown and Medoff, 1978).

so I can distinguish between full-time and three different forms of part-time work. I consider data from the years 2008 and 2010, supplemented by information from the year 2006, as only in those waves all the variables of interest are surveyed. From the analysis I exclude firms that gave illogical answers.<sup>4</sup> I analyze the impact of part-time workers on firm performance, relative to full-time workers. Therefore I restrict my sample to firms that have at least three employees. Public organizations do not aim to maximize their profit hence I eliminate the public sector from the sample. Moreover, I exclude firms of the banking and insurance industry. These firms report total assets instead of total sales and therefore they are not suitable for the empirical analysis. As a part of the firms cannot be observed over the whole period, I end up with an unbalanced panel containing 5513 observations.

As an indicator for financial firm performance I use value added. Value added is defined as total sales minus intermediate inputs. The measure for innovative firm performance is a binary variable that takes the value 1, if the firm has introduced new products to the market or realized innovations in the production process in the current year. Product and process innovations are both output-oriented measures for innovation. In contrary to input-oriented innovation measures like expenditures for research and development, output-oriented innovation measures indicate the benefit and not the cost part of an innovation. Firms benefit from product innovations through additional sales and from process innovations through cost reductions in the production process (Hollenstein, 2003). Thus this variable is well suited as an indicator for innovative firm performance in my empirical analysis.

As main explanatory variables I consider three different forms of part-time work. I insert a variable measuring the share of employees working more than 24 hours, but less than the full-time workload per week,<sup>5</sup> which I define as large part-time work. A working time between 15 and 24 hours per week is defined as medium part-time work. Finally, small part-time work summarizes employees that work less than 15 hours per week. For all variables I use full-time equivalents. The share of employees working full-time is the reference category.

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<sup>4</sup> E.g. I exclude firms that report shares of full-time and part-time work that do not sum up to one hundred percent.

<sup>5</sup> Full-time workers work on average 39.1 hours per week (see Table 1).

The input factor “labor” is measured by the sum of all employees who work in a firm. For this variable I also calculate full-time equivalents. To measure the input factor “capital” I use the sum of total investments as a proxy.

The IAB Establishment Panel provides various control variables. I include dummy variables that take the value 1, if the firm is independent of other business units or newly founded. Furthermore I consider the technical state of a firm’s machinery and equipment.<sup>6</sup> Reorganization tendencies are covered by the two control variables indicating insourcing and outsourcing. Moreover, I take into account if a firm offers working time flexibility. The flexibility of scheduling working time provides in addition to part-time work a possibility for a better work-life balance (Den Dulk et al., 2013) and hence can influence employees’ performance. It is important to consider training policies of firms, as training may influence both financial performance and innovations through the external knowledge inflow into the production process (Thornhill, 2006). Thus I control for the share of employees receiving further training.

Part-time workers are distinct from full-time workers with respect to their personal and job-specific characteristics (Fernández-Kranz and Rodríguez-Planas, 2011) thus I have to consider the workforce composition of the firms. As mainly women work part-time (Booth and van Ours, 2008), I control for the share of females. Moreover, I can account for the share of employees, who have the same educational background. I distinguish between low-skilled (no specific vocational education), skilled (vocational education) and high-skilled (higher education or university degree) employees. I control for the share of apprentices and the share of employees, who have a fixed-term work contract. Firms use both, apprentices and fixed-term workers, to reach more flexibility (Valverde et al., 2000) and therefore they have to be considered in the empirical analysis as possible substitutes for part-time work.

Firm performance depends, in addition to internal processes, also on environmental dynamics. A possibility to consider the extent of environmental dynamics is to account for the amount of competitive pressure. Nickell (1996) argues that firms have to be more productive, when they face a high amount of competitors, in order to survive on the market than those firms, which face only a few competitors. E.g. they need more efficient allocation of resources or production processes. I

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<sup>6</sup> The technical state of machinery and equipment is measured on a five point scale, ranging from “state of the art” (1) to “obsolete” (5).

generate four dummy variables to indicate the competitive pressure a firm faces (no, low, medium and high competitive pressure).

Moreover, I control for industry<sup>7</sup> and region<sup>8</sup>, as small industries, the manufacturing sector in East Germany and firms located in small federal states are overrepresented in the sample (Fischer et al., 2009). I also include a control variable to account for the considered year. Table 1 gives an overview of all included variables.

[Insert Table 1 about here]

On average about sixteen percent of all employees in the sample work part-time (see Table 1). Though, distribution of part-time work through industries is different. In manufacturing and construction part-time work is uncommon. Less than ten percent of the employees work part-time. Whereas in trade and service, part-time work is used more frequent. More than twenty percent up to nearly forty percent of the employees work in a part-time job (see Figure 1).

[Insert Figure 1 about here]

## 6 Estimation Strategy

I follow Künn-Nelen et al. (2013) to empirically investigate how part-time work affects financial firm performance and set up the estimation equation stated below:

$$\ln(\text{value added}_{it}) = \alpha_1 + \beta_1 \ln(K_{it}) + \gamma_1 \ln(FTE_{it}) + \delta_1 \frac{PT_L}{FTE_{it}} + \zeta_1 \frac{PT_M}{FTE_{it}} + \eta_1 \frac{PT_S}{FTE_{it}} + \kappa_1 X_{it} + u_{1it} \quad (7)$$

I use the logarithmized value added of firm  $i$  at time  $t$  as dependent variable. The main explanatory variables are the share of employees working in a large, medium or small part-time job measured in full-time equivalents, whereas the corresponding regression coefficients denoted by  $\delta_1$ ,  $\zeta_1$  and  $\eta_1$ .<sup>9</sup>  $X$  captures the included control variables. The error term is indicated by  $u_{1it}$ .<sup>10</sup> I estimate equation (6) using Pooled Ordinary Least Squares (OLS).

<sup>7</sup> In the empirical analysis I differentiate between eight industries.

<sup>8</sup> I use the sixteen German federal states as a region classification.

<sup>9</sup> For simplicity, I set  $\delta_1 = \gamma(\theta_1 - 1)$ ,  $\zeta_1 = \gamma(\theta_2 - 1)$  and  $\eta_1 = \gamma(\theta_3 - 1)$ .



As the IAB Establishment Panel provides information whether a firm introduces a new product to the market or new techniques to the production process, I use a binary variable as indicator for innovative firm performance. Thus I estimate the second estimation equation as Pooled Linear Probability Model (LPM):<sup>11</sup>

$$innovation_{it} = \alpha_2 + \beta_2 \ln(K_{it}) + \gamma_2 \ln(FTE_{it}) + \delta_2 \frac{PTL}{FTE_{it}} + \zeta_2 \frac{PTM}{FTE_{it}} + \eta_2 \frac{PTS}{FTE_{it}} + \kappa_2 X_{it} + u_{2it} \quad (8)$$

OLS estimates of equations (7) and (8) could be misleading, as the decision to employ a specific number of part-time workers may be influenced by unobserved third factors that also influence firm performance. E.g. if it is difficult for a firm to find competent full-time workers on the labor market, the performance will decrease and at the same time the firm will employ fewer full-time workers. Therefore part-time work could be endogenous. To solve the problem of endogeneity I use an Instrumental Variable (IV) estimation strategy.<sup>12</sup> Following Künn-Nelen et al. (2013) I use the lagged share of part-time workers as an instrument for the current share of part-time workers. I end up with three instruments for the three defined part-time work forms. The past workforce composition has a high impact on today's employment shares but should not influence today's firm performance. Therefore the three lags are assumed to be suitable instruments. In all regressions I use robust standard errors.

## 7 Results

In this section I present estimation results for the analysis how part-time work influences firm performance. First I present the results of the OLS estimations. I expect part-time work to have a negative effect on both, financial firm performance measured by value added and innovative firm performance indicated by product and process innovations. Table 2 reports the OLS estimation results considering all control variables.

[Insert Table 2 about here]

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<sup>10</sup> The constant, denoted by  $\alpha_1$ , also includes the input factor “technical progress” of the Cobb-Douglas production function.

<sup>11</sup> For completeness, I also estimate equation (8) using Probit estimation strategy. As results are quite similar to results reached by estimating a Linear Probability Model, I do not report Probit regression here.

<sup>12</sup> I do not estimate a Fixed Effects (FE) model, as there is only minor within variation of the regression coefficients and thus it is not possible to get meaningful results.

Column 2 displays the relationship between the three part-time work forms and the logarithmized value added. Part-time work, in comparison to full-time work, is negatively associated with financial firm performance as expected in hypothesis 1. Here the negative coefficient for part-time work indicates that financial firm performance of firms having part-time workers is lower than financial firm performance of firms with full-time workers. More precisely, the coefficients for large, medium and small part-time work are -0.28%, -0.55% and -1.19% and are statistically significant at the 5% level for large and small part-time work and at the 1% level for medium part-time work, respectively. Thus smaller weekly working hours are associated with a stronger negative impact on financial firm performance, as also expected in hypothesis 1.

Column 3 indicates the estimation results for innovative firm performance. For large part-time work I find a negative effect. The coefficient is -0.15% and statistically significant at the 5% level. Though, medium and small part-time workers have the same influence on innovations as full-time workers, both coefficients are insignificant. Moreover, I do not find that part-time workers with shorter weekly working hours have a stronger negative impact on innovative firm performance than part-time workers with longer weekly working hours, as expected in the second hypothesis.

To account for potential endogeneity I estimate equations (7) and (8) using an IV estimation strategy. Table 3 reports the first stage and second stage estimation results and includes all control variables.

[Insert Table 3 about here]

To instrument part-time work I regress the current extent of part-time work on the lagged share of part-time work. The coefficients for the three instruments are statistically significant at the 1% level as shown in columns (2) to (4). In addition the Kleibergen and Paap (2006) Wald F Statistic, indicating the joint significance of the used instruments, is 20.04. Considering the “rule of thumb” proposed by Staiger and Stock (1997), the value for the F Statistic exceeds the critical point of 10. Hence there is no weak instruments problem here.<sup>13</sup>

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<sup>13</sup> In the IV estimation I use three instruments for the three endogenous regressors. As it is an exactly identified case, I could not perform a test for the exogeneity of the instruments. However it is reasonable to suppose that the lagged share of part-time work is correlated with the actual extent of part-time work, but should not influence actual firm performance.

Columns (5) and (6) display the second stage estimation results. Similar to the OLS estimation results I find a negative impact of part-time work on financial firm performance in comparison to full-time work. The effect of large part-time work on financial firm performance is -0.27%. For medium and small part-time work the effect is -2.16% and -2.54%, respectively. Similar to the OLS estimation result the size of the coefficients for part-time work increases with shorter weekly working hours in the IV estimation. Though, the coefficients for large and small part-time work become insignificant. Thus in the IV estimation I only find partly support for my first hypothesis. I do not find a difference between part-time and full-time workers in their influence on innovative firm performance. Here coefficients for all three forms of part-time work are insignificant. Thus the second hypothesis is not supported by the empirical results.

## **8 Investment in General and Specific Human Capital**

In section 2 I hypothesize that part-time work negatively influences financial and innovative firm performance through the lack of human capital of part-time workers. In this section I compare the investment in human capital of firms with high shares of part-time workers with the human capital investment of firms that solely employ full-time workers. I distinguish between investment in general human capital (external training courses, external lectures, self-managed general learning) and specific human capital (internal training courses, on-the-job learning, internal meetings and quality circles).

Table 4 presents the OLS estimation results. Column 2 displays the estimation results for general human capital investments and column 3 shows the results for the support of investment in specific human capital of the workforce.

[Insert Table 4 about here]

Firms with high shares of part-time workers invest less in general and specific human capital of their employees. I find that firms employing a high share of small part-time workers support significantly less further general and specific training of their employees. The corresponding regression coefficients are -0.66% and -1.52% and are statistically significant at the 1% level. Medium part-time work also has a negative impact on a firm's investment strategy in human

capital. However, I only find a statistically significant negative effect for the investment in general human capital. The corresponding coefficient is -0.16% and statistically significant at the 10% level. I do not find significant results for large part-time work.

Though, as I have firm-level data, I cannot investigate which specific employee receives further training. But the analysis shows that on average firms employing high shares of part-time workers support significantly less training programs of their workforce. This result is in line with the human capital theoretical considerations in section 2. The empirical results support the assumption that the negative influence of part-time work on financial firm performance stems from part-time workers lack of human capital.

## **9 Discussion**

In this paper I analyze the influence of part-time work on firm performance. In addition to a good financial performance, it is important for firms to generate innovations to be successful in the long run. Therefore I distinguish between financial and innovative firm performance. Additionally, I distinguish between three different forms of part-time work (large, medium and small part-time work), which differ with respect to weekly working hours to provide more detailed analysis of part-time work.

I expect part-time work to negatively influence both, financial and innovative firm performance, as part-time workers have lower work experience and accumulate less human capital than full-time workers. Moreover, part-time workers are disadvantaged by training policies of firms. I also expect differences between distinct part-time workers. The lower the weekly working hours the larger the negative impact on financial and innovative firm performance, as those part-time workers have the lowest work experience.

I find support for my first hypothesis that firms employing part-time workers have a lower financial performance than firms employing full-time workers. As expected, small part-time workers, which have the fewest weekly working hours, have the largest negative influence on financial firm performance compared to full-time workers. The negative influence of part-time work on financial firm performance can be explained by lower work experience and lower human

capital of part-time workers. I find empirical evidence for this argumentation as firms with high share of part-time workers invest on average less in general and specific human capital of their workforce than firms, which only employ full-time workers.

In contrast to the empirical results of Künn-Nelen et al. (2013) and Garnero et al. (2014), who determine that part-time work positively affect financial firm performance in the Netherlands and Belgium, respectively, I find a negative effect of part-time work in Germany. The distinct empirical results might be due to the fact that part-time work is not so common in Germany and less accepted in German firms. Part-time workers therefore might be more disadvantaged by firms' training policies resulting in a higher lack of human capital of part-time workers in Germany.

Though, I do not find support for my second hypothesis. There is no significant difference between part-time and full-time workers in their impact on innovative firm performance. Precisely, I do not find differences between the impacts of all three forms of part-time work and full-time work on innovative firm performance. Empirical results might be explained by the fact that for the occurrence of innovations it is important for firms to generate new knowledge. Part-time workers can also bring external knowledge into firms. By employing many part-time workers a firm can use more sources of external knowledge than employing solely full-time workers. This may compensate the lack of human capital.

This study has important practical implications. If a firm decides to employ part-time workers, it should notice not to employ too many workers with reduced weekly working hours. Part-time workers have lower work experience and human capital than full-time workers, which negatively affects financial firm performance. Moreover, part-time work generates more fix costs than full-time work through additional operative costs, like e.g. higher recruitment costs (Montgomery, 1988). Another aspect that matters is the number of working hours part-time workers have in a week. The firm needs to make sure that part-time workers have sufficient routine and work experience.

However this study shows that innovative performance of firms is not affected by weekly working hours of its employees'. In addition to the mentioned disadvantages, part-time work provides the possibility for a firm to attract potential workers, which could not work full-time (e.g. women with young children), and thus increase the firm's recruitment pool. This becomes especially important

if it is difficult for the firm to find qualified workers on the labor market. Moreover, part-time work is associated with higher job satisfaction (Booth and van Ours, 2008) and better work-life balance (Higgins et al. 2000). High job satisfaction and work-life balance indicate good working conditions and therefore the firm can attract more competent workers on the labor market as well as achieving more commitment of employees to the firm. Additionally, part-time work gives the employer the possibility to retain firm-specific knowledge. Firms can provide part-time job to employees, which otherwise would have quit their jobs, like women after maternity leave or older employees, and hence saving their knowledge (Edwards and Robinson, 1999).

This study focuses on analyzing differences between firms employing part-time and full-time workers and includes therefore different firm characteristics. For future research it might be interesting to include differences between part-time and full-time workers as well as between distinct forms of part-time workers, like distinct educational background or different occupations.

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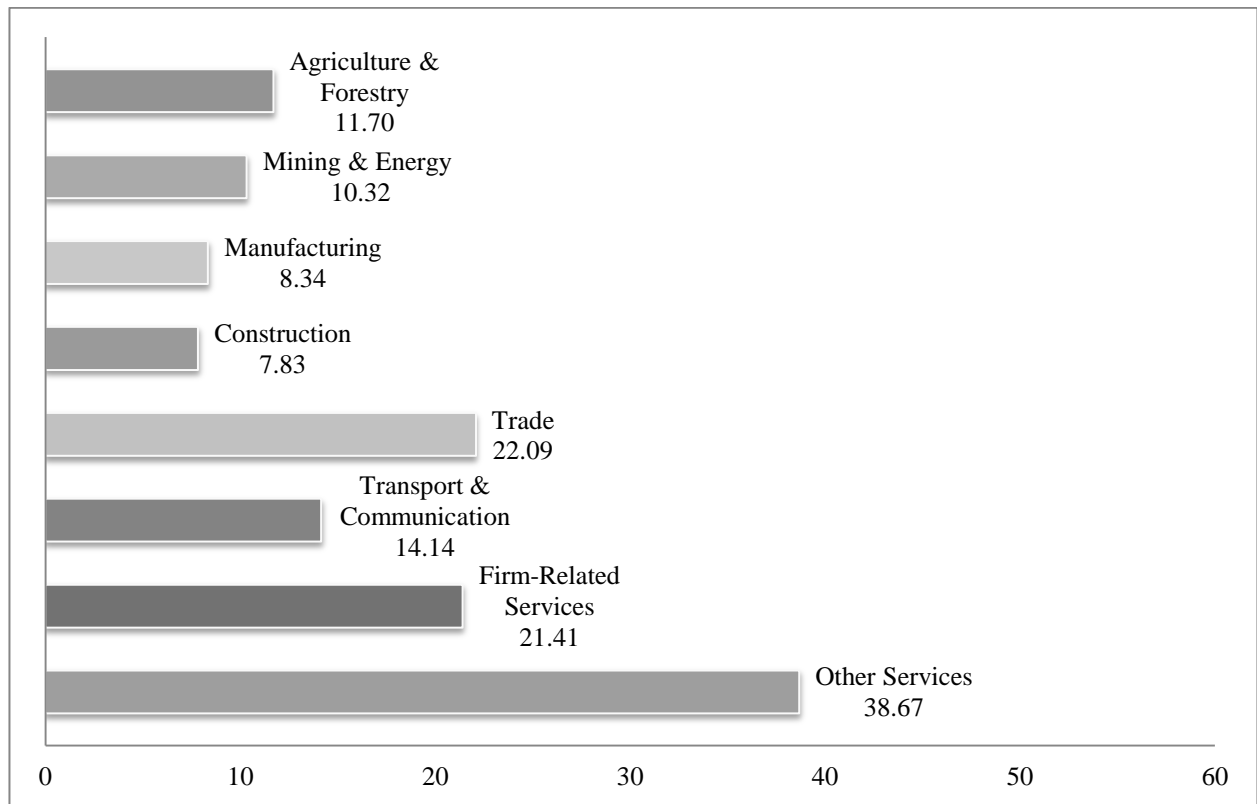
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## Figures

**Figure 1** Share of Part-Time Workers over Industry



Note: All information refer to the absolute number of part-time workers. There is no reformulation into full-time equivalents.

Source: IAB Establishment Panel (waves 2008 and 2010), own calculations.

## Tables

**Table 1 Descriptive Statistics**

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
<b>Dependent Variables</b>					
ln (value added)	5513	14.695	1.920	6.824	22.549
innovation	5513	0.339	0.473	0	1
<b>Explanatory Variables</b>					
ln (K)	5513	11.879	2.259	5.704	21.286
ln (FTE)	5513	3.798	1.583	0.313	10.723
part-time	7777	16.189	20.664	0	100
weekly working hours	7777	39.149	15.964	35	45
weight 1 (large part-time)	7777	0.820	0.014	0.778	0.857
large part-time (FTE)	7777	4.750	10.468	0	83.784
weight 2 (medium part-time)	7777	0.499	0.021	0.433	0.557
medium part-time (FTE)	7777	2.845	5.498	0	51.316
weight 3 (small part-time)	7777	0.192	0.008	0.167	0.214
small part-time (FTE)	7777	0.898	2.055	0	18.750
part-time (FTE)	7777	8.493	12.247	0	83.784
full-time	5513	83.276	21.070	0	100
<b><i>firm characteristic</i></b>					
independent	5513	0.833	0.373	0	1
newly founded	5513	0.529	0.499	0	1
technical state	5513	0.730	0.444	0	1
insourcing	5513	0.025	0.157	0	1
outsourcing	5513	0.017	0.129	0	1
working time flexibility	5513	0.617	0.486	0	1
further training	5513	37.153	29.194	0.171	100
investment in general human capital	5513	0.934	0.248	0	1
investment in specific human capital	5513	0.800	0.400	0	1
<b><i>workforce composition</i></b>					
apprentices	5513	5.606	8.240	0	91.727
fixed-term contract	5513	5.411	11.214	0	100
female	5513	35.419	27.723	0	100
low-skilled	5513	14.510	21.290	0	100
skilled	5513	63.240	23.232	0	100
high-skilled	5513	10.358	16.199	0	100
<b><i>firm environment</i></b>					
no competitive pressure	5513	0.042	0.201	0	1
low competitive pressure	5513	0.102	0.302	0	1
medium competitive pressure	5513	0.391	0.488	0	1
high competitive pressure	5513	0.465	0.499	0	1

<b><i>industry</i></b>					
agriculture & forestry	5513	0.024	0.152	0	1
mining & energy	5513	0.033	0.180	0	1
manufacturing	5513	0.392	0.488	0	1
construction	5513	0.087	0.281	0	1
trade	5513	0.129	0.336	0	1
transport & communication	5513	0.053	0.224	0	1
firm-related services	5513	0.132	0.339	0	1
other services	5513	0.150	0.357	0	1
<b><i>region</i></b>					
schleswig-holstein	5513	0.031	0.172	0	1
hamburg	5513	0.019	0.135	0	1
lower saxony	5513	0.076	0.264	0	1
bremen	5513	0.045	0.207	0	1
north rhine-westphalia	5513	0.096	0.294	0	1
hesse	5513	0.059	0.235	0	1
rhineland-palatinate	5513	0.045	0.207	0	1
baden-württemberg	5513	0.090	0.286	0	1
bavaria	5513	0.072	0.259	0	1
saarland	5513	0.033	0.178	0	1
berlin	5513	0.042	0.201	0	1
brandenburg	5513	0.066	0.248	0	1
mecklenburg-western pomerania	5513	0.052	0.222	0	1
saxony	5513	0.105	0.307	0	1
saxony-anhalt	5513	0.085	0.278	0	1
thuringia	5513	0.087	0.282	0	1
<b><i>year</i></b>					
year = 2008	5513	0.537	0.499	0	1

Note: The number of observations is higher for weekly working hours and part-time work, as the instruments from the year 2006 are included.

Source: IAB Establishment Panel (waves 2006, 2008 and 2010), own calculations.

**Table 2 Part-time Work, Financial Firm Performance and Innovative Firm Performance (OLS Estimation)**

<i>Dependent Variables</i>	ln (value added)	innovation
<i>Explanatory Variables</i>	Coefficient	Coefficient
ln (K)	0.1332*** (0.0085)	0.0266*** (0.0043)
ln (FTE)	0.9641*** (0.0127)	0.0308*** (0.0067)
large part-time (FTE)	-0.0028** (0.0012)	-0.0015** (0.0006)
medium part-time (FTE)	-0.0055*** (0.0021)	-0.0018 (0.0012)
small part-time (FTE)	-0.0119** (0.0059)	0.0000 (0.0032)
firm characteristic controls	yes	yes
workforce composition controls	yes	yes
firm environment controls	yes	yes
industry controls	yes	yes
region controls	yes	yes
year control	yes	yes
constant	10.3885*** (0.1054)	0.1511** (0.0627)
Observations	5513	5513
R-squared	0.8777	0.1299

Note: Robust standard errors in parenthesis.

\* Statistically significant at the 0.1 level; \*\* at the 0.05 level; \*\*\* at the 0.01 level.

Source: IAB Establishment Panel (waves 2008 and 2010), own calculations.

**Table 3** Part-time Work, Financial Firm Performance and Innovative Firm Performance (IV Estimation (2SLS))

<i>Dependent Variables</i>	First Stage			Second Stage	
	large part-time (FTE)	medium part-time (FTE)	small part-time (FTE)	ln (value added)	innovation
<i>Explanatory Variables</i>	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
ln (K)	-0.2086** (0.1008)	-0.0743 (0.0592)	0.0445** (0.0188)	0.1493*** (0.0097)	0.0190*** (0.0053)
ln (FTE)	0.7532*** (0.1607)	-0.0714 (0.0942)	-0.2976*** (0.0352)	0.9176*** (0.0165)	0.0345*** (0.0092)
large part-time (FTE)				-0.0027 (0.0024)	-0.0022 (0.0016)
medium part-time (FTE)				-0.0216*** (0.0077)	-0.0018 (0.0041)
small part-time (FTE)				-0.0254 (0.0186)	-0.0147 (0.0093)
large part-time (FTE), t-2	0.5733*** (0.0401)	0.0443*** (0.0142)	0.0040 (0.0042)		
medium part-time (FTE), t-2	0.2572*** (0.0523)	0.4063*** (0.0401)	0.0423*** (0.0114)		
small part-time (FTE), t-2	0.2536*** (0.0962)	0.2334*** (0.0689)	0.4578*** (0.0397)		
firm characteristic controls	yes	yes	yes	yes	yes
workforce composition controls	yes	yes	yes	yes	yes
firm environment controls	yes	yes	yes	yes	yes
industry controls	yes	yes	yes	yes	yes
region controls	yes	yes	yes	yes	yes
year control	yes	yes	yes	yes	yes
constant	-3.8558*** (1.2485)	1.7064** (0.6943)	0.7111** (0.2832)	10.6062*** (0.1232)	0.2703*** (0.0791)
Observations	3515	3515	3515	3515	3515
F-Statistic First Stage	73.93	38.61	49.37		
Centered R-squared	0.5016	0.3576	0.3606	0.8883	0.1348
KP F-Statistic	20.0427	20.0427	20.0427		

Note: Robust standard errors in parenthesis.

\* Statistically significant at the 0.1 level; \*\* at the 0.05 level; \*\*\* at the 0.01 level.

Source: IAB Establishment Panel (waves 2006, 2008 and 2010), own calculations.

**Table 4** Investment in General and Specific Human Capital (OLS Estimation)

<i>Dependent Variables</i>	general human capital	specific human capital
<i>Explanatory Variables</i>	Coefficient	Coefficient
large part-time (FTE)	-0.0005 (0.0004)	0.0002 (0.0005)
medium part-time (FTE)	-0.0016* (0.0008)	-0.0008 (0.0011)
small part-time (FTE)	-0.0066*** (0.0022)	-0.0152*** (0.0031)
capital and labor input	yes	yes
firm characteristic controls	yes	yes
workforce composition controls	yes	yes
firm environment controls	yes	yes
industry controls	yes	yes
region controls	yes	yes
year control	yes	yes
constant	1.0099*** (0.0218)	0.6859*** (0.0392)
Observations	5513	5513
R-squared	0.0351	0.0854

Note: Robust standard errors in parenthesis.

\* Statistically significant at the 0.1 level; \*\* at the 0.05 level; \*\*\* at the 0.01 level.

Source: IAB Establishment Panel (waves 2008 and 2010), own calculations.